Aviation Investigation Final Report

Location:	Victoria, Texas	**Accident Number:**	CEN20FA032
Date & Time:	December 9, 2019, 20:17 Local	**Registration:**	N4602B
Aircraft:	Cessna 208	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The airline transport pilot departed on a night cargo flight into conditions that included an overcast cloud ceiling and "hazy" visibility, as reported by another pilot. About one minute after takeoff, the pilot made a series of course changes and large altitude and airspeed deviations. Following several queries from the air traffic controller concerning the airplane's erratic flight path, the pilot responded that he had "some instrument problems." The pilot attempted to return to land at the departure airport, but the airplane impacted terrain after entering a near-vertical dive.

The airplane was one of two in the operator's fleet equipped with an inverter system that electrically powered the pilot's (left side) flight instruments. Examination of the annunciator panel lighting filaments revealed that the inverter system was not powered when the airplane impacted the ground. Without electrical power from an inverter, the pilot's side attitude indicator and horizontal situation indicator (HSI) would have been inoperative and warning flags would have been displayed over the respective instruments.

The pilot had a history of poor procedural knowledge and weak flying skills. It is possible that he either failed to turn on an inverter during ground operations and did not respond to the accompanying warning flags, or he did not switch to the other inverter in the event that an inverter failed inflight. Due to impact damage, the operational status of the two inverters installed in the airplane could not be confirmed. However, the vacuum-powered flight instruments on the copilot's (right side) were operational, and the pilot could have referenced these instruments to maintain orientation.

Based on the available information, the pilot likely lost control of the airplane after experiencing spatial disorientation. The night marginal visual flight rules conditions and instrumentation problems would have been conducive to the development of spatial

disorientation, and the airplane's extensive fragmentation indicative of a high-energy impact was consistent with the known effects of spatial disorientation.

Ethanol identified during toxicology testing may have come from postmortem production and based on the low levels recorded, was unlikely to have contributed to this accident. Morphine identified in the pilot's liver could not be used to extrapolate to antemortem blood levels; therefore, whether or to what extent the pilot's use of morphine contributed to the accident could not be determined.

Probable Cause and Findings

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

The pilot's loss of control due to spatial disorientation. Contributing to the accident were the inoperative attitude indicator and horizontal situation indicator on the pilot's side of the cockpit, and the pilot's failure to reference the flight instruments that were operative.

Findings

Personnel issues	Spatial disorientation - Pilot
Personnel issues	Use of equip/system - Pilot
Personnel issues	Aircraft control - Pilot
Aircraft	(general) - Not attained/maintained
Aircraft	AC inverter - Incorrect use/operation
Environmental issues	Low visibility - Effect on personnel

Factual Information

History of Flight

Initial climb	Loss of control in flight (Defining event)

On December 9, 2019, about 2017 central standard time, a Cessna 208B airplane, N4602B, was destroyed when it was involved in an accident near Victoria, Texas. The airline transport pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 135 cargo flight.

The instrument flight rules (IFR) flight was planned from Victoria Regional Airport (VCT), Victoria, Texas, to George Bush Intercontinental Airport (IAH), Houston, Texas. The airplane was loaded with 752 lbs. of non-hazardous cargo and the pilot received an IFR clearance that included a routing direct to the navigational fix, GMANN, and the DUUUK3 arrival to IAH. The pilot was unfamiliar with VCT and incorrectly taxied to runway 31 left. The controller informed the pilot to taxi to runway 13 left as originally instructed.

About 2004, the pilot departed VCT and was cleared to 3,000 ft mean sea level (msl). As the airplane climbed through 1,900 ft mean sea level (msl), air traffic control data showed the airplane make a series of fifteen course changes that continued for the remainder of the flight. The course changes alternated between left and right turns, and each involved a heading change of more than 90°. The controller queried the pilot several times concerning the airplane's erratic course changes and assigned the pilot a heading of 035° toward GMANN. The pilot continued to make large turns with erratic altitude and airspeed changes and the pilot often responded to the controller with unintelligible transmissions.

About 2011, the pilot stated that he had "some instrument problems." The controller suggested a return for landing at VCT and the pilot concurred. The pilot was initially cleared for a visual approach to VCT, but when another pilot reported "really hazy" conditions near the airport, the controller notified the pilot he would be given radar vectors and to maintain 3,000 ft msl. The pilot acknowledged these new instructions. The airplane continued to make large turns and subsequently entered a rapid descent, during which radar contact was lost.

