



Air Transportation Safety Investigation Report A20W0072

COLLISION WITH POWER LINE

Privately registered
Harmon Rocket II, C-FZXS
Hugget/Goodwood Field Aerodrome, Alberta
26 September 2020

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. **This report is not created for use in the context of legal, disciplinary or other proceedings.** See the Terms of use at the end of the report.

History of the flight

At about 1317¹ on 26 September 2020, the Harmon Rocket II amateur-built aircraft (registration C-FZXS, serial number 140) departed from Rocky Mountain House Aerodrome (CYRM), Alberta, for a flight to Hugget/Goodwood Field Aerodrome (CGF5), with 2 people on board. The purpose of the flight was to get to a gathering of friends, who were to spend the afternoon go-karting at the racetrack adjacent to the airfield. The aircraft arrived overhead of CGF5 at 1337 and proceeded to do 2 circuits around the field given that the pilot had never been to this location.

After the 2nd circuit, the aircraft turned left, descended to approximately 25 feet above ground level (AGL) and flew over the racetrack straightaway from north to south. Based on videos recorded by observers on the ground, at the south end of the straightaway the aircraft initiated a climb and struck the upper of 2 wires of an unmarked power line on the north side of Township Road 504 at between 32 and 35 feet AGL (Figure 1). The aircraft pitched up steeply, climbed to approximately 700 feet while rolling right to an almost inverted attitude and changing heading to the west. When the aircraft began to descend, it rolled left to a wings-level attitude, and continued to descend until it struck the ground, in a 40° nose-down attitude.

There was a post-impact fire, which consumed most of the aircraft. The 2 occupants were fatally injured. No emergency locator transmitter (ELT) signal was detected, and the ELT was destroyed in the fire.

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

Figure 1. Map showing the occurrence aircraft's flight path, the power line and the accident site (Source: Google Earth, with TSB annotations)



Weather information

The 1300 aerodrome routine meteorological report for Edmonton International Airport (CYEG), 21 nautical miles to the east of CGF5, was:

- wind from 320° True at 19 knots, with gusts to 26 knots
- visibility: 20 statute miles
- broken ceiling at 6000 feet AGL, with additional broken layers at 8000 and 23 000 feet AGL
- temperature: 16 °C, dew point –1 °C
- altimeter setting: 29.66 inches of mercury

Weather was not considered a factor in this accident.

Aircraft information

The Harmon Rocket II is an amateur-built aircraft that is created by modifying a Van's Aircraft RV-4. The Harmon kit provides for the installation of a larger engine by widening the fuselage and

lengthening the RV-4 by 18 inches. The wing is modified, and the landing gear material and placement is also changed to accommodate the larger engine. The aircraft has a relatively high power-to-weight ratio that leads to performance suitable for advanced aerobatic flight.

The occurrence aircraft was equipped with a Textron/Lycoming IO-540 engine and dual control sticks; however, all other engine and flight controls were installed for the forward seat only. The aircraft was used regularly at air shows across Canada, the U.S., and Mexico.

Occupant information

The pilot held an airline transport pilot licence (ATPL) - aeroplane, endorsed for single and multi-engine aircraft, and for gliders. He had also obtained a type rating for the Harmon Rocket II. His medical certificate was valid for the personal type of flight undertaken. The pilot's personal logbook was partially destroyed in the post-impact fire; however, the last legible entry recorded that he had accumulated 4568.1 total flight hours, as of 21 February 2020. The pilot was a well-known air show performer and held a Level 1 Statement of Aerobatic Competency (SAC),² which authorized him to perform unrestricted aerobatic manoeuvres at any altitude.

The passenger held a private licence (PPL) – airplane, endorsed for single engine land aircraft with a night rating.

International Council of Airshows

The mandate of the International Council of Airshows (ICAS) is “to provide information to air show sponsors and pilots; to promote safety at all aviation events; and to work with government agencies to develop air show safety standards.”³ Founded in 1967, ICAS is a North American organization that liaises with the Federal Aviation Administration in the U.S. and Transport Canada (TC) in Canada to set the standards that aerobatic performers must meet and comply with to be able to participate in air shows across Canada and the U.S.

The ICAS *Aerobatic Competency Evaluation Manual*⁴ (the ACE Manual) is recognized by TC as the document that details how aerobatic performers will meet the standards required to participate in sanctioned air shows with a public audience. The program provides for the issuance of an SAC, through TC, which details the authorized aircraft, aircraft category, minimum altitude, minimum lateral distance, and manoeuvres.

According to the ACE Manual, an SAC allows the holder to perform aerobatics in front of an audience at a public aviation event; however the investigation determined that this flight was not identified as a public aviation event. Neither the ACE Manual nor the SAC relieves the holder from the requirements of the *Canadian Aviation Regulations* (CARs).

² In Canada, a Statement of Aerobatic Competency (SAC) is issued by Transport Canada to pilots after they successfully complete the Aerobatic Competency Evaluation (ACE) Program administered by the International Council of Airshows. Pilots are awarded SAC levels as follows: Level 4 (800 feet AGL minimum), Level 3 (500 feet AGL minimum), Level 2 (250 feet AGL minimum), Level 1 (Unrestricted).

³ International Council of Airshows, <https://airshows.aero/CMS/About> (last accessed on 16 December 2020).

⁴ International Council of Airshows, *Aerobatic Competency Evaluation Manual* (Revision 9, effective 01 January 2019), at <https://airshows.aero/CMS/AboutACE> (last accessed on 05 January 2021).

