Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A10O0240

LOSS OF CONTROL AND COLLISION WITH TERRAIN
SENECA COLLEGE OF APPLIED ARTS AND TECHNOLOGY
BONANZA F33A C-GSCZ
TORONTO/BUTTONVILLE MUNICIPAL AIRPORT, ONTARIO
10 NM E
18 NOVEMBER 2010

Canada

Aviation Investigation Report

Loss of Control and Collision with Terrain

Seneca College of Applied Arts and Technology
Bonanza F33A C-GSCZ
Toronto/Buttonville Municipal Airport, Ontario
10 nm E

18 November 2010

Report Number A10O0240

Synopsis

At approximately 1819 Eastern Standard Time, the Seneca College of Applied Arts and Technology (Seneca College) Beechcraft F33A aircraft (registration C-GSCZ, serial number CE-1709) departed Toronto/Buttonville Municipal Airport for Kingston Airport, Ontario, on a night visual flight rules flight with an instructor and 2 commercially-qualified students on board. Weather en route began to deteriorate and the aircraft headed back to Toronto/Buttonville Municipal Airport. The aircraft was observed on radar to be westbound in level flight before it turned north and began to climb. The aircraft then turned abruptly to the left and descended; radar contact was lost. The aircraft was subsequently located in a ploughed level field approximately 10 nautical miles east of the Toronto/Buttonville Municipal Airport. It was destroyed on ground impact and the 3 occupants were fatally injured. There was no fire and the emergency locator transmitter did not activate. The accident occurred at approximately 1844 Eastern Standard Time during the hours of darkness.

Ce rapport est également disponible en français.

Other Factual Information

History of Flight

The purpose of the flight was to fly at night under visual flight rules (VFR) to the Kingston Airport (CYGK) to practice instrument flight rules (IFR) approaches before returning to Toronto/Buttonville Municipal Airport (CYKZ) later in the evening. It was planned that one student would fly from the left seat to CYGK while the other was seated in the back. They would switch at CYGK and the second student would fly simulated instrument approaches. The students would switch seats again for the return flight. The instructor was the pilot-in-command and was seated in the right seat. The aircraft departed CYKZ at approximately 1819 [1] with the first student in the left seat as planned.

Approximately 11 nautical miles (nm) east of the Oshawa Airport (CYOO), the flight crew reported deteriorating weather conditions and decided to return and perform a simulated RNAV approach at CYKZ.

During the return flight, radar information indicated that C-GSCZ maintained an altitude of approximately 2300 [2] feet above sea level (asl) and a ground speed of 130 knots (approximately 115 indicated air speed (IAS)) [3] on a track of 260 degrees [4] true. As it proceeded, C-GSCZ contacted CYKZ tower and requested clearance to perform a simulated area navigation (RNAV) approach to Runway 33. The instructor was handling radio communication with CYKZ, suggesting that the student was flying the aircraft. The CYKZ tower controller provided the clearance for the approach with instructions to maintain VFR, not to exceed 2500 feet asl and report when passing LOBNI (see Appendix A). Instead of reading back the clearance or otherwise acknowledging the clearance as would have been the norm, the instructor's response was "standby". There were no further radio transmissions from the aircraft.

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1 All times are Eastern Standard Time (Coordinated Universal Time minus 5 hours).

2 All altitude values are estimated based on radar return data which has a plus or minus 50 feet variance.

3 Radar displays ground speed. The indicated airspeed was calculated based on wind aloft data.

4 All tracks are true unless stated otherwise.

Immediately after this last communication, the radar indicated the aircraft began a climbing right turn to a track of 330°. The airspeed reduced to approximately 90 knots IAS during the climb. The second last radar contact showed the aircraft climbing through an altitude of 2800 feet asl, and turning westbound to a track of 277° with a further reduction to 50 knots IAS. The last radar contact at about 1843 indicated the aircraft was tracking 211°, descending rapidly through 2100 feet asl with the IAS at 90 knots and increasing (see Figure 1).

A second Seneca College Bonanza aircraft that was training in the CYOO Airport area was requested by the tower to break off training and head westbound to the area of the last radar contact with C-GSCZ but was unable to locate the aircraft. A police helicopter was also dispatched to the same area and, using a search light, was able to locate the wreckage.

