Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
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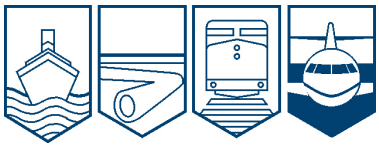

CONTROLLED FLIGHT INTO TERRAIN

AERO PENINSULE LTEE (DBA AIR OPTIMA)
CESSNA 310R, C-GABL
POKEMOUCHE, NEW BRUNSWICK
14 DECEMBER 2010

Canada

Aviation Investigation Report

Controlled Flight into Terrain

Aero Peninsule Ltee (doing business as Air Optima)
Cessna 310R, C-GABL
Pokemouche, New Brunswick 5.5 nm WNW
14 December 2010

Report Number A10A0122

Synopsis

At 1941, Atlantic Standard Time, the Aero Peninsule Ltee (doing business as Air Optima) Cessna 310R (registration C-GABL, serial number 0927) departed the Montréal/St-Hubert Airport, Quebec, on a night instrument flight rules flight to the Pokemouche Airport, New Brunswick. Between 2156 and 2158, 3 transmissions were received from the occurrence aircraft's 406 megahertz emergency locator transmitter; however, the signal terminated before the location could be determined. The wreckage was located 2 days later in a wooded area, approximately 5.5 nautical miles west-northwest of the Pokemouche Airport. The aircraft was destroyed by the impact and post-crash fire. The lone occupant was fatally injured.

Ce rapport est également disponible en français.

Other Factual Information

History of Flight

On 29 November 2010, the occurrence aircraft was flown to the Montréal/St-Hubert Airport (CYHU), Quebec, for the installation of a new audio panel and Garmin GNS 430W global positioning system (GPS). On 13 December 2010, the pilot (who was also the owner of the company) departed Bathurst, New Brunswick, and flew to Montréal, Quebec, on a commercial flight, arriving that evening. The following day, the pilot was scheduled to conduct a test flight and receive familiarization training on the new equipment before returning to the company's base at the Pokemouche Airport (CDA4), New Brunswick.

The pilot awoke prior to 0800 [1] (0700 local) and arrived at CYHU at approximately 1220. The test flight was delayed until 1722. During the 56 minute test flight, the new components were checked for proper operation and the pilot received familiarization training on the new audio panel and GPS. Two instrument approaches and a hold were conducted using the autopilot coupled to the GPS. No aircraft system defects were noted during the test flight.

The pilot initially intended to stay in Montréal a second night and depart for CDA4 the following day. However, due to an unexpected request for a charter flight on the morning of 15 December 2010, the pilot elected to depart for CDA4 immediately following the test flight. Upon completion of the test flight, the pilot had the aircraft refuelled and checked the destination weather. After checking the weather, the pilot ordered additional fuel. At 1941, the aircraft departed CYHU, as a non-revenue flight, [2] on an instrument flight rules (IFR) flight for CDA4.

At approximately 2105, the pilot contacted the Quebec Flight Information Centre to obtain the latest Bathurst Airport (CZBF) and Greater Moncton International Airport (CYQM) weather. [3] The CZBF weather was reported to the pilot as: ceiling 200 feet above ground level (agl), ¼ statute mile (sm) visibility in light drizzle and fog, and wind 010° magnetic (M) at 6 knots. According to the graphical area forecast, CDA4 would experience similar weather conditions as CZBF for the duration of the period (see Appendix A). The weather in CYHU on departure was visual meteorological conditions and the pilot listed Fredericton International Airport as the alternate airport on his flight plan, as it met alternate airport weather limits.

Approaching CDA4, the pilot contacted the company on the radio and was advised that lights on a tower several kilometres away were visible from the airport. The pilot did not state his approach intentions to the Moncton Area Control Center controller or the company employee manning the radio at CDA4. The wind at the time favoured Runway 13, which has a published

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1 All times are in Atlantic Standard Time (Coordinated Universal Time minus 4 hours).

