Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A12W0121

LOSS OF CONTROL AND COLLISION WITH TERRAIN

ALTA FLIGHTS LIMITED
CESSNA 172M C-GRGW
CLARESHOLM, ALBERTA, 22 NM WNW
26 AUGUST 2012

Canada

Aviation Investigation Report

Loss of Control and Collision with Terrain

Alta Flights Limited
Cessna 172M C-GRGW
Claresholm, Alberta, 22 nm WNW
26 August 2012

Report Number A12W0121

Summary

The Alta Flights Limited Cessna 172M (registration C-GRGW, serial number 17265472) departed Springbank Airport, Alberta, on a visual flight rules flight to conduct a pipeline patrol to the south, through foothill terrain. While the aircraft was circling a pipeline stream crossing on Chaffen Creek, approximately 22 nautical miles west-northwest of Claresholm, Alberta, near the Chain Lakes Reservoir, it entered a spin, descended steeply, and collided with terrain at 1734 Mountain Daylight Time. The pilot, who was the sole occupant of the aircraft, sustained fatal injuries. The aircraft was destroyed by impact forces, and there was no post-impact fire. The 406-MHz emergency locator transmitter activated on impact. The accident occurred during daylight hours.

Ce rapport est également disponible en français.

Factual Information

History of the Flight

The aircraft, C-GRGW, had departed Edmonton International Airport (CYEG) in late morning on the day of the accident, on a routine pipeline patrol to the south. The first segment of the patrol terminated at Springbank Airport (CYBW), where C-GRGW landed at 1554 [1] to report problems with a pipeline between Springbank Airport and Pincher Creek, Alberta. The client contacted Alta Flights Limited headquarters and requested a patrol of the line. The company informed the pilot of this request, and the day's flying was revised. The aircraft departed Springbank Airport at 1642 (Appendix A).

In the vicinity of the accident site, C-GRGW made several low-level left-hand turns. A change in engine sound was heard, accompanied by entry into a spin to the left and a rapid descent. When the aircraft did not recover from the descent, an emergency call was made via satellite phone by witnesses, who reached the site on foot approximately 1 hour after the accident.

Site Information

The accident occurred about 1700 feet west of Highway 22, in rolling foothills ranchland. At the site, a small meandering creek (Chaffen Creek) was oriented east-west, with banks about 13 feet apart and 6 feet deep (Appendix B). Elevation was 4300 feet above sea level (asl). The aircraft collided with the ground vertically at the south edge of the creek, in a nose-down, wings-level attitude, on a heading of 260° magnetic. There were no indications of rotation about the yaw axis. After the initial impact, the fuselage bounced and came to lie in the water on the north side of the creek, with the left wing detaching and coming to rest on the north bank. The right wing remained attached and lay on the north bank, along with numerous pieces of the aircraft. All 4 wing fuel tanks had separated, and damage indicated that they contained substantial quantities of fuel. Wing flaps were in the retracted position. The engine mounts were broken, and the engine was connected to the airframe only by the engine control cables. The crankshaft flange had broken aft of the propeller, and fracture surfaces and propeller damage indicated that the engine was developing significant power on impact. The severity of the impact damage precluded detailed examination of flight control rigging and determination of elevator trim setting; however, no discrepancies were found in the flight control systems.

The pilot's seat was separated from its tracks, and the adjustment locking pin was bent, indicating that it was engaged on impact. All tracks were broken, with the rear stops in position. The plastic windshield had disintegrated, and there were no indications of a bird strike, such as feathers, on recovered windshield pieces or interior components.

---

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

Flight Following and Emergency Locator Transmitter Data

C-GRGW was equipped with a SkyTrac Systems Limited (SkyTrac) ISAT 100 [2] global positioning system (GPS)−based flight-following system, which transmitted time, location, altitude, heading, and ground speed to the company's computer system. These data were transmitted on a 5-minute subscription basis. The Transportation Safety Board (TSB) Laboratory extracted data recorded in the on-board SkyTrac unit for the last flight at 5-second intervals. These recorded data ended at 1707:07, and did not include the last minutes of the flight.