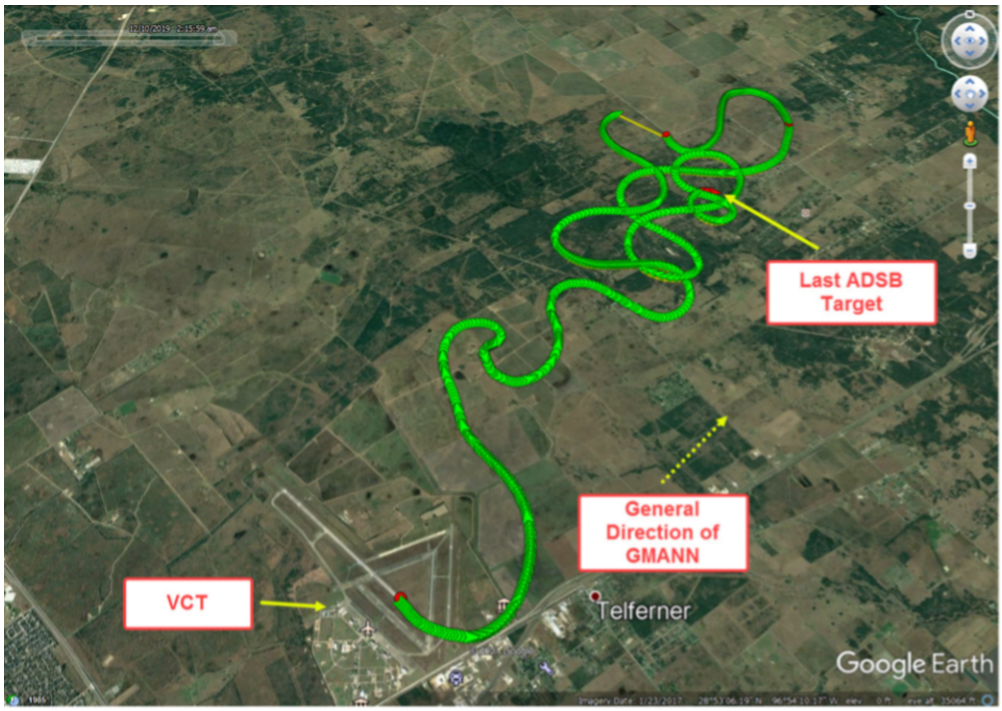

Figure 1. Flight Path of the Airplane

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	61,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	5-point
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:**	December 5, 2019
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	August 23, 2019
Flight Time:	(Estimated) 12680 hours (Total, all aircraft), 1310 hours (Total, this make and model), 110 hours (Last 90 days, all aircraft), 31 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

The pilot was hired by Martinaire Aviation in November 2017. A review of initial training records revealed situational awareness and procedural knowledge challenges. After the pilot

struck a taxiway sign while exiting a runway on January 1, 2018, he received remedial ground training.

In September 2018, the pilot chose to leave Martinaire Aviation to work for a passenger-carrying Part 135 operator in Hawaii that also flew Cessna 208 airplanes. According to the director of operations for that company, the pilot was released during initial training due to weak instrument flying skills, language difficulties, and poor systems knowledge.

The pilot returned to employment at Martinaire Aviation in February 2019. On August 23, 2019, during his last checkride which was flown in an inverter-equipped airplane, the pilot required instruction for the inverter system, including the need to select one of the two inverters during the engine start checklist. The accident flight was the pilot's third flight in an inverter-equipped airplane.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N4602B
Model/Series:	208 B	**Aircraft Category:**	Airplane
Year of Manufacture:	1988	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	208B0140
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	October 28, 2019 Annual	**Certified Max Gross Wt.:**	8752 lbs
Time Since Last Inspection:	17222 Hrs	**Engines:**	1 Turbo prop
Airframe Total Time:	17284 Hrs at time of accident	**Engine Manufacturer:**	Pratt & Whitney
ELT:	Installed	**Engine Model/Series:**	PT6A-114
Registered Owner:	Martinaire Aviation	**Rated Power:**	675 Horsepower
Operator:	Martinaire Aviation	**Operating Certificate(s) Held:**	On-demand air taxi (135)

The accident airplane was one of two in the operator's fleet of Cessna 208 airplanes equipped with two inverters, either of which electrically powered the flight instruments on the pilot's (left) side. The inverter selector switch had three positions labeled "1", "OFF", and "2". An annunciator panel light labeled "INVERTER INOP" illuminated if neither inverter was powering the system due to a failure or if an inverter was not selected.

