



Air Transportation Safety Investigation Report A1800153

COLLISION WITH TERRAIN

Piper PA-28R-200, C-GDUM
Brantford Airport, Ontario
13 November 2018

History of the flight

At approximately 0027¹ on 13 November 2018, the privately owned Piper PA-28R-200 aircraft (registration C-GDUM, serial number 28R7535272) departed from Burlington Executive Airport (CZBA), Ontario, with 2 people on board. The intended destination could not be determined, because neither a flight plan nor an itinerary were filed for the flight.

Several minutes² before departure, a succession of 5 keyed microphone clicks were recorded on the aerodrome traffic frequency at CZBA. This sequence of clicks is used by pilots to turn on the ARCAL (aircraft radio control of aerodrome lighting), which includes runway lighting. Although these clicks were recorded, no verbal transmissions normally associated with departing or arriving aircraft traffic were recorded.

Shortly after departure, at 0028, the aircraft began to be recorded on radar climbing west of CZBA toward the Brantford Airport (CYFD), Ontario, located 28 nautical miles (nm) to the southwest.³ At 0043, when the aircraft was approximately 4 nm east of CYFD at 1600 feet,⁴ a series of clicks was

¹ All times are Eastern Standard Time (Coordinated Universal Time minus 5 hours).

² The exact time of the microphone clicks is uncertain, because the audio recording was compressed.

³ CYFD has a UNICOM radio frequency with limited hours of operation. It was not staffed at the time of the occurrence.

⁴ In this report, all altitudes are above sea level, unless otherwise noted.

recorded on the CYFD aerodrome traffic frequency. Again, no associated verbal communications were recorded.

A review of the radar data indicated that, between 0043 and 0114, the aircraft circled CYFD, which has an elevation of 815 feet, at altitudes between 2000 and 1100 feet, with a ground speed ranging from 110 to 60 knots. During this time, both the aircraft altitude and the ground speed generally decreased.

During the same time, 26 additional instances of a series of 3 to 5 clicks were recorded on the aerodrome traffic frequency, and the lighting intensity of the ARCAL varied in response to these clicks, as designed. The variance in intensity of the runway lighting was recorded by security cameras near the airport.

The aircraft was last recorded on radar at 0115 at an altitude of 1000 feet and a ground speed of 50 knots, very near the impact location. At about the same time, the aircraft was recorded on the security footage descending rapidly towards the south end of the airport and striking the ground. The 2 occupants were fatally injured from the force of the impact. The aircraft was significantly damaged.

There were no witnesses and because the emergency locator transmitter (ELT) did not activate, search and rescue services were not alerted. Airport personnel found the aircraft wreckage the following morning during their routine airfield inspection.

Weather information

There are no weather reporting stations at either CZBA or CYFD; however, terminal area forecasts for the 3 closest stations⁵ indicated that low visibility, which would prohibit visual flight rules flight, would prevail in the area at or around the aircraft's departure time. It could not be determined if the pilot reviewed these forecasts or the current weather before the flight.