2 The occurrence aircraft was not being operated for hire for the purpose of transporting persons, personal belongings, baggage, goods or cargo at the time of the occurrence. As a result, it was being operated as a non-revenue generating flight and therefore not subject to CAR 703.

3 CDA4, located 35 nautical miles (nm) east of CZBF, does not have a local weather reporting station.

instrument approach based on area navigation (RNAV) using a global navigation satellite system (GNSS) (see Appendix B).

At 2139:09, the aircraft started a normal descent. At 2146:04, approximately 26 nautical miles (nm) from CDA4, the aircraft descended below radar coverage at an altitude of 4400 feet asl.

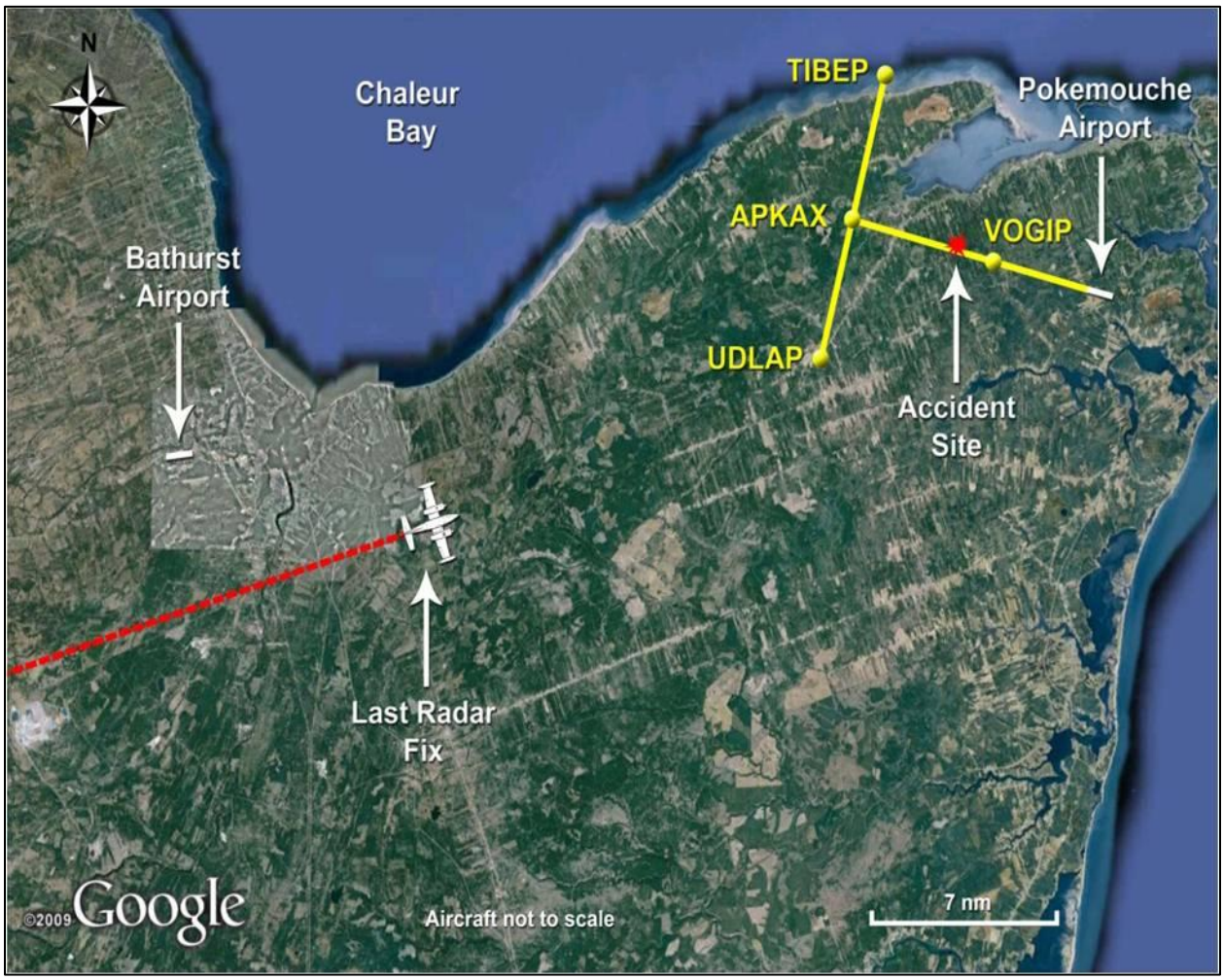

Figure 1. Aircraft flight path to Pokemouche Airport (CDA4)