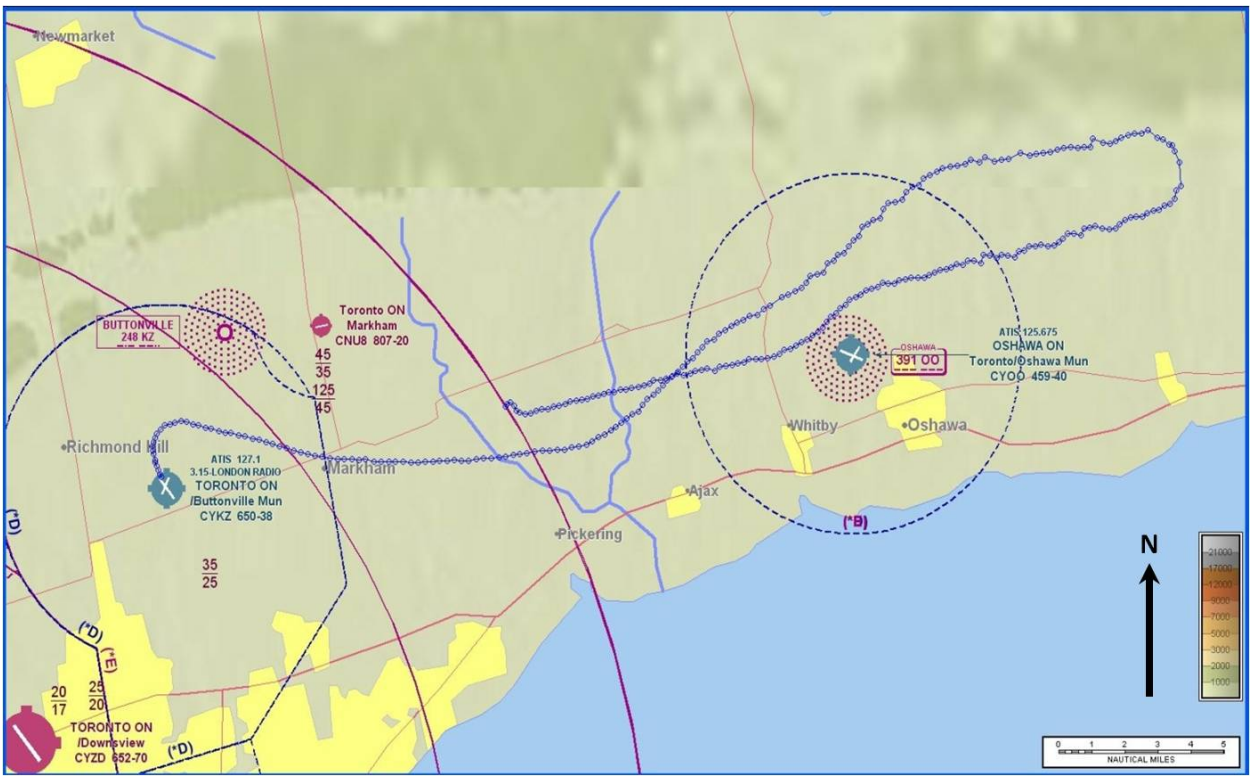

Figure 1. Actual flight path

Wreckage Description and Examination

The wreckage was located in a level ploughed field in a non-residential area at an elevation of 695 feet asl. The aircraft struck the ground right side up, nose down at an angle of 40° creating a shallow crater. The wings also struck the ground and left ground scars which indicate that the aircraft was in a near wings-level attitude.

The aircraft broke up on a track of 303° and came to rest 350 feet from the original point of impact. The wreckage trail comprised several airframe components including the propeller, doors, panels and seats. The engine remained partially attached to the main wreckage. The left horizontal stabilizer separated from the empennage and was located along the wreckage trail.

The vertical and right horizontal stabilizer remained attached to the separated aft fuselage section. The wings partially separated but remained in proximity of the main wreckage. The aircraft's cabin was substantially damaged with no remaining structural integrity. The left and right wing attachment fittings remained attached to the carry-through structure. On impact, the wings failed in overload outboard of the attachment fittings. Continuity check of all primary flight controls cables was confirmed. The flaps and the landing gear were fully retracted. The integrity of the seats and restraining systems were compromised during the impact sequence. Overall examination of the wreckage determined that the aircraft was intact prior to impact.

Due to the extent of damage to the wings, it could not be determined if the stall vane was serviceable prior to impact.

Examination of the two control columns identified their position on the aircraft. Both columns were found along the wreckage trail. The left presented little damage in comparison to the right. The right had both handles sheared at the base in overload.

The engine was later disassembled and examined. There was no evidence of any pre-impact internal engine failures. The damage to the variable pitch propeller was indicative of the engine producing power prior to the ground impact. There was no engine instrument evidence to indicate the amount of engine power being produced at the time of impact.

The ELT was damaged during the impact and was found separated from the aircraft in the field. The antenna cable was detached from the ELT and therefore it was unable to transmit a signal.

Aircraft

This F-33A Bonanza was a four-place, low-wing monoplane equipped with retractable landing gear, a 285-horsepower Teledyne Continental Motors IO-520 engine, and a 3-blade Hartzell propeller.

Records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The aircraft was manufactured in November of 1992 and was registered in Canada to Seneca College since December of 1992. It was certified to be operated by a single pilot and was considered by Seneca College to be appropriate for its flight training operations. Seneca College operated 5 Beechcraft Bonanza F33As at the time of the occurrence.

The aircraft was maintained under an approved Continuous Care Inspection maintenance program. It had accumulated approximately 10 116 hours of flight time. Its last inspection was performed 8 days prior to the occurrence and had since accumulated 16 hours. Maintenance records indicate that there were no deferred defects, except for the electric pitch trim which had been de-activated earlier in the year. Manual pitch trim was used to operate the pitch trim system.

The aircraft was equipped with dual flight controls allowing for control from either of the two front seats. The instrument panel was arranged where all flight instruments were on the left side in front of the student, engine instruments in the center, and radios and navigation equipment, including the GPS, in front of the instructor.