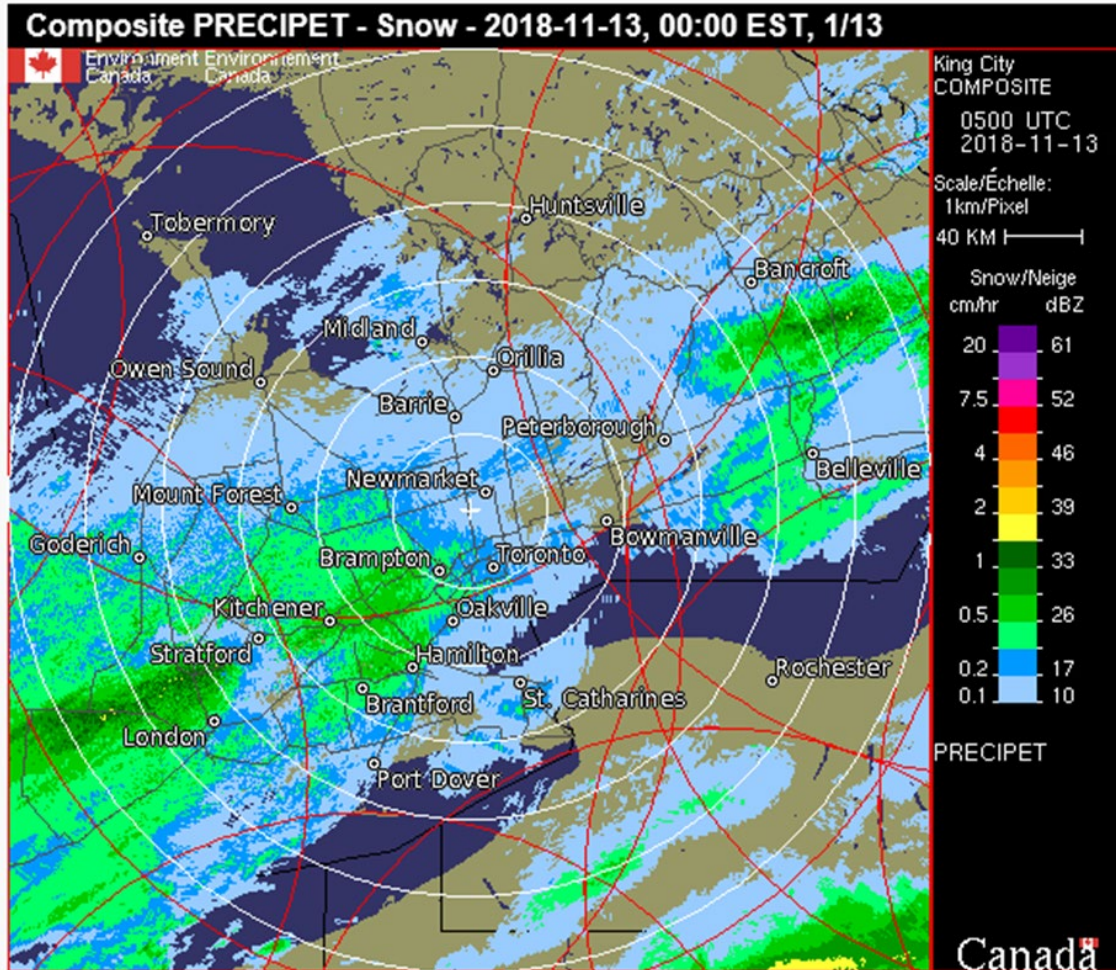
Based on historical weather radar data (Figure 1), there was precipitation in the form of rain or light snow at CZBA at the time of departure. The aerodrome routine meteorological reports from the 3 closest stations indicated visibilities as low as 1 statute mile in snow showers, and cloud ceilings at 1900 feet, with light winds and outside temperatures of around 0 °C at the surface.

Precipitation in the form of rain and/or snow was also recorded west of CZBA, and reduced visibility was reported for the entire route from CZBA to CYFD. With the freezing level at the surface, in-flight icing conditions were prevalent within this area of precipitation and within the clouds in this area.

Security footage taken near CYFD at the time the occurrence aircraft arrived overhead, and for the subsequent time the aircraft circled, showed that ground visibility was reduced due to snowfall in the area.

⁵ The 3 closest stations were Kitchener/Waterloo Airport (CYKF) (23 nm west), Hamilton Airport (CYHM) (16 nm south-southwest), and Toronto/Lester B. Pearson International Airport (CYYZ) (17 nm northeast).

Figure 1. Weather radar image showing system covering southeastern Ontario around the time of departure from CZBA (Source: Environment and Climate Change Canada)



Pilot information

The pilot held a private pilot licence, endorsed for single-engine land aeroplanes, originally issued on 15 March 1989. The licence was endorsed with a night rating; however, it did not include an instrument rating.

At the pilot's last medical examination, on 07 December 2017, he had reported a total flying time of 2200 hours, including 60 hours over the previous 12 months. Following the examination, Transport Canada (TC) requested additional medical information from the pilot on 2 occasions, in February and March 2018. Although the pilot did receive TC's requests, TC never received the requested information.

On 22 May 2018, TC informed the pilot that it had suspended his medical certificate, rendering his pilot's licence invalid. There were no flights recorded in the occurrence aircraft's journey log after 04 March 2018; however, numerous flights that took place afterwards were recorded on separate pieces of paper in the pilot's flight bag. The information on these pieces of paper was limited; consequently, it could not be determined how many flights occurred after 04 March 2018, or if the pilot met the recency requirements for night flying.

Post-mortem examination

Toxicological screening of the pilot following the accident determined that the pilot had an ethanol level of 66 mg/100 mL (0.066% weight per volume). However, the analysis of post-mortem blood–alcohol concentration (BAC) can present some uncertainty, given several biological and environmental variables. It was not possible to determine the pilot’s exact BAC⁶ at the time of the accident.