Wreckage Information

The aircraft was located approximately 5.5 nm west-northwest of CDA4, aligned with the final approach segment of the RNAV instrument approach to Runway 13. The aircraft began striking the tops of the trees approximately 70 feet above ground. The tree strike damage and wreckage trail indicate that initial contact with the trees occurred with the wings level in a shallow descent. As the aircraft's forward speed decreased, impact strikes to the right wing caused the aircraft to roll to the right as it continued to descend. The right wing tip fuel tank was found lodged in a tree 235 feet from the main wreckage. The right engine cowl and right aileron were located 153 and 120 feet respectively from the main wreckage. The aircraft struck the ground inverted, approximately 589 feet from the point of initial impact with the trees, and was destroyed by the impact and an intense post-crash fire.

An examination of the aircraft wreckage revealed no pre-impact anomalies. The damage noted on the propeller blades was consistent with rotation at the time of impact indicating the engines were delivering power. The complete cockpit, including the flight instruments and avionics was destroyed by the post-impact fuel-fed fire. The flaps, landing gear, and landing lights were found in the extended position.

Pilot

Records indicate that the pilot was certified and qualified for the flight in accordance with existing regulations. There was no indication that incapacitation or physiological factors affected the pilot's performance.

The pilot held an Airline Transport Pilot Licence with an instrument rating and valid category 1 medical. The pilot had accumulated approximately 6000 total flight hours, with about 3000 hours on the Cessna 310. The pilot was very familiar with the local terrain as CDA4 was the company's base of operations.

The most recent pilot proficiency check (PPC) had been completed on 22 May 2010, using the company's other Cessna 310. The pilot demonstrated competency in the use of the King KLN 90 GPS installed in that aircraft for the en route phase of flight only. There is no record of the pilot having received training for GPS approaches nor is GPS approach training required by regulation when operating as a non-revenue flight.

The pilot's experience using the newly installed Garmin GNS 430W GPS and the new audio panel on the accident aircraft was limited to the training received in CYHU on the day of departure and during the occurrence flight.

The pilot received initial controlled flight into terrain (CFIT) avoidance training on 26 June 2000. Annual recurrent CFIT avoidance training was completed on 16 May of 2009 and again on 15 May 2010. There is no record of the pilot having ever completed crew resource management (CRM) or pilot decision making training.

The Operator

Aero Peninsule Ltee, when operating revenue flights under *Canadian Aviation Regulations* (CAR) Subpart 703, was authorized for en route GPS navigation only, not GPS approaches. The operator had not obtained Operations Specification 100 authorizing the conduct of GPS approaches on revenue flights. The operator's *Company Operations Manual*, Chapter 5 –Training, requires pilots to undergo RNAV training for the en route phase of flight only. The company did not provide training to pilots on how to conduct RNAV approaches, nor was it required by regulation.

The company's operations manual requires pilots to undergo initial CFIT training, and then recurrent CFIT training biennially. There is no requirement for CAR 703 operators to provide CRM or pilot decision making training.

Aircraft

The aircraft was certified, equipped and maintained in accordance with existing regulations and approved procedures. The occurrence aircraft had a 100-hour inspection completed on 19 November 2010 and there was no record of unresolved deficiencies. The weight and center of gravity were within prescribed limits at the time of the accident. The aircraft was equipped and certified for IFR flight, flight into known icing and could carry a pilot and 5 passengers (see Photo 1).

