

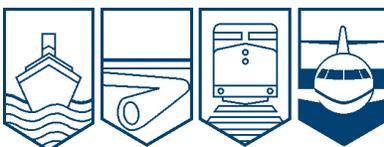
Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

AVIATION INVESTIGATION REPORT

A09C0172



CONTROLLED FLIGHT INTO TERRAIN

LOCKHART AIR SERVICES LIMITED

CESSNA 310R, C-GFIT

CAT LAKE, ONTARIO, 8 nm SW

06 NOVEMBER 2009

Canada

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.

Aviation Investigation Report

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Summary

The Lockhart Air Services Limited Cessna 310R (registration C-GFIT, serial number 310R1865) departed Sioux Lookout, Ontario, on a night visual flight rules flight to Cat Lake, Ontario, with a pilot and two passengers on board. The aircraft was on a company flight itinerary. When the aircraft did not arrive at its destination, a search was launched. The wreckage of the aircraft was located two days later in a wooded area about eight nautical miles southwest of Cat Lake. The occupants of the aircraft were fatally injured upon impact and the aircraft was destroyed.

Ce rapport est également disponible en français.

Other Factual Information

History of the Flight

Lockhart Air Services Limited (Lockhart Air Services) operates a commercial air taxi service under subpart 703 of the *Canadian Aviation Regulations* (CARs) and services various communities in northwestern Ontario. The company operates a pilot self-dispatch system.¹ The purpose of the flight was to transport two passengers and baggage from Sioux Lookout to Cat Lake, Ontario. The flight departed on 06 November 2009 at about 1800² with an estimated time en route of 45 minutes. After take-off, the pilot advised the Sioux Lookout Flight Service Station that they were clear of the zone and were climbing to 5500 feet above sea level (asl).

Upon arrival in the Cat Lake area, the aircraft flew over the airport and proceeded southwest. The aircraft's flight path was consistent with a visual inspection of the runway and a downwind leg to intercept the final approach to Runway 11. While manoeuvring to join the final approach, the aircraft collided with rising terrain approximately eight nautical miles (nm) southwest of Runway 11.

The aircraft struck a densely wooded area. During the impact sequence, the fuel cells ruptured, resulting in an explosion and torching of tree tops. The pilot and both passengers were fatally injured upon impact and the aircraft was destroyed. The fuselage was not consumed by fire.

At 2200, when the aircraft had not yet arrived at its destination, the operator notified the Joint Rescue Coordination Centre (JRCC) in Trenton, Ontario, and a search was initiated. The aircraft was located at 1930 on 08 November 2009.

The aircraft was equipped with a Dorne & Margolin ELT 8.1 emergency locator transmitter (ELT). The ELT antenna was torn off during impact and, as a result, no ELT signal was transmitted.

Weather

There is no recorded or reported weather for Cat Lake. The nearest reported weather is for Pickle Lake, Ontario, 70 nm to the east. The weather at Pickle Lake at 1900 was as follows: wind 170° True (T) at 10 knots, variable from 080° to 230°, visibility 15 statute miles, a few clouds at 24 000 feet above ground level (agl), temperature 4°C, dew point 2°C, altimeter 29.41 inches of mercury, remarks cirrus 1 okta,³ sea level pressure 977 hectopascals.

¹ Under CAR 703, pilot self-dispatch, operational control is delegated to the pilot-in-command of a flight by the operations manager, who retains responsibility for the day-to-day conduct of flight operations.

² All times are central standard time (Coordinated Universal Time minus six hours).

³ Cloud layer amounts are reported in eighths (oktas) of sky coverage.

The barometric pressure in the area was active before the occurrence; the Pickle Lake pressure had decreased from 30.18 to 29.41 inches in a 24-hour period.

Sunset on November 6 occurred at 1633 and the end of official twilight was 1709. Moonrise did not occur until 1936; the flight arrived in the Cat Lake area in total darkness.