Although there is currently no specific BAC limit in the *Canadian Aviation Regulations* (CARs), section 602.03 in force at the time of the occurrence stated:

No person shall act as a crew member of an aircraft

- (a) within 8 hours after consuming an alcoholic beverage;
- (b) while under the influence of alcohol; or
- (c) while using any drug that impairs the person’s faculties to the extent that the safety of the aircraft or of persons on board the aircraft is endangered in any way.⁷

According to the Transport Canada *Aeronautical Information Manual* (TC AIM):

[e]ven small amounts of alcohol (0.05 percent) have been shown in simulators to reduce piloting skills. The effect of alcohol and hypoxia is additive, and at 6 000 ft ASL [above sea level] (1 830 m), the effect of one drink is equivalent to two drinks at sea level. The body metabolizes alcohol at a fixed rate and no amount of coffee, medication or oxygen will alter this rate. ALCOHOL AND FLYING DO NOT MIX.⁸

The FAA’s *Pilot’s Handbook of Aeronautical Knowledge* states: “[s]tudies have shown that consuming alcohol is closely linked to performance deterioration.”⁹ It also states that

“[e]ven in small amounts, alcohol can impair judgment, decrease sense of responsibility, affect coordination, constrict visual field, diminish memory, reduce reasoning ability, and lower attention span.”¹⁰

Tolerance can vary from one individual to another; however, general impairment signs for people with an ethanol level of 30 to 120 mg/100 mL (0.030% to 0.120%) include “mild euphoria, talkativeness, decreased inhibitions, decreased attention, impaired judgment, and increased reaction time.”¹¹

TSB recommendation regarding alcohol use

Following a TSB investigation in 2015¹² that found that alcohol intoxication was a causal or contributing factor in an accident involving a commercial turboprop aircraft, the TSB made a recommendation that

the Department of Transport, in collaboration with the Canadian aviation industry and employee representatives, develop and implement requirements for a comprehensive substance abuse program,

⁶ BAC can be affected by decomposition and degradation of biological samples.

⁷ Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, section 602.03 (effective from 22 March 2006 to 11 December 2018).

⁸ Transport Canada, TP 14371, *Transport Canada Aeronautical Information Manual* (TC AIM), AIR – Airmanship (28 March 2019), section 3.9, at <https://www.tc.gc.ca/eng/civilaviation/publications/tp14371-menu-3092.htm> (last accessed on 09 April 2019).

⁹ Federal Aviation Administration, FAA-H-8083-25B, *Pilot’s Handbook of Aeronautical Knowledge* (2016), p. 17-15.

¹⁰ Ibid.

¹¹ Ibid.

¹² TSB Aviation Investigation Report A15P0081.

including drug and alcohol testing, to reduce the risk of impairment of persons while engaged in safety sensitive functions. These requirements should consider and balance the need to incorporate human rights principles in the *Canadian Human Rights Act* with the responsibility to protect public safety.

TSB Recommendation A17-02

In response to this recommendation, TC amended CARs section 602.03 in December 2018 to increase the required time between alcohol consumption and operating an aircraft from 8 hours to 12 hours.¹³

In addition to this completed safety action, TC's latest response to the recommendation in March 2019 indicates that it had reviewed policies and regulations regarding impairment and was in the process of developing policy and regulatory options to promote the continued safety of the aviation system. Work was also ongoing to define safety sensitive positions, prescribe a BAC limit, and encourage industry to expand the use of employee assistance programs to treat employees with substance abuse and mental health issues.

Although the Board is encouraged by the actions taken to date, TC's latest response does not provide any information regarding the development and implementation of requirements for a comprehensive substance abuse program, including drug and alcohol testing, which is the intent of Recommendation A17-02. It is unclear if the safety deficiency identified in this recommendation will be fully addressed. Therefore, the Board considers TC's response to Recommendation A17-02 to be **Satisfactory in Part**.

Aircraft information

The Piper PA28R-200 Arrow II is a single-engine 4-seat aircraft equipped with retractable landing gear and manually operated flaps. When the occurrence aircraft was manufactured, it had been equipped with an automatic gear extension system, but this system had been disabled. The stall speed of the aircraft with both the flaps and the landing gear retracted is approximately 61 knots calibrated airspeed.¹⁴

The last entry in the occurrence aircraft's journey log was on 04 March 2018 and indicated that the aircraft had accumulated a total of 3454 hours since new. Records indicated that up to that point, the aircraft had been maintained in accordance with existing regulations and approved procedures. The aircraft was not equipped with de-icing or anti-icing systems, other than electrical heating of the pitot-static probe.

The aircraft's 2 front seats were equipped with 3-point safety belts, in the form of 2 lap belts each with a detachable single-point shoulder harness. The back seats were equipped with lap belts only. The passenger was seated in the back.

The aircraft was equipped with a TEL82 121.5 MHz ELT manufactured by Technisonic Industries Ltd.