The aircraft's 406 Megahertz (MHz) ELT, which was not GPS-encoded, [4] was destroyed by the severe impact and post-crash fire, causing it to stop functioning after 3 transmissions. The 406 MHz ELTs are not yet required by CARS nor required to be GPS encoded. However, if installed, the 406 ELT has to be registered with the Canadian beacon registry of the National Search and Rescue Secretariat.[5] The aircraft was not equipped with on board recorders, nor were any required by regulation.

The newly installed Garmin GNS 430W GPS [6] included a terrain awareness feature provided as a standard on 400W-series units to increase situational awareness and help reduce CFIT. An enhanced terrain awareness warning system (TAWS) is an additional optional feature on 400W-series units. The terrain awareness feature of the GPS, which defaults to ON unless selected OFF by the pilot, provides a visual depiction of high terrain or obstacles relative to the aircraft altitude. Terrain above or within 100 feet below the aircraft's altitude is depicted in red. Terrain between 100 and 1000 feet below the aircraft altitude is depicted in yellow and terrain more than 1000 feet below the aircraft's altitude is depicted in black.

During GPS approach mode, the terrain awareness feature, if active, will provide a visual warning to the pilot if the aircraft is too low on approach. An aural warning is also available for this model. However, it was not part of the GPS package installed in the occurrence aircraft. The terrain awareness visual warning feature was demonstrated briefly to the pilot during the 56-minute test flight. It could not be determined if the pilot had previously completed any self-study on the new equipment.

Transport Canada has submitted Notices of Proposed Amendments (NPAs), scheduled for publication in the Canada Gazette Part I during 2011 that will require a TAWS system be installed in any commercially operated turbine powered aircraft with six or more passenger seats. As of this writing, these new regulations have not been implemented.

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4 A GPS-encoded ELT, includes a GPS position in the signal transmitted to Search and Rescue services.

5 CAR 605.38(4).

6 The installed Garmin GNS 430W GPS came equipped with database cycle #1012 which was due to expire on 15 December 2010.

Photo 1. Occurrence Aircraft C-GABL

Airport

CDA4 is a registered aerodrome, located in uncontrolled airspace at an elevation of 68 feet above sea level (asl). The only published approach for Runway 13 is an RNAV (GNSS) approach (see Appendix B). The minimum safe altitude within 25 nm of the airport published on the approach chart is 1900 feet asl. Crossing the UDLAP initial entry point for the approach, an aircraft can descend to a minimum altitude of 1600 feet asl. From the aircraft's last recorded radar position, approximately 15 nm from UDLAP at an altitude of 4400 feet asl and a ground speed of 180 knots, a descent rate of approximately 500 feet per minute would be required to cross UDLAP at 1900 feet for the GPS approach. Once an aircraft reaches APKAX, it can descend to 1000 feet asl until 4 nm from the airport, at which point the final descent may be initiated. The highest terrain between APKAX and Runway 13 is 130 feet asl. There are 2 other published approaches for the Pokemouche Airport, a GPS and a non-directional beacon approach, both on Runway 31. The descent minimum on all 3 approaches is 680 feet asl.

Weather

CZBF is the nearest aviation weather station to CDA4. The weather at CZBF at 2100 feet was as follows: wind 010° true (T) at 6 knots, variable from 330°T to 040°T, visibility ¼ sm in light drizzle and fog, vertical visibility 200 feet agl, temperature and dew point 5°C, altimeter 29.41 inches of mercury (in. Hg), remarks fog eight oktas. [7]

The terminal area forecast issued at 1941 on 14 December 2010 and valid at 2000 feet called for overcast clouds with bases at 2500 feet and tops at 20 000 feet, visibility 3 sm to 6 sm in light rain

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7 Cloud layer amounts are reported in eights (oktas) of sky coverage.

and mist. In addition, extensive ceilings based at 300 feet agl with scattered altocumulus castellanus clouds topped at 22 000 feet were forecast,reducing visibility to 1 sm in rain showers and mist with some local conditions of ½ sm visibility in fog. The enroute icing conditions were forecast to be nil to light rime in cloud. A quasi stationary cold front was lying north to south directly over CZBF with these forecasted conditions east of the cold front (see Appendix A).