Topography

The topography southwest of Cat Lake consists of muskeg and bush and, at night, is devoid of any lights or other distinguishable features that could assist a pilot in discerning a horizon. Darkness and the absence of visual cues can adversely influence a pilot's perception of the aircraft's position and movement, and make it more difficult for a pilot to maintain control and to avoid terrain. In some situations, the limited visual cues in sparsely settled areas may lead pilots to believe that they are at a higher altitude than they actually are.⁴

Pilot

The pilot was certified and qualified in accordance with existing regulations and met the crew rest requirements. The pilot held a commercial licence with a current instrument rating and had a total of 1819 hours of flying time including a total of 176 hours on the Cessna 310.

There was no indication of any physical issue with the pilot that may have contributed to the accident.

Aircraft

The Cessna 310R is a twin-engine, piston-powered aeroplane equipped to carry a pilot and five passengers. It was approved for day/night visual flight rules (VFR) and instrument flight rules (IFR) operations. It was also equipped with an autopilot and a global positioning system (GPS).

Records indicate that the aircraft was maintained in accordance with Lockhart Air Services' approved maintenance control system. A review of the aircraft's weight and balance information indicated that the aircraft was within the prescribed limits during the occurrence flight. A review of the operational flight plan and fuel upload receipts indicated that the aircraft had approximately 400 pounds of fuel on board at the time of the occurrence.

The pilot did not report any technical difficulties with the aircraft prior to the accident. A review of technical records indicates that there were no deferred or outstanding defects on the aircraft.

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The aircraft was equipped with two barometric pressure altimeters. Both altimeters incorporated the three-pointer type of display. This display format has a higher potential for being misread, as compared to altimeters incorporating other types of displays, such as the drum-and-pointer type.⁵ Nearly 12 full turns of the adjustment knob are required to effect a one-inch barometric pressure change in the altimeter setting. A one-inch decrease in barometric pressure results in an increase of indicated altitude of about 1000 feet if no adjustment is made. An adjustment of this magnitude is uncommon in day-to-day operations. New, larger, technologically advanced aircraft are increasingly being equipped with a drum-and-pointer type of altimeter system from the factory.

The aircraft's last flight before the accident flight occurred on 05 November 2009. The altimeter setting at Sioux Lookout at the conclusion of that flight was 30.13 inches. The altimeter setting for Sioux Lookout at the start of the accident flight was 29.44.

Wreckage Information

The tree strikes and wreckage information indicated that the aircraft contacted the trees on rising terrain in a near-level flight attitude (see Photo 1). The initial tree strikes involved just the tips of the trees, for approximately 150 yards, and progressed to severe shearing and breaking of the tree trunks for another 150 yards until the remaining aircraft fuselage came to rest (see Photo 2). The direction of the wreckage trail was 340° magnetic, indicating that C-GFIT was tracking away from the village of Cat Lake at the time of impact. The wreckage site elevation was 1460 feet asl.



Photo 1. Tree damage

⁵ United States Naval Research Laboratory, Washington, DC: J.H. Hill and R. Chernikoff, 26 January 1965

Most of the flight instruments were destroyed by impact forces; however, investigators were able to read the altimeter setting on the right side altimeter. Its setting scale was set to approximately 30.40 inches of mercury.

An inspection of the aircraft wreckage including the engines, propellers, and flight controls revealed no pre-impact anomalies. The engine instruments and GPS were removed from the wreckage and sent to the TSB Laboratory in Ottawa. Analysis of the tachometer, oil pressure gauges, cylinder head temperature gauges and manifold pressure gauges indicated that the engines were producing power at the time of impact.



Photo 2. Final impact point

Global Positioning System (GPS)

The GPS was identified as a Bendix/King KLN 94 (part number 069-1034-0101). According to the manual and the manufacturer, this panel-mounted device does not retain any flight track data.

The operator was authorized to conduct GPS approaches using the Cessna 310R. The aircraft was equipped with a GPS under the authority of a limited supplemental type certificate, and the pilot was trained and qualified to carry out GPS approaches.

Arrival Procedures

The Cat Lake Airport is a certified aerodrome, located in uncontrolled airspace, at an elevation of 1344 feet asl. An RNAV GNSS⁶ approach is published for Runway 11; however, no radio communication facilities are provided.

The CARs require that pilots arriving at an aerodrome under VFR must ascertain that the runway of intended landing is suitable for landing and that there is no risk of collision with other aircraft or vehicles.⁷

⁶ Instrument approach based on area navigation (RNAV) using a global navigation satellite system (GNSS).