At 1734, a 406-megahertz (Mhz) emergency locator transmitter (ELT) signal was received by the Canadian Mission Control Centre (CMCC). Due to terrain blocking of the signal and satellite geometry, the initial recorded location was 67 nautical miles (nm) northeast of the accident site. When Alta Flights Ltd. management was queried, this position was discounted as being grossly off course, and the SkyTrac database was consulted. The last recorded transmission, at 1732, showed the location of the aircraft as 21.77 nm west-northwest of Claresholm Industrial Airport at 4849 feet asl, heading 080° true, with a ground speed of 76 knots. This location coincides with the accident site.

At 1832, the ELT signal was lost, and then was re-established at 2334. At that time, the position was fixed within 6 nm of the location. The unit transmitted an effective signal until 1300, 27 August, when it was switched off.

Conduct of Pipeline Patrols

Except in areas of high air traffic, or in metropolitan areas, pipeline patrols are normally flown with a single pilot, who also fills the role of observer. At points of particular interest, including stream crossings, or points of unusual activity in the vicinity of pipelines, the pilot would take notes and multiple photographs to be included in reports submitted to the clients. Pilots would usually circle the site to the left, at altitudes between 200 and 700 feet above ground level (agl). The hand-held digital single-lens reflex (DSLR) camera, featuring autofocus, required the picture to be framed through the viewfinder, and was capable of taking photos in quick succession. Performing detailed photography required the pilot to fly with one hand on the control yoke, and to frame the pictures while in the turn with the other hand. Depending on the desired view, steep bank angles could be necessary.

The TSB Laboratory extracted photos from the storage card of the camera that was found with C-GRGW. On the day of the accident, the pilot had taken 144 digital photographs on the leg from Edmonton to Springbank Airport, and 90 photographs on the accident flight. These included a sequence of 5 photos taken at very short intervals, with the aircraft directly over the Chaffen Creek crossing, which was 940 feet south of the accident site. Photographic analysis of

---

[2] The SkyTrac ISAT 100 is an automated flight-following system that automatically tracks the location and velocity of specially-equipped aircraft and other mobile assets, providing this information in near−real-time to dispatchers, aviation managers, and other authorized users. The equipment includes geo-location and data communications devices that use satellite-based technology.

the last photograph taken showed the aircraft orbiting the crossing at approximately 45° of bank, approximately 350 feet agl, and on a southerly heading.

Analysis of SkyTrac data indicated that 2 left turns had been made about 30 nm north of the accident site. During portions of these turns, the aircraft was banked at an average of 46° and 51°. Average ground speed during these turns was 93 and 103 knots.

Pilot Experience

Records indicated that the pilot was certified and qualified for the flight in accordance with existing regulations. The pilot had a total flying time of approximately 6900 hours, and had flown for Alta Flights Ltd., exclusively on pipeline patrols, since 2003, accumulating approximately 5000 hours in that environment on the Cessna 172. Before employment at Alta Flights Ltd., the pilot had been engaged in aerial application flying. The pilot last flew on 21 August, and then spent 3 days flying as observer, which were followed by a day off on 25 August. The pilot was reported to be well rested and in good spirits on the day of the accident.

Pilot Training

Pipeline patrol pilots were given combined annual recurrent training / pilot-proficiency checks by the company. In addition to the normal items on a pilot-proficiency check (flight planning, pre-take-off, take-off and landings) pipeline patrol pilots demonstrate proficiency in medium to steep turns, approach to stalls, and reduced indicated-airspeed maneuvers at 60 knots with flaps at 20°. The accident pilot's last training in April 2012 was conducted by the company Pipeline Department Manager.

Company

Alta Flights Ltd. was authorized by Transport Canada (TC) to operate under *Canadian Aviation Regulations* (CARs) Subparts 702, 703, and 704. Pipeline patrol operations, which were inaugurated in 1990, were conducted under Subpart 702: Aerial Work.

The company was not required by TC regulations to have a Safety Management System (SMS) in place; however, the company did have a SMS that was promulgated in February 2011. The company used a corrective / preventive action request (CPAR) form to identify risks and report hazards. Before the accident, there were no CPARs related to pipeline patrols. A risk management progress worksheet was generated by the company for the risks associated with low-level aerial inspection of pipeline networks. The worksheet identified bank angles of 35° to 40° below 1000 feet agl as a risk. The company's risk-control option was to enhance ground-school training to emphasize the unique operational aspects of pipeline inspection. Additionally, the probability of the hazard was assessed as low, as the inspections were carried out at near-maximum cruise airspeeds that would provide a large airspeed margin above the stall speed, and a stall event had not been reported previously.