On the day of the occurrence, the departure altimeter setting for CYHU was 29.61 in. Hg and arrival altimeter [8] setting for CZBF was 29.41 in. Hg. This decrease in atmospheric pressure would equate to a 200 foot low indication on an aircraft's altimeter if the CYHU altimeter setting was still being used on arrival at CDA4.

Controlled Flight into Terrain

A CFIT accident is an occurrence in which an aircraft, under the control of the crew, is flown unintentionally into terrain, obstacles, or water with no prior awareness on the part of the crew of the impending collision. In March 2010, the TSB issued a multi-modal Watchlist to identify the safety issues investigated by the TSB that pose the greatest risk to Canadians. One of the aviation safety issues identified is the number of fatalities that continue to occur when aircraft collide with land and water while under crew control. [9]

Between 2000 and 2009, there have been 129 CFIT accidents in Canada, resulting in 128 fatalities. Collisions with land and water account for 5% of accidents but nearly 25% of all fatalities. This type of accident often happens when visibility is low, at night, or during poor weather. Such conditions reduce pilot situational awareness of surroundings and make it difficult to tell whether the aircraft is too close to the ground. In addition, non-precision instrument approaches, which often involve multiple step-down altitudes, also increase the risk of CFIT. [10] The risk is greater for small aircraft, which venture further into remote wilderness or into mountainous terrain but are not required to have the same type of ground proximity warning equipment as large airliners.

The TSB has investigated numerous collisions with land and water and has identified deficiencies, made findings, and issued recommendations such as installing ground proximity warning systems in smaller aircraft. Advances in technology have resulted in cockpit equipment that can significantly improve a pilot's situational awareness. But, without a mandatory requirement for TAWS, passengers and crews continue to be at risk of CFIT.

The following TSB Laboratory report was completed:

LP032/2011 – Terrain Elevations and Graphic Illustrations Cessna 310R, C-GABL

This report is available from the Transportation Safety Board upon request.

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8 Bathurst Airport altimeter setting is used for Pokemouche Airport – Appendix B.

9 http://www.tsb.gc.ca/eng/surveillance-watchlist/aviation/air_2.pdf

10 Federal Aviation Administration, "General Aviation Controlled Flight into Terrain Awareness," *Advisory Circular (AC) 61-134* (2003).

Analysis

There was no indication that an aircraft system malfunction contributed to this occurrence, nor is there any indication that incapacitation or physiological factors affected the pilot's performance. As a result, the analysis will examine the weather, training, and the pilot decision making factors which most likely contributed to this occurrence.

On the day of the occurrence, the departure altimeter setting for CYHU was 29.61 in. Hg and the arrival altimeter setting for CZBF was 29.41 in. Hg. If the CZBF altimeter setting was not applied prior to the commencement of the instrument approach, the aircraft's actual altitude would have been 200 feet lower than indicated on the altimeter. While an altimeter error of this nature would reduce safety margins, levelling off at the minimum descent altitude with the incorrect altimeter setting of 29.61 in. Hg would still provide several hundred feet of clearance between the aircraft and the terrain. As a result, it is unlikely that the aircraft impacted the ground simply because the altimeter had not been switched to the current CZBF altimeter setting.

This occurrence involved several of the most common factors associated with controlled flight into terrain (CFIT) accidents. In particular, it involved flight conditions that would make it nearly impossible to see the approaching terrain and it involved an instrument approach procedure with multiple step-down altitudes. As a result, each time that a descent is commenced, the pilot must remain vigilant to ensure that the aircraft does not descend below the appropriate minimum safe altitude, which during this portion of the approach was 1000 feet above sea level (asl). The combination of a non-precision instrument approach, conducted at night, with low ceilings and limited visibility significantly increases the risk of CFIT.