⁷ CARs 602.96(2) (a) and (b) and 602.97

Lockhart Air Services pilots were trained to set and cross-check both altimeters to the current setting as well as enter the altimeter setting into the GPS. On the ground, altimeters are cross-checked to confirm that both read the same field elevation and, in the air, by confirming that they both read a similar altitude. The Lockhart Air Services standard operating procedures (SOPs) contain the following night VFR arrival procedure:

Night approaches are difficult and pilots should be aware of the Black Hole effect. Circling at night is not advisable unless there are two pilots flying the aircraft. Wherever possible a complete circuit or straight in approach should be flown. Turns onto base leg shall be made at least 3 nm from the airport. 1000' agl shall be maintained until on final and on the glide path. Utilize the autopilot as much as possible.

Lockhart Air Services trained its pilots to use RNAV GPS approaches as a backup, whenever such approaches were available. Pilots arriving at an airport under night VFR conditions were to program the GPS unit with the approach, overfly the airport, join a downwind leg, and then to intercept the final approach at or outside of the final approach waypoint (FAWP). The aircraft's track during the approach was consistent with this procedure.

Safety Management System

Lockhart Air Services was not required to have a safety management system (SMS) in place.⁸ However, in June 2009, the Transport Canada Ontario region offered operators in its region an opportunity to voluntarily enter into a Transitioning to Safety Management Systems program. This program requires that participating companies establish an internal reporting system, procedure for root cause analysis, and a corrective action plan. Lockhart Air Services participated in this program. A review of program-related information did not reveal any occurrences involving the accident pilot that were similar in nature to this occurrence.

Analysis

The degree of damage indicated that the engines were producing power and the aircraft was operating at significant speed at impact. This, coupled with the wings-level shallow descent angle at which the aircraft contacted the trees, indicates that the aircraft was likely operating normally and under the control of the pilot at impact.

The right altimeter subscale was set to 30.40 inches, which was approximately one inch higher than the prevailing altimeter setting of approximately 29.41 inches. The Lockhart Air Services SOPs require pilots to set and cross-check both altimeters, so the left altimeter was likely set to 30.40 inches as well. Because it requires many turns of the setting knob to achieve a one-inch change in the setting, it is likely that the pilot set the fractional subscale to 0.40, thereby setting the barometric pressure of both altimeters approximately one inch too high. Setting the

⁸ The target date for SMS implementation of all 703 air taxi operators is January 2011.

altimeters one inch too high would cause them to read approximately 1000 feet higher than the aircraft's actual altitude, and the pilot would be led to believe that he was about 1000 feet higher than he actually was.

In total darkness and with no visual cues, the pilot would have to rely solely on his altimeters to determine his altitude. A 1000-foot error could be more difficult to detect with the three-pointer type of altimeter installed on the occurrence aircraft because the longer pointers (the ones most often referenced) would be in a similar position at either setting (see Appendix A – Altimeter Comparison). As a result, the pilot likely did not notice the incorrect altimeter settings and, during the downwind leg, descended to terrain height believing that he was descending to the circuit altitude.

The aircraft overflew the airport and then turned away from the airport in a westerly direction, in accordance with the Lockhart Air Services procedure of confirming that the runway was suitable for use, and then joined the downwind leg. The position of the wreckage indicates that the pilot intended to intercept the final approach for Runway 11. In total darkness, flying the aircraft away from a lighted community and runway placed the aircraft in a position where the pilot was left without any visual clues that might help him determine his position relative to the ground and increased the risk of collision with terrain.

Findings as to Causes and Contributing Factors

1. The aircraft's altimeters were likely set incorrectly, resulting in a higher reading that led the pilot to descend below a safe altitude.
2. While manoeuvring for the approach to Runway 11 at Cat Lake, the aircraft descended and collided with trees on rising terrain.

Finding as to Risk

1. Manoeuvring at night away from visual cues may result in a sudden loss of visual reference, thereby increasing the risk of collision with the ground.