The aircraft was not certified or equipped to fly in icing conditions, and only the pitot probe located under the left wing's leading edge was electrically heated. The stall warning vane, also located on the left wing leading edge, was not heated.

The aircraft was limited to a never exceed indicated airspeed of 196 knots, and at the maximum gross weight of 3400 lbs, the aircraft stalls at an indicated airspeed of 63 knots with flaps retracted and 51 knots with flaps extended. The pilot operating handbook does include an emergency speed reduction procedure of dropping the landing gear to prevent excessive speed build up in case of pilot disorientation or loss of control.

Electric Pitch Trim System

C-GSCZ was involved in an occurrence on 21 June 2009 when 2 students had difficulty controlling the electric pitch trim system during an approach with the landing gear and flaps extended. The trim motor began to operate without being selected by the students resulting in the aircraft pitching nose up abruptly. It required the effort of both students to maintain level flight. The electric pitch trim system eventually disconnected by itself and the aircraft landed safely. The electric pitch trim system master switch had not been selected off during the event. Maintenance personnel were unable to duplicate the fault, but as a precaution, Seneca College de-activated the electric pitch trim systems on all of its Bonanza aircraft.

The Transportation Safety Board (TSB) became involved in this previous occurrence. The electric pitch trim motor assembly was retrieved and shipped to the TSB Laboratory (Occurrence A09O0133). During examination, the only fault found was that one of the magnetic shields for the clutch solenoid had failed in fatigue. It was not determined whether the shield failure contributed to the trim runaway condition. The only other manner that the clutch would have remained engaged was if a short existed in the control switch or the wiring from the switch to the servo. However, maintenance conducted several tests and was unable to duplicate the fault. According to maintenance records, the electric pitch trim system remained de-activated on this aircraft.

Because of this previous occurrence, the TSB examined the remaining components of the trim system. The system circuit breaker located on the right instrument sub panel was substantially damaged and its position could not be determined. However, tests on the other trim system components and the aircraft wiring did not reveal any anomalies that would suggest the electric trim system was either powered or operating at the time of the accident.

Instructor Flying Experience

The instructor was certified and qualified for the flight in accordance with existing regulations. He held a commercial pilot licence with a group 1 instrument rating and was qualified to fly single and multi-engine land aircraft. The instructor was a graduate of the Seneca College flying program who was subsequently hired by Seneca College as an instructor in July 2008. Since that time he had accumulated approximately 900 hours as an instructor. One month prior to the occurrence he was issued a Class 1 Flight Instructor rating.

A review of his flying record dating back to April 2009 indicated that he had flown 23.7 hours in night conditions. Since that date his total instrument instruction time was 13.7 hours of which 2.7 were flown in night conditions. All of the instrument hours were flown two months prior to the occurrence. He had a total of 234.1 hours on the Bonanza F33A, of which 41.2 were instrument and 3.1 at night.

Table 1 shows other total flying time in hours based on the instructor's log book:

Table 1. Total flying time in hours based on Instructor log book

Total Flying Time	Pilot-in-Command Single Engine Aircraft	Pilot-in-Command Multi Engine Aircraft	Pilot-in-Command Night Flying Single Engine	Instrument Actual	Instrument Total
1254.3	1098.5	2.5	63.6	7	175 [5]

Student Flying Experience

[5] There was an additional 33.4 hours of instrument instruction recorded in Seneca's FRASCA instrument simulator which had not been transcribed into his personal log book.

The student flying held a valid commercial pilot licence. The following chart indicates the student's flying experience in hours including total time flying prior to entering the Seneca College flight program:

Table 2. Student's flight hours prior to entering Seneca College flight program

Total Flying Time	Pilot-in-Command Single Engine Aircraft	Night Flying On Bonanza F33A	Pilot-in Command On Bonanza F33A Daytime	Dual Daytime Flying on Bonanza F33A	Instrument Total
207.4	90.4	4	32	23	47

Intended Flight Path

The aircraft was expected to remain in VFR conditions, climb 200 ft and maintain an altitude of 2500 feet asl while turning south to intercept the RNAV Runway 33 approach procedure. Upon reaching VIGSA the aircraft would turn northbound to a track of 333° magnetic. Once past this waypoint, the aircraft would have begun to descend to 1500 feet asl and, upon overflying waypoint LOBNI, would have contacted Buttonville tower. This is a standard published procedure for an RNAV (GNSS) [6] approach to Runway 33, which the aircraft was intending to perform.

Radar data indicates that after receiving the clearance from the tower, the aircraft was in a climbing right turn toward the north. As the aircraft climbed from approximately 2300 up to 2800 feet asl the IAS dropped from 115 knots to 60 knots. The aircraft then started rolling to the left but the airspeed dropped further to 50 knots. This was followed by a rapid loss of altitude and a correspondingly rapid increase in airspeed. The last radar contact showed the aircraft at an altitude of approximately 2100 feet asl descending rapidly at 9600 feet per minute and accelerating through 140 knots.