If the inverter system was not powered, "ATTITUDE" and "COMPUTER" flags appeared over the attitude indicator, and "NAV" and "COMPASS" flags appeared over the horizontal situation indicator (HSI). During ground operations, after the attitude indicator and HSI gyros on the

pilot's side were electrically powered for about 2 minutes, their respective flags dropped out of view to indicate normal operation.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	KVCT,115 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	20:34 Local	**Direction from Accident Site:**	310°
Lowest Cloud Condition:	Few / 1500 ft AGL	**Visibility**	6 miles
Lowest Ceiling:	Overcast / 4800 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	160°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.84 inches Hg	**Temperature/Dew Point:**	23°C / 20°C
Precipitation and Obscuration:	Moderate - None - Haze		
Departure Point:	Victoria, TX (VCT)	**Type of Flight Plan Filed:**	IFR
Destination:	Houston, TX (IAH)	**Type of Clearance:**	IFR
Departure Time:	20:04 Local	**Type of Airspace:**	Class E

Several weather facilities in the area reported restricted visibility in mist and haze. A pilot flying in the vicinity described the weather conditions as "really hazy." At the time of the accident, the sun was 35° below the horizon and the moon was 54° above the horizon.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	28.8525,-96.918609(est)

The airplane impacted a rural area on a southwesterly heading in a nearly vertical attitude. The propeller hub was buried about 5 ft deep into clay soil and the airplane was highly fragmented, with remnants of the fuel tank and engine tubing located 225 ft from the main wreckage.

The propeller was attached to the reduction gear flange and all three blades were separated from the hub about 1 ft from the shank. Two of the blades were found with the main wreckage, with the third blade about 160 ft from the main wreckage.

All primary and secondary flight controls were attached to the airframe and flight control continuity was confirmed to the extent allowed by impact damage. The flaps were in the retracted position. The fuel tanks were impact damaged and no fuel was recovered. Disassembly of the engine revealed rotational damage consistent with the engine producing power at the time of ground impact.

Examination of the vacuum-driven attitude, direction, and turn-and-bank gyro rotors (copilot's side) showed evidence of rotational scoring. The electrically-powered attitude gyro (pilot's side) did not show evidence of rotational scoring. The position of the inverter select switch could not be determined due to impact damage. Impact damage precluded testing of the inverter select switch and the two inverters.

The annunciator panel was examined and individual annunciator lights were removed and x-rayed to determine the condition of the filaments inside the bulbs. The only annunciator light that demonstrated hot filament stretch was the INVERTER INOP light, which was consistent with this light being illuminated when ground impact occurred.

Communications

Although the filed flight plan indicated that the airplane was equipped with conventional navigation capabilities and was therefore not capable of flying directly to a navigation (RNAV) fix, the pilot received and accepted an IFR routing that included the RNAV fix GMANN. After departing VCT, the pilot was unable to maintain a straight course toward GMANN and was subsequently assigned a heading toward GMANN by ATC. Following the accident, the FAA adjusted IFR routing protocols near VCT to ensure airplanes with conventional navigational capabilities would not be assigned a direct routing to an RNAV fix.

After the pilot stated that he had "instrument problems" and agreed to return to VCT, the controller asked if the pilot had the airport in sight. The pilot responded that he was "looking" for the airport. The controller issued the pilot a visual approach clearance before the pilot confirmed that he had visually acquired the airport, which was not in accordance with FAA directives. Based on another pilot reporting hazy conditions, the controller subsequently informed the accident pilot that he would be provided radar vectors.

Medical and Pathological Information

Toxicology testing performed by the FAA's Forensic Sciences Laboratory identified ethanol at 0.010 gm/hg in brain tissue and 0.017 gm/hg in muscle tissue. Morphine was identified at 32 ng/hg in liver but was not identified in muscle. No blood was available for testing.

Ethanol is the intoxicant commonly found in beer, wine, and liquor. It acts as a central nervous system depressant. After ingestion, at low doses, it impairs judgment, psychomotor functioning, and vigilance. Ethanol may also be produced in the body after death by microbial activity.

Morphine is an opioid pain medication available by prescription as a Schedule II controlled substance. It is also a metabolite of both codeine and heroin. It is considered cognitively impairing and sedating. After use, it is stored in liver but not muscle.

Several weeks before the accident, the pilot underwent dental surgery while in South Korea. No information about medications prescribed or used by the pilot following this surgery was available.

Organizational and Management Information

The operator's training courseware included applicable information that described the annunciator panel and inverter system. The airplane's engine start checklist required an inverter be selected on and the taxi checklist required an inverter be checked on. The before takeoff checklist required the annunciator panel be checked for all lights extinguished.

Additional Information

Spatial Disorientation

The FAA's Airplane Flying Handbook (FAA-H-8083-3B) 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 can and will confuse the pilot. Because of inertia, the sensory areas of the inner ear cannot detect slight changes in airplane attitude, 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.

Administrative Information

Investigator In Charge (IIC):	Folkerts, Michael
Additional Participating Persons:	Christian Morales; Flight Standards District Office; San Antonio, TX Ricardo Asensio; Textron Aviation; Wichita, KS Alan Rusinowitz; Martinaire Aviation; Addison, TX Marc Hamilton; Transportation Safety Board of Canada; Ottawa
Original Publish Date:	October 20, 2021
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=100672

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