Wreckage information

The wreckage was located in a grassy area approximately 340 feet north of the intersection of runways 05/23 and 17/35. The damage to the aircraft, impact marks, and wreckage trail indicated that

¹³ The new regulation was published in the *Canada Gazette*, Part II, on 12 December 2018.

¹⁴ Piper Aircraft Corporation, *Cherokee Arrow PA-28R-200, Airplane Flight Manual*, Specifications 1-1 (13 July 1973).

the aircraft struck the ground on a heading of approximately 350° magnetic, in a nose-low and left-bank attitude, at a moderate forward speed.

Just before the impact with the ground, the propeller struck a runway sign and became separated from the aircraft. The aircraft's main landing gear was substantially damaged; the left main gear was separated and found 180 feet from the initial point of impact. The nose landing gear was also separated and found at the initial point of impact. The gear handle was damaged in the impact, but the damage to the gear assemblies indicated that the landing gear had been extended before impact.

The flaps were found in the fully retracted position, coinciding with the position of the flap control lever in the cockpit. The damage to the left-wing fuel tank during the impact prevented the investigation from determining how much fuel was in it at the time of the occurrence. A total of 60 L (15.8 U.S. gallons) remained within the right-wing fuel tank.

The structural integrity of the cockpit was somewhat compromised, but not to a degree that would be unsurvivable. The damage to the nose, however, was indicative of a significant rate of deceleration that was likely not survivable. The aft cabin, fuselage, and empennage received only minor damage. The 2 occupants were found wearing their lap belts, but the pilot's available shoulder harness was not connected to the lap belt. It could not be determined if using the shoulder harness would have increased his chances of survival.

The ELT and the associated antenna and cable were undamaged; however, the system did not activate. The switch on the ELT was in the ARMED position, and so was the remote switch in the cockpit. Although the ELT did not need to be recertified until February 2019, the ELT battery pack was supposed to have been replaced 12 days before the accident. As a result, the ELT did not meet the certification requirements.

Emergency locator transmitter examination

The ELT was removed and shipped to the TSB Engineering Laboratory in Ottawa, Ontario, to determine why the ELT did not activate. The examination determined that, although the battery pack had expired, it could still produce sufficient voltage to power the ELT; however, the inertia switch failed to activate the ELT on impact. Further examination showed fretting inside the switch cylinder. During testing, it was determined that residue from this fretting created increased friction and binding, and resulted in the ELT not activating even when deceleration forces in excess of 15g were applied in the direction of the switch-sensitive axis.

This type of switch failure has been identified in at least 3 other accidents investigated by the TSB.¹⁵ These previous failures were not limited to 121.5 MHz ELTs; they were also associated with newer 406 MHz units, on both fixed- and rotary-wing aircraft. Two of the ELT manufacturers involved issued Service Bulletins¹⁶ in 2005 and 2008, recommending replacement of the "g" switches on ELTs that had been in service for 10 years, and different tests or switch replacements for ELTs that had been in service for 5 to 9 years. They had determined that this type of failure most often occurred in aircraft that were subject to shock and high vibrations and in ELTs that had been in service for 5 years or longer. The recommendations in these bulletins, however, are not mandatory.

¹⁵ TSB aviation investigation reports A07O0190, A16A0041, and A16P0045.

¹⁶ ACK Technologies Inc. Service Bulletin SB E-01.8 (09 July 2005), and Narco Avionics Inc. Service Bulletin E-910 SB2 (06 August 2008).

The severity of the occupants' injuries meant that the unserviceability of the ELT and the fact that search and rescue was not alerted did not affect the outcome in this accident.

Safety message

The pilot involved in this accident did not have a valid pilot licence because his medical certificate was invalid. The aircraft departed into poor weather conditions, including in-flight icing, for which the pilot was not qualified and the aircraft was not equipped. To ensure safety, pilots must fly within their limits, whether these limits are based on regulations, qualifications, or physiology, or are restricted by the prevailing weather conditions.

Safety action taken

During post-accident testing, the activation switch for the aircraft's ELT did not function as designed. This type of failure has been identified by the TSB previously. Although it did not affect the outcome of this accident, it could do so in other accidents, because potentially life-saving rescue-aid could be delayed significantly.

After the accident, the ELT manufacturer (Technisonic Industries Ltd.) issued Service Bulletin SB ELT19-01 on 22 March 2019. The Service Bulletin recommends that the inertia switch be tested annually for proper operation and be replaced every 5 years. The manufacturer plans to distribute the information to all purchasers of ELT batteries to provide maximum awareness of this recommendation.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 08 May 2019. It was officially released on 24 May 2019.

ABOUT THIS INVESTIGATION REPORT

This report is the result of an investigation into a class 4 occurrence. For more information, see the Occurrence Classification Policy at www.tsb.gc.ca

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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