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6 RNAV GNSS – Area Navigation Global Navigational Satellite Systems

Assuming a constant rate of descent at approximately 9600 feet per minute, the time required to reach ground elevation would have been 8.6 seconds.

Turning Stall

When an aircraft is in a climbing turn, the higher wing is at a greater angle of attack than the lower wing. If the aircraft approaches the stall airspeed, the higher wing will stall first turning the aircraft in the direction of the higher wing. Engine power results in an increased airflow over the inboard sections of the wing during the approach to stall. This causes a delayed separation of the airflow compared to the outboard sections where the ailerons are located. The outboard section stalls before the inboard and if an asymmetry exists between the wings, the wing drop will be more pronounced. The flight manoeuvre that was observed on radar and further supported by engineering estimations was indicative of a wing stall.

Meteorological Conditions

CYKZ, located approximately 10.5 nautical miles (nm) west of the occurrence site, at 1900 on the evening of the occurrence, was reporting the winds from 280° at 6 knots and the visibility at 15 miles, a few clouds at 2000 and 5000 feet, a temperature of 2.3° and a dew point of -0.6°C. At 2000, the winds were from 300° at 4 knots, visibility 15 miles, a few clouds at 2000 and 22 000 feet, a temperature of 1.4°C and a dew point of -0.8°C.

The CYKZ forecast for the time period was for winds from 300° at 5 knots, visibility more than 6 miles, a few clouds at 3000 feet and broken clouds at 6000 feet. Temporarily reduced visibility to 5 miles in light rain showers and mist, with broken clouds at 2000 feet and winds from 330° at 10 gusting 20 knots was forecast to be over approximately 2 hours prior to the occurrence. The later part of the forecast period indicated winds from 320° at 5 knots, visibility more than 6 miles and a few clouds at 3000 feet.

CYOO, located approximately 10.4 nm east of the occurrence site, at 1900 on the evening of the occurrence, was reporting the winds from 310° at 5 knots and the visibility at 9 miles, scattered clouds at 3600 feet and broken clouds at 4500 feet, a temperature of 1°C and a dew point of 1°C.

There were 4 special weather observations for CYOO as follows:

- At 1919, the winds were from 340° at 6 knots, variable from 290° to 350°, visibility still at 9 miles, scattered clouds at 1500 feet, broken clouds at 2400 and 3600 feet with the temperature and dew point still at 1°C.
- At 1923, the winds were from 320° at 5 knots, visibility at 9 miles, scattered clouds at 1500 and 2000 feet, broken clouds at 2600 and 3400 feet, a temperature of 2°C and dew point of 2°C.
- At 1932, the winds were from 320° at 5 knots, visibility at 9 miles, scattered clouds at 1700 feet, broken clouds at 2200, 2900 and 3900 feet, a temperature of 2°C and dew point of 2°C.
- At 1933, the winds were from 310° at 6 knots, visibility at 9 miles in light rain, scattered clouds at 1700 feet, broken clouds at 2200 and 2700 feet, overcast clouds at 3700 feet, a temperature of 2°C and dew point of 2°C.

The next regular weather observation for CYOO, at 2000, was reporting the winds from 350° at 5 knots, visibility at 9 miles in light rain, overcast clouds at 1400 feet, a temperature of 2°C and dew point of 2°C.

There was no Terminal Area Forecast for CYOO.