The operator was not authorized to conduct GPS approaches on revenue flights, and there was no evidence of the pilot undergoing the required training for conducting GPS approaches. While familiar with the aircraft and operating environment around CDA4, the pilot was inexperienced with the newly installed equipment. As a result, trying to use the new and unfamiliar GPS with a terrain awareness feature and audio panel in adverse weather at night would have increased pilot workload and made it difficult to maintain situational awareness. Based on the heading and location of the aircraft at the time of the impact, it is likely that the pilot was attempting to carry out the area navigation (RNAV) approach to Runway 13 and inadvertently flew into terrain.

The pilot elected to return to CDA4 on the evening of 14 December 2010 so the aircraft would be available for an unexpected charter flight booked for the following morning. This influenced the pilot's decision to depart, despite the pilot's lack of familiarity with the new GPS and unfavourable weather at the destination. The pilot, under self-imposed pressure, likely elected to carry out a GPS approach to Runway 13 in IFR weather that was at or below landing limits. The other two approaches available were on Runway 31, both having the same landing limits as the approach to Runway 13.

Currently, there is no requirement for smaller Canadian-registered aircraft to be equipped with TAWS. Although Transport Canada has proposed new regulations which will require TAWS for commercially operated turbine powered aircraft with 6 or more passenger seats, the regulation will not require TAWS be installed on commercially operated turbine power aircraft

with less than 6 passenger seats. The lack of regulation requiring TAWS on all commercially operated passenger aircraft places flight crew and passengers travelling on those aircraft at increased risk of CFIT.

The occurrence aircraft was fitted with a terrain awareness feature which would visually warn the pilot of the aircraft's proximity to terrain if it got too low during an instrument approach. This type of equipment is an example of recent advances in technology designed to improve a pilot's situational awareness and reduce the risk of CFIT. However, in order for its full potential to be realized, pilots must be properly trained in the use of the terrain awareness feature.

In this occurrence, the pilot received a brief familiarization session on the GPS, avionics, and terrain awareness feature that had newly been installed in the aircraft. It is unknown whether or not the terrain awareness feature was activated during the RNAV approach to Runway 13. It is possible that the terrain awareness feature was activated and that the pilot did not understand the information that was being presented. The lack of adequate training on newly installed equipment, such as a GPS with a terrain awareness feature, increases the risk of improper use during flight.

It took 2 days for search and rescue (SAR) personnel to locate the aircraft. This is due to the 406 MHz ELT, which was not equipped with GPS encoding, only transmitting briefly before it was rendered inoperative. If 406 MHz ELTs are not GPS-encoded, there is increased risk that SAR services will be delayed unnecessarily if the ELT is rendered inoperative following an occurrence.

Findings as to Causes and Contributing Factors

1. The pilot, under self-imposed pressure to meet an unexpected charter request the next day, likely elected to carry out an area navigation (RNAV) approach in instrument flight rules (IFR) weather that was at or below landing limits.

2. It is likely that the aircraft was inadvertently flown into terrain while the pilot was attempting to carry out the RNAV approach to Runway 13.

3. Attempting to use a new and unfamiliar global positioning system (GPS), terrain awareness feature and audio panel in adverse weather at night would have increased pilot workload, making it difficult to maintain situational awareness.

Findings as to Risk

1. The combination of a non-precision instrument approach, conducted at night, with low ceilings and limited visibility significantly increases the risk of controlled flight into terrain (CFIT).

2. The lack of regulation requiring TAWS on all commercially operated passenger aircraft places flight crew and passengers travelling on those aircraft at increased risk of CFIT.

3. The lack of adequate training on newly installed equipment, such as a GPS with a terrain awareness feature, increases the risk of improper use during flight.

4. If 406 MHz emergency locator transmitters (ELT) are not GPS-encoded, there is increased risk that search and rescue services will be delayed unnecessarily if the ELT is rendered inoperative following an occurrence.