Wreckage analysis

When the aircraft collided with the power line, the aircraft contacted the upper wire just over the nose, and then it slid up the cowl until it struck the leading edge of the canopy. The canopy fractured and immediately separated from the airframe, landing in the field south of Township Road 504. The remainder of the airframe struck the ground in a high-energy state, approximately 2000 feet to the southwest of the power-line strike. The fuselage, from the instrument panel to the tail, was consumed by fire. The outer portions of the wings, flaps and ailerons remained outside of the burn area. The rudder, horizontal stabilizer and elevator were mostly consumed by fire but still recognizable. Because the cables connecting the rudder were made out of stainless steel and withstood the fire, control continuity to the rudder was established. However, control continuity to the flaps, ailerons and elevator could not be determined given that the aluminum push/pull tubes were all destroyed by fire. A video of the flypast just before the wire strike showed the aircraft responding to flight control inputs.

Power transmission lines and marking

The power transmission line north of Township Road 504 consisted of a 2-wire, 14.4 kV rural supply line.⁵

In general, rural power poles stand approximately 35 feet (10.6 m) tall once placed in position. The top (high-voltage) wire is mounted on insulators on the top of the pole. The lower (ground potential or neutral) wire is attached via insulators approximately 4.5 feet below the top of the pole. The approximate 400-foot span between the poles allows the top wire to hang at a height of 32 feet (9.7 m) at the midpoint.

Section 601.23 of the CARs states that:

any building, structure or object, including any addition to it, constitutes an obstacle to air navigation if [...] it is higher than 90 m AGL and is located within 6 km of the geographical centre of an aerodrome.⁶

In addition, subsection 601.25(1) of the CARs states:

If the Minister determines that a building, structure or object, other than a building, structure or object described in section 601.23, is hazardous to air navigation because of its height or location, the Minister shall require the person who has responsibility for or control over the building, structure or object to mark and light it in accordance with the requirements of Standard 621.^{7,8}

⁵ The top wire was a high-voltage 14.4 kV line, and the bottom wire was a neutral (ground potential) wire. Both were Bethlehem Steel Co. conductor, galvanized steel, stranded (Hi-Con HSC-130), size 6, stranding 3 x 0.117 inches (diameter), with a minimum breaking strength of 4295 pounds, or 19 105 newtons.

⁶ Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, paragraph 601.23(1)(b).

⁷ Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, subsection 601.25(1).

⁸ Transport Canada has stated that, in some instances, it may identify objects having a height of less than that specified in section 601.23 of the *Canadian Aviation Regulations* as obstacles requiring lighting or marking, based on safety factors such as exposure to a known air traffic route or aviation activities.

Although the wire that the occurrence aircraft struck was within 6 km (actual distance was 0.88 km) of the geographical centre of CGF5, there was no requirement for marking the wires because the highest point of the power line was only 10.6 m.

Low-height wire crossings are very common in Canada, and as part of a previous investigation,⁹ TC has stated that it would not be reasonable to require lighting or marking for all of them.

Low flying

The CARs state that “No person shall operate an aircraft in such a reckless or negligent manner as to endanger or be likely to endanger the life or property of any person.”¹⁰

In some cases, low-level flight is required for certain activities such as aerial work, external load operations, wildlife surveys, pipeline or power line inspections and air shows. However, regarding minimum altitudes and distances to be flown over non-built-up areas, the CARs state:

Except where conducting a take-off, approach or landing or where permitted under section 602.15, no person shall operate an aircraft [...] at a distance [vertical or lateral] less than 500 feet from any person, vessel, vehicle or structure.¹¹

The *Transport Canada Aeronautical Information Manual* (TC AIM) contains the following warning in bold font regarding low flying:

Warning—Intentional low flying is hazardous. Transport Canada advises all pilots that low flying for weather avoidance or operational requirements is a high-risk activity.¹²

The TC AIM section on permissible low flying also contains the following note:

The hazards of low flying cannot be over-emphasized. In addition to the normal hazards of low flying, such as impact with the ground, two issues regarding man-made structures should be stressed [...]

Wire-strikes [*sic*] account for a significant number of low flying accidents. A number of these accidents occur over level terrain, in good weather and at very low altitudes.

The regulations governing low-level flight are located in several areas of the CARs. It is the responsibility of the pilots to ensure that all regulations are strictly adhered to.¹³

The TSB has completed a number of investigations into low flying in the recent past.¹⁴ The investigation into a similar accident in which a Bell 206B helicopter collided with power transmission lines near Flatlands, New Brunswick, in 2016, determined that low-altitude flying was risky, particularly if appropriate pre-flight planning and reconnaissance were not conducted, and that it may result in a collision with wires or other obstacles, increasing the risk of injury or death.

⁹ TSB Aviation Investigation Report A16A0084.

¹⁰ Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, section 602.01.

¹¹ Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, paragraph 602.14(2)(b).

¹² Transport Canada, TP 14371, *Transport Canada Aeronautical Information Manual* (TC AIM), AIR – Airmanship (26 March 2020), section 2.4.1.

¹³ Transport Canada, TP 14371, *Transport Canada Aeronautical Information Manual* (TC AIM), RAC – Rules of the Air and Air Traffic Services (26 March 2020), section 5.4.

¹⁴ TSB air transportation safety investigation reports A20P0060, A19Q0096, A18W0098, A18O0107, A17Q0050, and A16A0084.

Safety message

Low-level flight is a high-risk activity as not all hazards, such as power transmission lines, are physically marked or can be seen in time to avoid a collision.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 24 February 2021. It was officially released on 03 March 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.

ABOUT THIS INVESTIGATION REPORT

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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