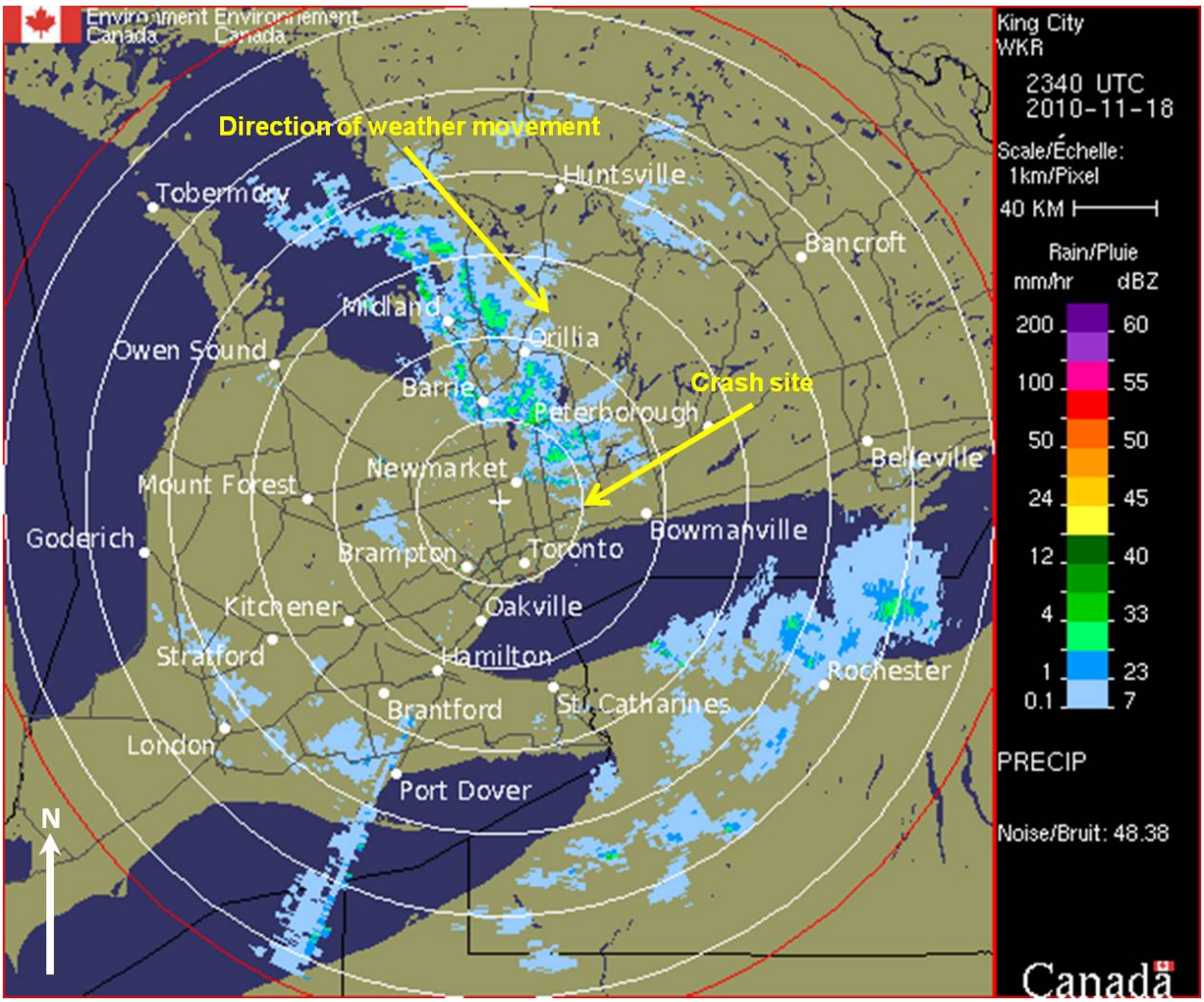


Figure 2. Location of Accident Site and Weather Conditions

Environment Canada radar indicated precipitation in the form of rain moving in a southerly direction towards Lake Ontario from Lake Huron. The graphical area forecast (GFA) clouds and weather forecast for Ontario region valid at 1900 hours, forecasted isolated towering cumulus clouds, 2 statute miles visibility in light snow showers with a ceiling of 1000 feet agl over and off Lake Huron. The GFA icing turbulence and freezing forecast issued at 1242 and valid at 1900 showed no icing being forecast with a freezing level at 2500 feet asl. A second GFA issued at 1832 and valid at 1900 showed moderate mixed icing between 3000 to 9000 feet asl. This forecast was not available prior to the aircraft departing CYKZ. Although no PIREPS were received prior to the occurrence, aircraft in the vicinity and at an altitude of 2500 agl, were encountering light icing conditions with mixed precipitation, and a temperature of approximately -2°C.

Although CYKZ and CYOO airports were reporting VFR weather conditions, at the mid-point between the two, there were ground reports of rain mixed with snow with temperatures suitable to icing.

The following TSB Laboratory reports were completed:

LP162/2010 – Instrument Analysis

LP164/2010 – Radar and ATC Synchronization

LP191/2010 – Aircraft Performance Analysis

Analysis

The analysis will focus on the environmental conditions at the location of the occurrence, and provide a plausible scenario for the deviation in the flight path that led to the loss of directional control and rapid descent with no recovery prior to ground impact.

Deteriorating weather conditions encountered enroute prompted the flight crew to cancel the planned flight to CYGK and return to CYKZ. Radar data and recorded voice communications indicate that the return flight was normal until the climbing right turn. During that turn, airspeed was allowed to decrease suggesting that engine power was not increased to maintain a safe airspeed. The aircraft rolled into a steep left turn with a high rate of descent. The flight manoeuvre that was observed on radar and further supported by engineering estimations indicates a left wing stall followed by an abrupt left wing drop. The abruptness of the wing stall could have been exacerbated by any airframe icing which may have accumulated on the wings.

Weather information from other aircraft in the vicinity and from ground observations indicated that local weather conditions which included rain, snow, and freezing rain, were quite different to the conditions at either CYOO or CYKZ. Encountering these weather conditions unexpectedly may have influenced the crew's decision to intentionally deviate to the north to find better weather. Outside visual reference may have also been hampered by these weather conditions and by darkness.

Although it is impossible to ascertain who was controlling the aircraft at the time, it is logical to assume that the student was at the controls while the instructor was requesting the approach clearance. When the aircraft stalled, the instructor would have been attempting to recover control. The rapidity of the stall, the airspeed during the descent and the lack of available altitude prevented a full recovery before the aircraft struck the ground. This would have been compounded by limited visual reference due to the weather conditions and the lack of flight instruments on the right side of the instrument panel.

There were approximately 8 seconds between the loss of control and when the aircraft struck the ground assuming a constant rate of descent of 9600 feet per minute. Ground impact marks show that, although the aircraft was nose down, it was in a near wings level attitude, suggesting that the recovery had been initiated but altitude and excessive descent speed precluded full recovery.