Meteorological Conditions

The nearest weather report, from the Alberta Forest Service Willow Creek automatic recording station, 11 nm northeast of the accident site, indicated that at 1800, the temperature was 19°C, the dewpoint was 6°C, and the wind was at 5 knots, gusting to 12 knots. Photographs taken by the pilot shortly before the accident showed that visibility was unlimited and the sky was clear.

Aircraft Performance

Records indicated that C-GRGW was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The aircraft had no known deficiencies before the accident flight. Wreckage examination did not reveal any pre-impact discontinuity in the flight controls.

C-GRGW was equipped with 2 main tanks located in the wings, holding 190 litres of useable fuel. To enable extended-range operations, the aircraft was fitted with wing auxiliary fuel tanks, which were installed in accordance with Flint Aero Limited supplementary type certificate (STC) SA1614WE, and a baggage compartment tank, which was installed in accordance with O & N aircraft modifications STC SA615NE, which increased the maximum certified take-off weight to 2550 lbs. The contents of the 87-litre wing auxiliary tanks and the 68-litre baggage tank are transferred to the main tanks in level flight when consumption allows for space in the main tanks. Before departing Edmonton, all tanks were filled, and at Springbank, the main and auxiliary tanks were filled, which would have serviced the aircraft to full fuel. The fuel used from the main tanks during the 52-minute flight before the accident would have been insufficient to require the transfer of fuel from the full auxiliary fuel tank.

At the time of the accident, the weight and balance of C-GRGW was determined to be within limits. The weight, at 2306 pounds, was below the maximum certified weight of 2550 pounds. The centre of gravity of 45.9 inches aft of the datum was near the aft limit of 47.3 inches.

At the existing ambient air temperature and dewpoint conditions, there was a risk of light carburetor ice at any power setting above descent power. [3] During the circling reconnaissance, moderate engine power would have been required to maintain altitude, which would have minimized this risk.

Cessna 172M Stall/Spin Characteristics

Performance charts in the Cessna 172M *Pilots Operating Handbook* indicate that, under the conditions that C-GRGW was operating at the time of the last photo (bank angle 45°, aircraft weight 2300 pounds, flaps up, and at the most aft centre of gravity), aerodynamic stall speed would have been 59 knots calibrated airspeed (KCAS). At 60° of bank, stall speed would be 71

---

[3] Transport Canada (TC), TP14371 2012, *Aeronautical Information Manual,* AIR Section 2.3. (19 December 2011)

KCAS. [4] At the density altitude at which C-GRGW was operating, these speeds at KCAS equate to a true airspeed (TAS) of 64 knots and 77 knots respectively.

The certified stall characteristics of the Cessna 172 are similar to those of a typical light aircraft. [5] A spin is considered to be an aggravated stall in which the wings are unequally stalled. [6]

TC has provided the following information on stall/spin awareness. [7]

> The primary cause of an inadvertent spin is one wing exceeding the critical angle of attack while executing a turn with excessive or insufficient rudder, and, to a lesser extent, aileron. In an uncoordinated manoeuvre, the pitot-static instruments, especially the altimeter and airspeed indicator, are unreliable due to the uneven distribution of air pressure over the fuselage. The pilot may not be aware that the critical angle of attack is about to be exceeded until the stall warning device activates. If a stall recovery is not promptly initiated, the aeroplane is more likely to enter an inadvertent spin. The spin that occurs from cross controlling an aircraft in a skidding turn usually results in rotation in the direction of the rudder being applied, regardless of which wing tip is raised.

With a clockwise rotating propeller, as viewed from behind, torque and propeller slipstream effects will exacerbate the aircraft's tendency to yaw to the left. [8]

The Cessna 172M *Pilots Operating Handbook* states that 1000 feet would be required for a one-turn spin entry and recovery.

