Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

Air Transportation Safety Investigation Report A20W0046

LOSS OF CONTROL AND COLLISION WITH TERRAIN

Privately registered
Murphy Aircraft Mfg Ltd. SR3500 (Moose), C-GATR
Rolly View, Alberta, 2 NM NE
03 July 2020

History of the flight

At 1040[1] on 03 July 2020, the privately registered amateur-built Murphy Aircraft Mfg Ltd. SR3500 (Moose) aircraft (registration C-GATR, serial number 258SR), equipped with amphibious floats, departed Cooking Lake Aerodrome (CEZ3), Alberta, for a seaplane training flight to Hastings Lake, Alberta, then to Coal Lake, Alberta, and back to CEZ3 with 3 people on board: the owner/pilot, a training pilot (who was the pilot-in-command), and a passenger.

Details of the flight path (Figure 1, main image) were captured by a portable global positioning system (GPS) in the aircraft. After departing Runway 10 at CEZ3 on wheels, the aircraft flew 6 nautical miles (NM) east to Hastings Lake and conducted a water landing at 1045. After the landing, the aircraft departed the lake and conducted a left climbing turn before proceeding toward the town of Rolly View, Alberta.

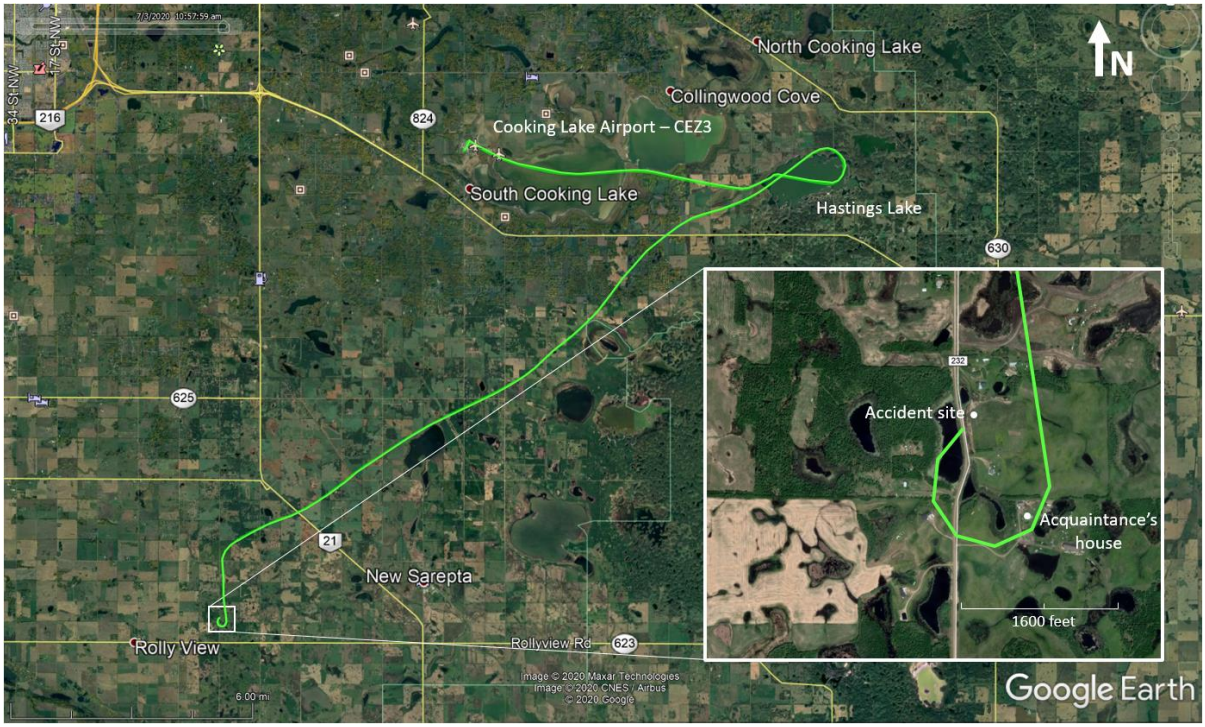
At 1047, the aircraft established cruise flight in a southwesterly direction for 12.5 NM. During cruise, the aircraft maintained an average ground speed of 118 mph and an average altitude of 486 feet above ground level (AGL).

At 1056, the aircraft began to descend from a height of 550 feet AGL and conducted a left turn to proceed on a southerly track of 161° magnetic for approximately 1 minute. While 2 NM northeast of Rolly View, the aircraft initiated a right turn at 300 feet AGL around the property owned by an acquaintance of the training pilot.

[1] All times are Mountain Daylight Time (Coordinated Universal Time minus 6 hours).