Findings as to Causes and Contributing Factors

1. After encountering adverse weather conditions, a climbing right turn was initiated. During the climbing turn, engine power was likely not increased and the airspeed decayed. The angle of attack on the left wing was allowed to increase until it stalled and dropped unexpectedly.

2. The location of the flight instruments made it more difficult for the instructor in the right seat to see and react to them and control of the aircraft was not regained before the aircraft struck the ground in a non-survivable impact.

Safety Action

Seneca College has instituted the following changes to its training program to enhance flight safety:

- Group weather briefing - This is attended by all instructors and students who will be flying on that particular shift. By doing this, it is ensured that everyone has looked at the weather prior to their flight. The only exception is if a student is going on a Transport Canada flight test where the student will be graded by an examiner for checking weather.

- Recurrent upset training for instructors - All instructors are to go through upset training in Seneca College flight training devices to learn how to regain control of an aircraft in emergency situations and recover from an unusual attitude. This training is done with certain flight instruments failed.

- Night flying ground briefing for instructors - A recurrent training session regarding night flying.

- Weather briefing for instructors - A recurrent training session regarding weather hazards with a focus on icing.

- Briefing on spatial disorientation for instructors - A recurrent training session reviewing different types of illusions and preventative measures.

- Expanded indoctrination training for new instructors - New instructors to have an expanded indoctrination checklist they complete when they start teaching at the college.

- The Seneca College aviation training program is broken up into different phases. An expanded training program is being developed for instructors who start training in a new phase of the program based on their past experience.

- Stand by attitude indicators to be installed in aircraft - The plan is for standby attitude indicators to be installed in all aircraft that require them. This is in the event there is a failure of the primary attitude indicator; the standby attitude indicator can be used to aid in flying the aircraft.

Seneca College has instituted the limits shown below for single engine at night operations:

- All night flying is to be conducted in VFR weather only.

- Instrument or IFR training may be conducted at night in VMC only.

- VFR flight plans are to be filed at night outside of the circuit (no IFR filing even in VMC).

- Reported and forecast visibility shall not be less than 6 statute miles. Authorized ceiling remains as per its Operations Manual Section 2.6.

- There shall be no visible or forecast precipitation in the area of operation when flying in temperatures of 5 °C or colder (at operating altitude).

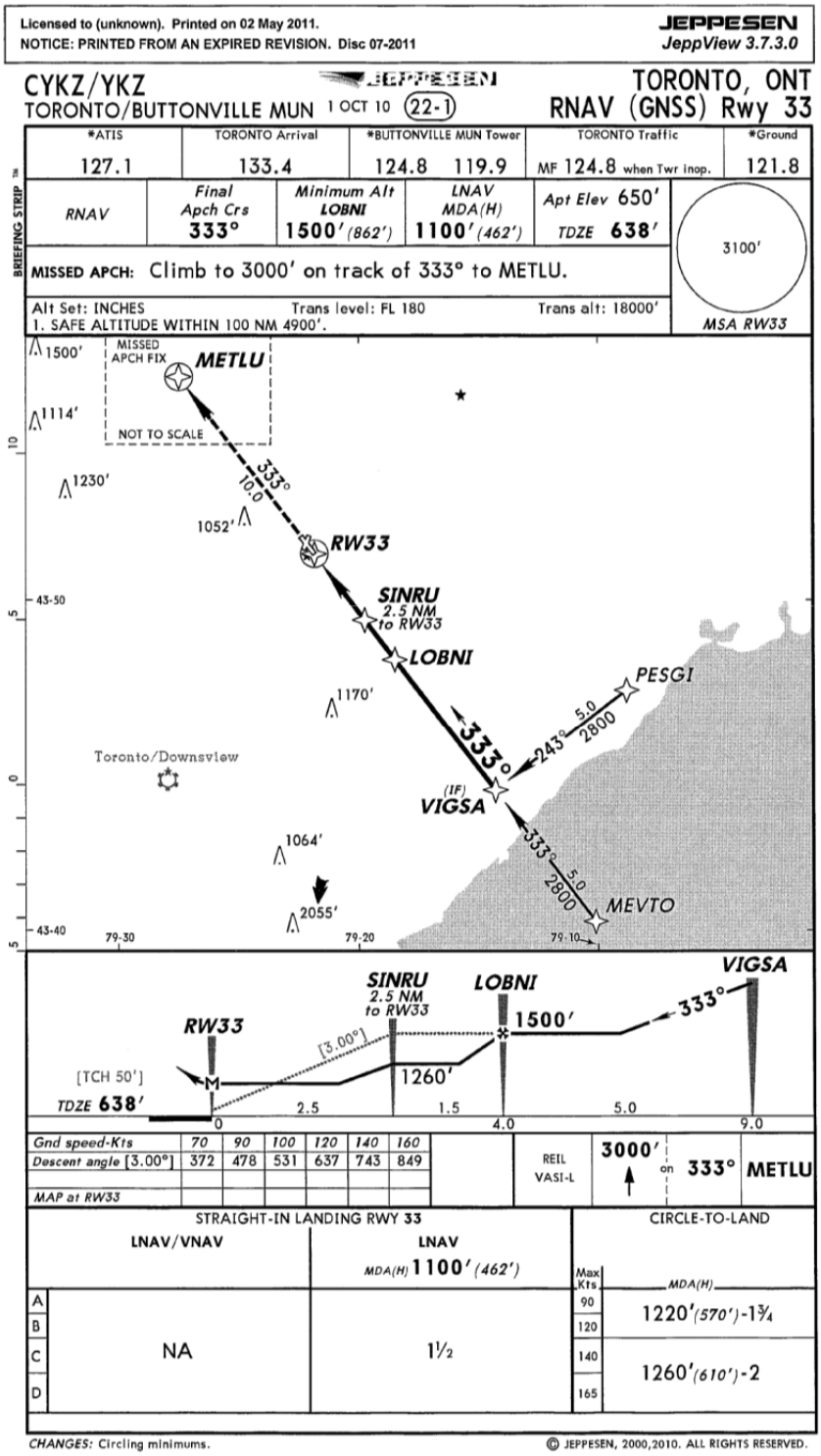
- No observers are permitted on board training flights at night i.e. 1 student and 1 instructor only. Combined lessons where more than one student participates will be restricted to daytime flying.