CAR 702 Accident Statistics

The total number of accidents during the past 10 years involving Canadian-registered aircraft operating under CAR 702 (Aerial Work) was compared with that for all commercial operations (CARs 703, 704, 705) in Canada. The number of CAR 702 accidents (257) comprised 31% of the total number of accidents involving commercial operators. Of the total number of accidents resulting in fatalities, 29% involved aircraft operating under CAR 702, and of the total number of fatalities, 19% involved aircraft operating under CAR 702.

---

4 Cessna 172M *Pilots Operating Handbook* performance charts are based on aircraft original configuration, and do not take into consideration auxiliary fuel tank installations. Wing Auxiliary Fuel System (STC SA1614WE) and Aft Compartment Fuel Tank (STC SA615NE), which are Federal Aviation Administration (FAA)−approved flight-manual supplements, have no performance data modifications documented, and refer to the original type certificate data sheet.

5 FAA Federal Aviation Regulations (FARs) Part 23 Sec. 23.221, Airworthiness Standards: Normal, Utility, Acrobatic and Commuter Category Airplanes

6 *Private Pilot Manual*, Jeppesen Sanderson Training Products (Colorado: Jeppesen Sanderson Inc., 1997), page 3−38

7 TC Civil Aviation, TP 13747, Guidance Notes: Private and Commercial Pilot Training, 2nd Edition, *Stall/Spin Awareness* (October, 2003)

8 *Private Pilot Manual*, Jeppesen Sanderson Training Products (Colorado: Jeppesen Sanderson Inc., 1997), page 3−50

TSB Laboratory reports

The following TSB Laboratory report was completed:

LP188/2012 – Download and Plot of Non-volatile Memory Data

This report is available from the TSB upon request.

Analysis

There were no indications that any aircraft systems contributed to the loss of control of the aircraft and its subsequent collision with the ground. Therefore, this analysis will focus on aircraft handling and the environment in which the flight was conducted.

Pipeline reconnaissance at Alta Flights Limited involved photography by a single pilot / observer, which often required that the aircraft be placed in a left turn to give the pilot the best unobstructed view of a location of interest. Angles of bank during this manoeuvring often were in the area of 45°, and at times exceeded 50°. The pilot of C-GRGW would have been viewing the outside world through a handheld camera at a time when the aircraft was in a critical phase of flight. At this time, the pilot's attention would have been distracted from control and monitoring of the aircraft.

There are no data to identify the spin characteristics of the Cessna 172 with the additional fuel tanks. Flight conditions during the stream-crossing reconnaissance and photography were conducive to stall and subsequent spin entry. These conditions would have been a relatively low airspeed / high angle of attack, steep bank angle to the left, moderate engine power, and possible excessive left rudder application. The steep descent, short wreckage trail, and low ground speed point to a loss of control at low altitude due to aerodynamic stall. Ground scars indicated that the spin rotation had been stopped; however, insufficient height remained to arrest the high rate of descent.

The pilot was highly experienced both in the Cessna 172 and in the pipeline patrol environment, and was familiar with maneuvering in steep turns at low altitude while inspecting and photographing ground features. The conduct of single-pilot, low-level pipeline patrols that include the additional task of photography can increase the potential for distraction from primary flying and increase the risk of loss of control. However, there are no definite explanations for the loss of control on this flight.

The reason for the change in engine noise as the aircraft entered the stall could not be determined. The engine appeared to have operated normally during descent, and there were signatures of high power application on impact. It is unlikely that a power interruption would have caused the pilot to lose control.

The quality of emergency locator transmitter (ELT) signals and reception, due to a number of factors, reduced that system's effectiveness in providing an accurate location of the accident. The real-time transmission of SkyTrac data was instrumental in pinpointing the location of the accident. In this occurrence, observation of the crash enabled timely access and potential rescue within a shorter time than would have been provided by mobilization based solely on ELT signal reception.

Findings

Findings as to Causes and Contributing Factors

1. For undetermined reasons, while manoeuvring during a low-level pipeline reconnaissance, control was lost and the aircraft entered an aerodynamic stall and spin.

2. Although the pilot was able to arrest the spin, the low altitude of the aircraft prevented recovery from the stall before the aircraft struck the ground.

Findings as to Risk

1. The conduct of single-pilot, low-level aerial inspection flights that include additional tasks beyond flying the aircraft, such as photography, increases the risk of loss of control.