During the southern arc of the turn, the aircraft's ground speed decreased from 117 mph to 93 mph, while the aircraft's altitude increased to 400 feet AGL. The radius of turn was approximately 600 feet (Figure 1, inset). While in the turn, the aircraft stalled and entered a spin with rotation to the left. At 1057, the aircraft struck terrain in a steep nose-down, left-wing low attitude, in farm pasture near Rolly View, approximately 12 NM east of the Edmonton International Airport (CYEG). The investigation was not able to determine which pilot was at the controls at the time of the accident.

Figure 1. Occurrence flight track, with final turn in inset image (Source: Google Earth, with TSB annotations)



The 406 MHz emergency locator transmitter activated on impact and transmitted a signal. The Canadian Mission Control Centre received the signal and then relayed the information to the Joint Rescue Coordination Centre in Trenton, Ontario.

All occupants were fatally injured. The aircraft was destroyed; there was no post-impact fire.

Weather information

The hourly aerodrome routine meteorological report issued at 1100 for CYEG, the closest airport to the accident site, showed the wind at 170° true at 10 knots. Visibility was 20 statute miles. There were few clouds at 18 000 and 25 000 feet AGL, with a temperature of 18 °C and a dew point of 11 °C. The altimeter setting was 29.92 inches of mercury.

Pilot information

Owner/pilot

The owner/pilot held a private pilot's licence - aeroplane issued on 10 February 2017 that was endorsed for single-engine land aeroplanes. He also held a valid Category 3 medical certificate with no restrictions, signed on 15 January 2019.

The owner/pilot had 209.7 hours of total flight time, including 137.4 hours as pilot-in-command and 72.3 hours of dual-instruction flight time. He had started his flight training on 20 November 2014 and received his initial private pilot licence - aeroplane on 04 February 2016. He first flew the occurrence aircraft on 29 August 2016 and had accumulated 106 hours total time on that aircraft, 43.5 hours of which were with the training pilot over the 4 years preceding the occurrence. Because the owner/pilot did not hold a seaplane class rating, he was not allowed to conduct seaplane operations as pilot-in-command with passengers on board.

Training pilot

The training pilot held a restricted airline transport pilot licence (ATPL) - aeroplane issued on 17 May 2017 that was endorsed for single- and multi-engine land and sea aeroplanes. His ATPL was originally issued on 31 March 1981, and he held a valid Category 1 medical certificate dated 09 December 2019.

One of the restrictions the training pilot was required to meet was that he must be accompanied by another pilot who holds an unrestricted pilot licence with the appropriate category, class, and type rating and with a valid medical certificate. During the seaplane training, because the owner/pilot did not hold a seaplane class rating, the training pilot did not meet the requirements of his restricted licence.

The investigation was unable to determine the total flight time of the training pilot. The last entry made in his personal log was dated 23 July 2007. On this date he had approximately 20 000 hours of total flight time, of which 2100 hours were on seaplanes. After this date, he began using a digital personal log accessible through his mobile phone, which was destroyed during the accident.

A review of the occurrence aircraft's journey log, including the day of the accident, revealed that the training pilot had flown 8.1 hours of training toward the seaplane rating with the owner/pilot. The dates of these flights were 16 June 2020, 18 June 2020, 19 June 2020, and 03 July 2020.

Seaplane rating information

The seaplane rating is intended for pilots who are already licensed. The minimum required flying time is 7 hours, which includes at least 5 hours of dual instruction and 5 solo takeoffs and landings.

There is no requirement to use a flight instructor to conduct the seaplane training. *Canadian Aviation Regulations* Standard 425 requires a person who conducts flight training toward the issuance of a seaplane class rating to be the holder of a commercial pilot licence or an ATPL and have experience of not less than 50 hours flight time on the class of aeroplane used for the training.[2]

Aircraft information

The Murphy Aircraft Mfg Ltd. SR3500 (Moose) is an amateur-built, 6-seat aircraft. The occurrence aircraft was configured with 4 seats. Construction of the occurrence aircraft was completed in 2004, and it was registered with Transport Canada (TC) on 21 December 2004. TC issued a special certificate

[2] Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, Standard 425, subsection 425.21(6).

of airworthiness for the aircraft on 20 April 2005. The aircraft was equipped with a 360 hp Vedeneyev M14P radial engine. The investigation was unable to determine the engine hours since new.

A review of the aircraft technical records indicated that annual inspections had been performed as required by regulations and that the last annual inspection was dated 02 March 2020. The last flight entry recorded in the journey log was dated 18 June 2020 with the aircraft having 312.4 hours total time since new.