- Any exceptions to this policy will be at the sole discretion of the CFI or delegate on a case by case basis.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 01 February 2012.

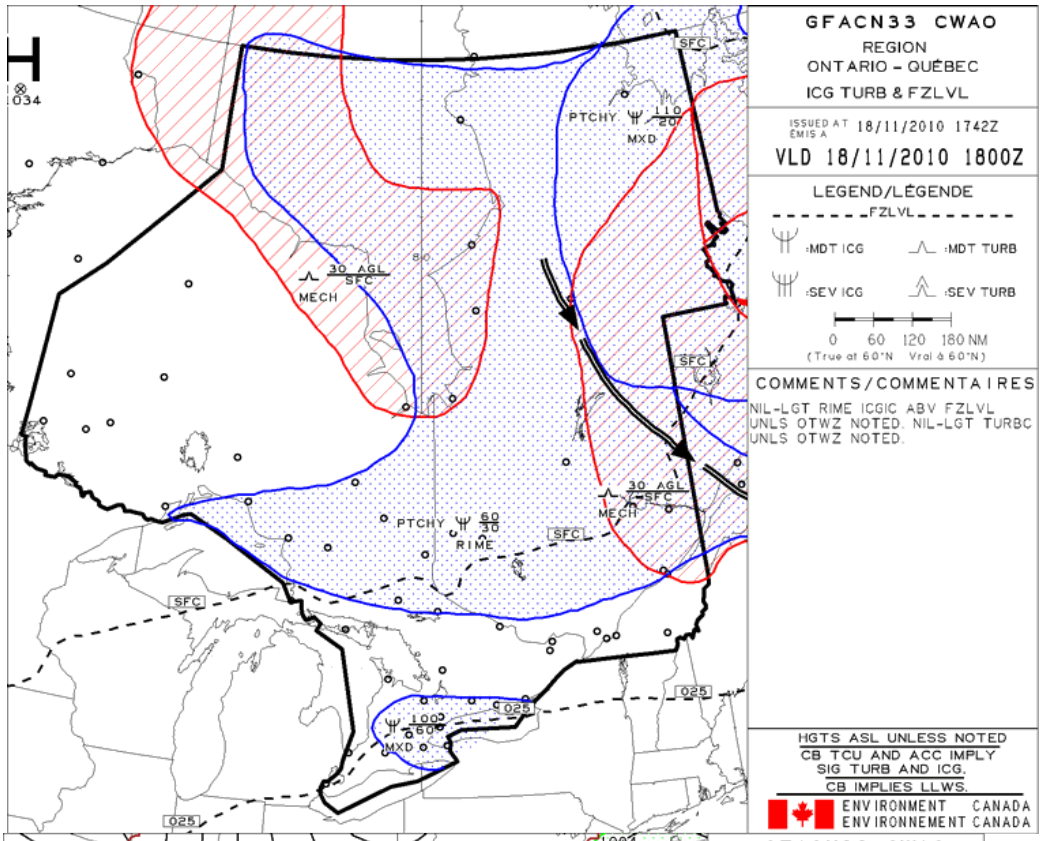
Visit the Transportation Safety Board's website (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.