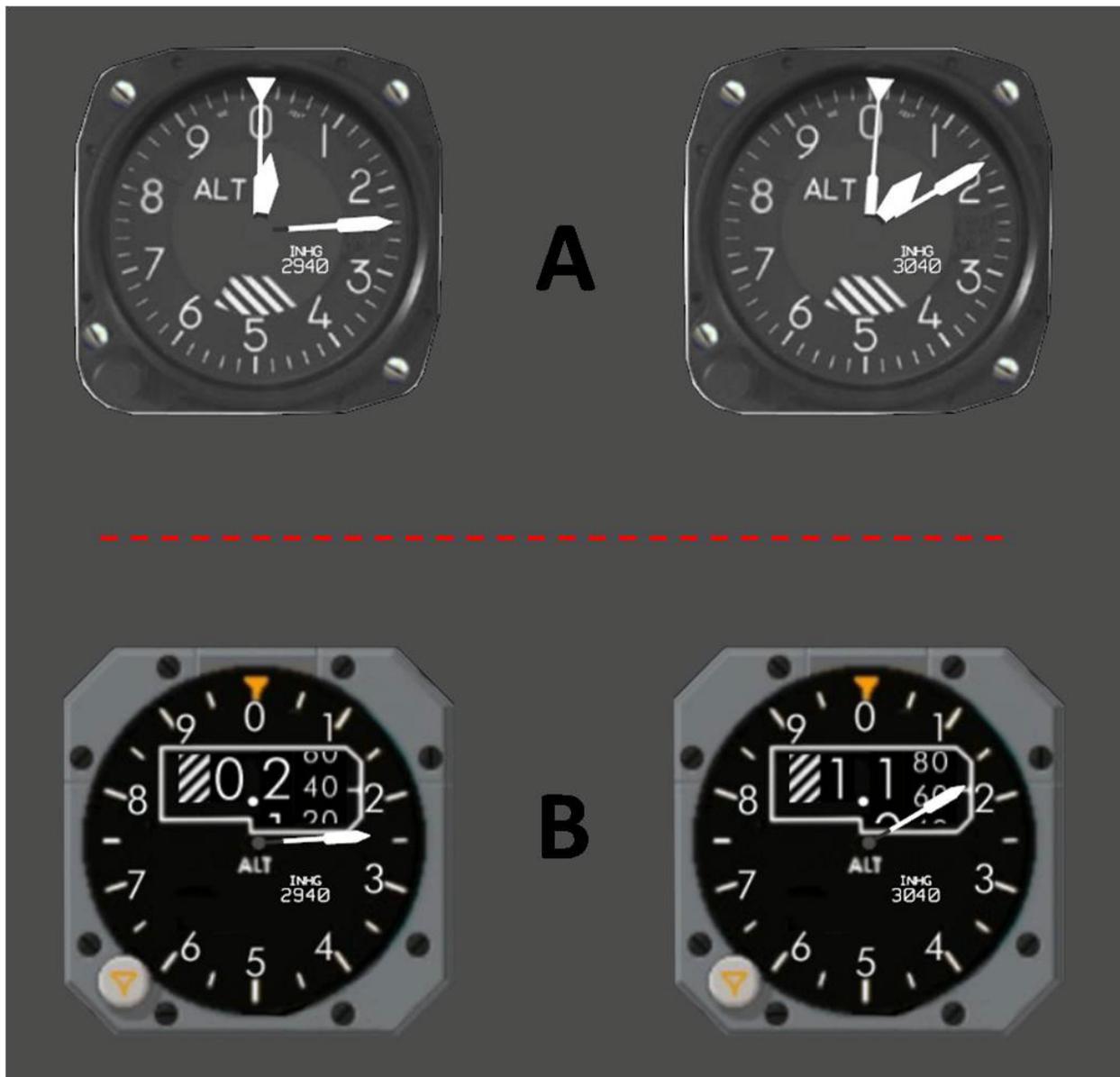
Other Finding

1. The aircraft would have been operated at a lower altitude throughout the flight, risking a potential conflict with other en route traffic or terrain.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 29 April 2010.

Visit the Transportation Safety Board's Web site (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A – Altimeter Comparison



- A. Difference in readings between pointer altimeters not obvious at a glance for settings of both 29.40 and 30.40.
- B. Drum counter type representation of altitude easier to read at a glance for settings of both 29.40 and 30.40.