Montana 3500 amphibious floats were installed on the aircraft in June 2020. The aircraft did not have a weight and balance document for the amphibious float installation. The investigation estimated that the aircraft took off from CEZ3 at near gross weight and that the centre of gravity was within limits.

The aircraft had no known deficiencies before the occurrence flight. There were no indications that the engine was incapable of producing power. Additionally, recovered engine data indicated that engine rpm and oil pressure were maintained until impact. The post-accident aircraft examination did not reveal any defects with the flight control system. The aircraft was not equipped with any stall warning devices.

Aerodynamic stall during a turn

An aerodynamic stall occurs when the wing's angle of attack exceeds the critical angle at which the airflow begins to separate from the wing. When a wing stalls, the airflow breaks away from the upper surface, and the amount of lift generated is reduced to below that needed to support the aircraft.

The speed at which a stall occurs is related to the load factor of the manoeuvre being performed. The load factor is defined as the ratio of the aerodynamic load acting on the wings to its gross weight, and represents a measure of the stress (or load) on the structure of the aircraft. By convention, the load factor is expressed in *g*.[3]

In straight and level flight, lift is equal to weight, and the load factor is 1*g*. In a banked level turn, however, greater lift is required. It can be achieved, in part, by increasing the angle of attack (by pulling back on the stick/elevator control), which increases the load factor. As the load factor increases with bank angle, there is a corresponding increase in the speed at which the stall occurs. As a result, a banked level turn is often accomplished with the addition of engine power to maintain airspeed. A stall that occurs at a higher speed as a result of a high load factor, such as bank angle increased beyond 30°, is called an accelerated stall.

Accelerated stalls are usually more severe than unaccelerated stalls, and are often unexpected. As an example, a stall from a steep bank angle (greater than 30°) can result in one wing stalling before the other, leading to a spin and the aircraft rapidly losing altitude.

[3] *g* is a unit of measurement of the force resulting from vertical acceleration due to gravity. An acceleration of 1 *g* is 9.8 m/s^2.

Aircraft performance

The recorded GPS data was used to determine the aircraft ground speed. Performance data in the pilot operating handbook was based on indicated airspeeds.[4] The pilot operating handbook did not contain an airspeed conversion chart to show differences between indicated airspeed and calibrated airspeed (CAS).[5]

The turn before the loss of control started on a southbound track and finished on a northbound track. The surface winds reported at CYEG were 170° true at 10 knots (12 mph). During the turn, the aircraft was operating at an average height of 365 feet AGL. Assuming the winds at that altitude were the same as the surface winds, the aircraft would have experienced a headwind at the start of the turn that transitioned to a tailwind at the end of the turn.

The average ground speed in the turn was 96 mph and when calculated with the winds, the aircraft's true airspeed (TAS)[6] would have been approximately 91 mph, or 87 mph CAS.

The radius of the turn was determined to be 600 feet. To achieve this radius at a constant altitude, with no slip or skid, at an average TAS of 91 mph, the aircraft would need a 43° bank angle.

With the aircraft configured with wheels, the no flap, power-off, wings-level stall speed of the aircraft is 63 mph[7] CAS. At a 43° bank angle, the load factor is 1.4*g*. In a turn where the altitude is maintained, the stall speed would increase to 75 mph CAS. There were no published stall speeds with the Montana amphibious floats installed.

In a coordinated climbing turn, the outside wing will typically stall first as it will have a greater angle of attack than the inside wing. During the stall, the aircraft will initially roll and yaw in the opposite direction of the climbing turn and a spin in the opposite direction of the turn may develop.

The investigation was unable to determine the aircraft's bank angle, pitch, and speed when the loss of control occurred. However, accelerated stalls are often caused by abrupt or excessive control inputs made during steep turns or pull-ups.

Safety messages

Steep turns increase the risk of an aerodynamic stall, and when conducted close to the ground, the chances of successfully recovering from a stall are decreased.

Additional vigilance and caution are required when manoeuvring close to the ground, and to prevent losing control due to a stall when an aircraft is not equipped with a stall warning device.

Although not a factor in the occurrence, pilots seeking instruction toward ratings should ensure that the individual providing instruction meets the regulatory requirements to do so.

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[4] Indicated airspeed is the airplane's speed as indicated by the airspeed indicator.

[5] Calibrated airspeed is indicated airspeed corrected for instrument and installation error in the pitot-static pressure system.

[6] True airspeed is the speed of the airplane relative to the air. It is calibrated airspeed corrected for the airspeed indicator error due to density and temperature.

[7] Murphy Aircraft Mfg Ltd., *Pilots Operating Manual*, Performance Specifications at Gross Weight (3500 lbs), p. 8.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 06 January 2021. It was officially released on 13 January 2021.

Visit the Transportation Safety Board of Canada's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

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

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