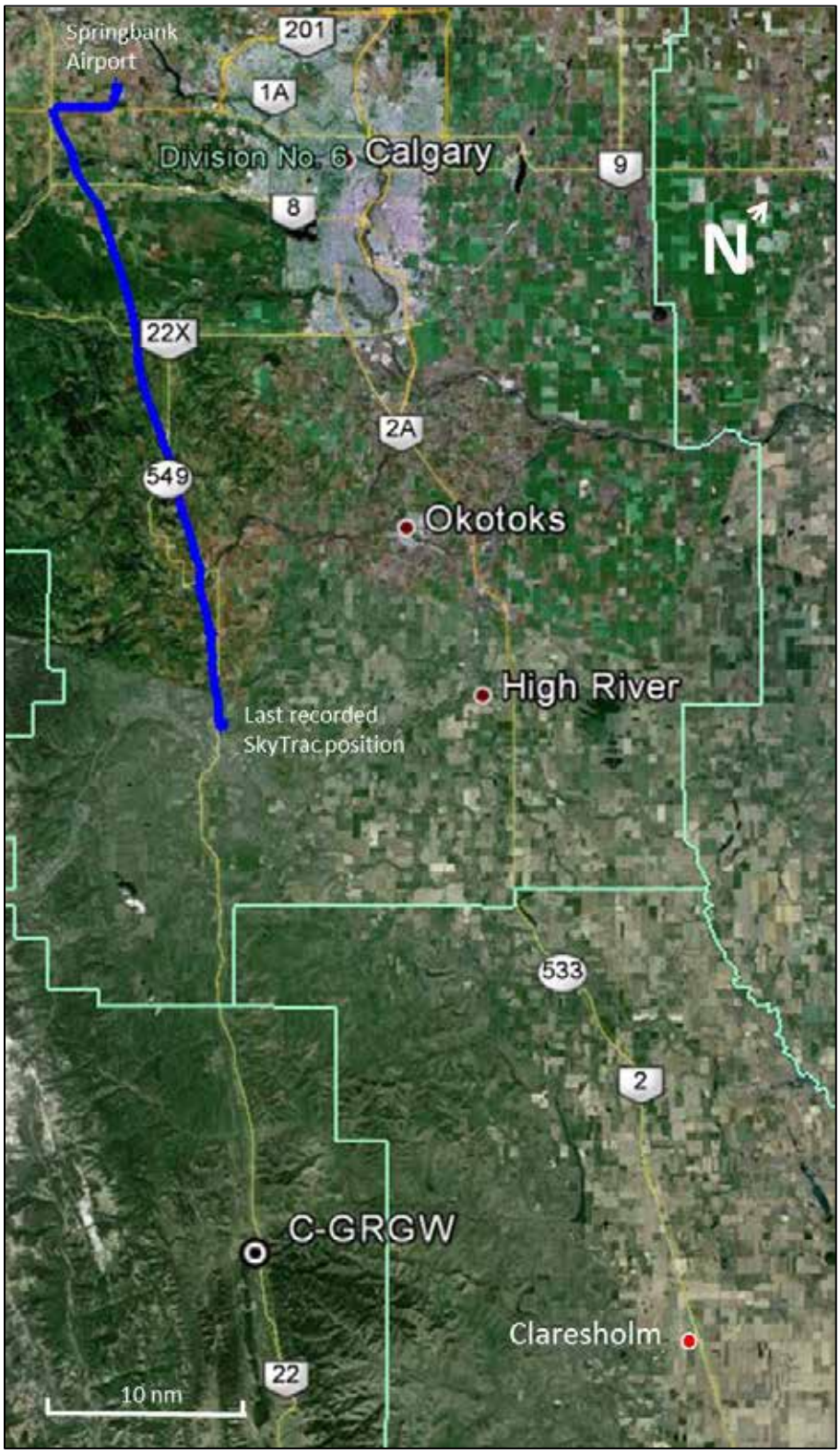
Other Findings

1. In this occurrence, the use of real-time, on-board global positioning system data by company flight-following personnel augmented the limited capabilities of emergency locator transmitter signals in locating the accident site by electronic means.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 17 July 2013. It was officially released on 16 August 2013.

Visit the Transportation Safety Board's website (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. 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.

Appendix A – Route of Flight



Appendix B – Aerial Photograph of Accident Site