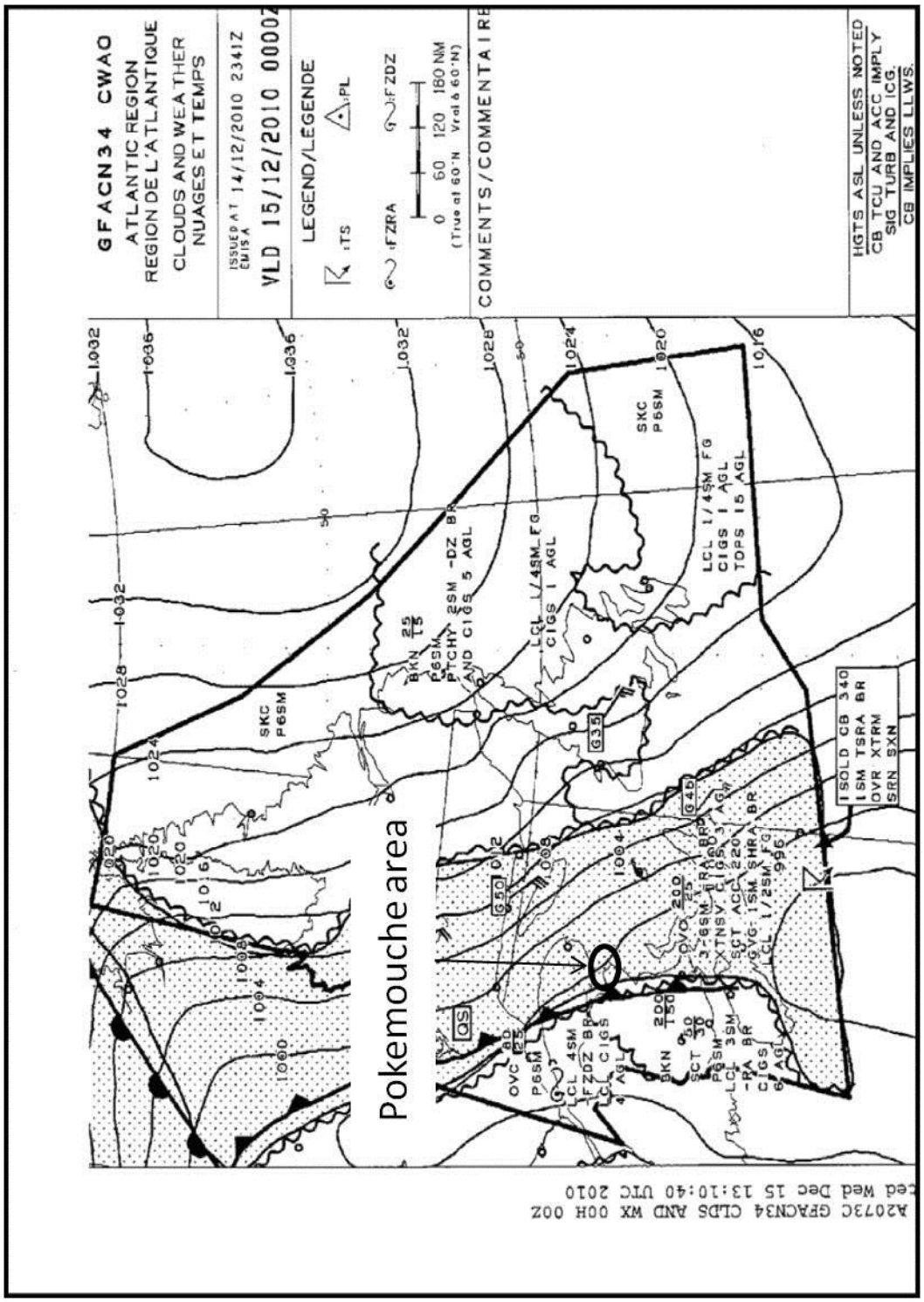
Other Finding

1. It is unlikely that the aircraft impacted the ground simply because the altimeter had not been switched to the current Bathurst altimeter setting.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 09 November 2011.

Visit the Transportation Safety Board's website (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 – Graphical Area Forecast



Appendix B –Pokemouche Airport Instrument Approach Chart