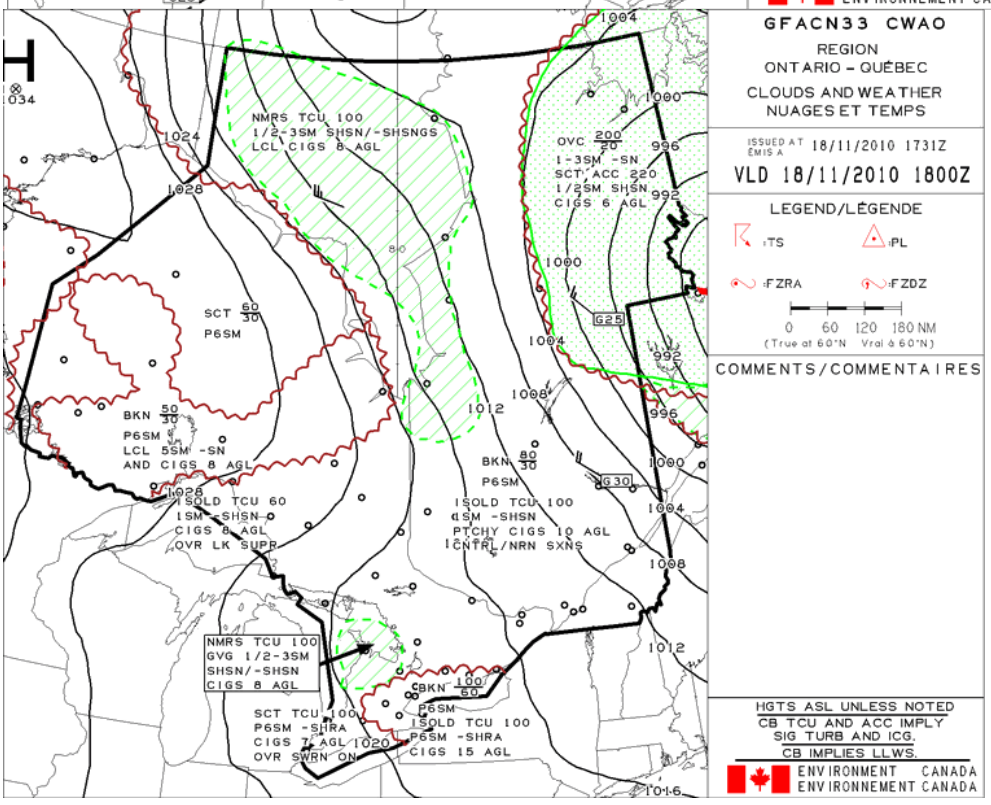
Appendix A – RNAV Runway 33 Approach Chart

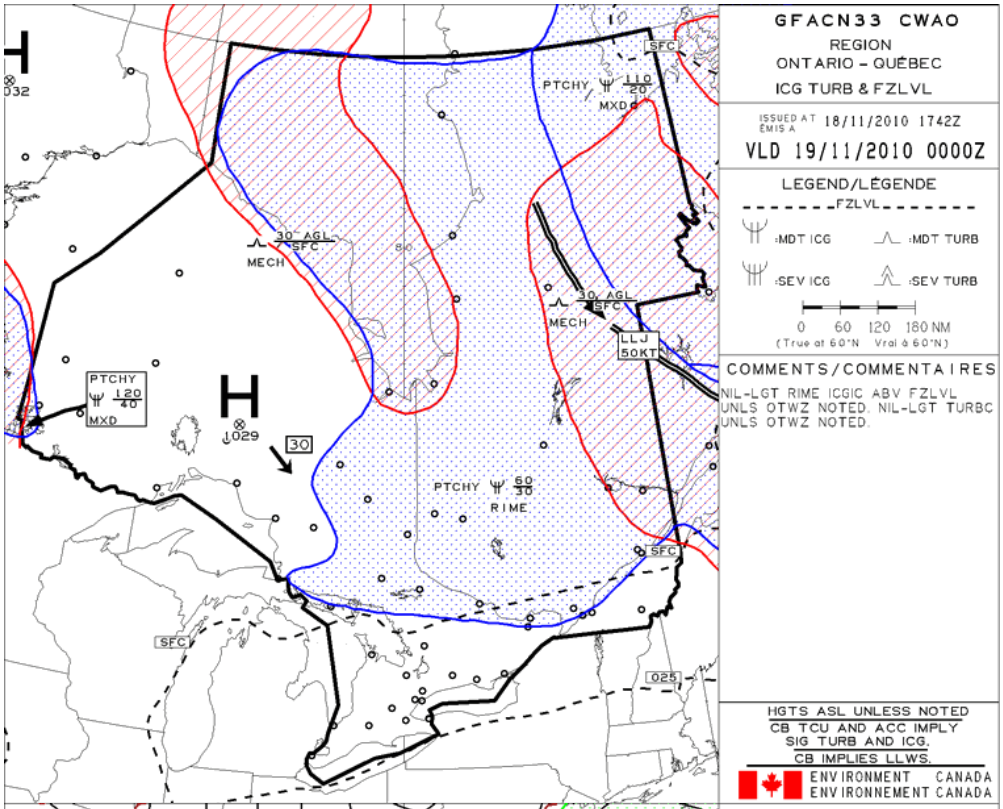


NOT FOR NAVIGATIONAL PURPOSES

Appendix B – Graphical Area Forecast



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REGION
ONTARIO – QUÉBEC
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MDT TURB
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(True at 60°N Vrai à 60°N)
COMMENTS/COMMENTAIRES
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HGTS ASL UNLESS NOTED
CB TCU AND ACC IMPLY SIG TURB AND ICG.
CB IMPLIES LLWS.
ENVIRONMENT CANADA
ENVIRONNEMENT CANADA
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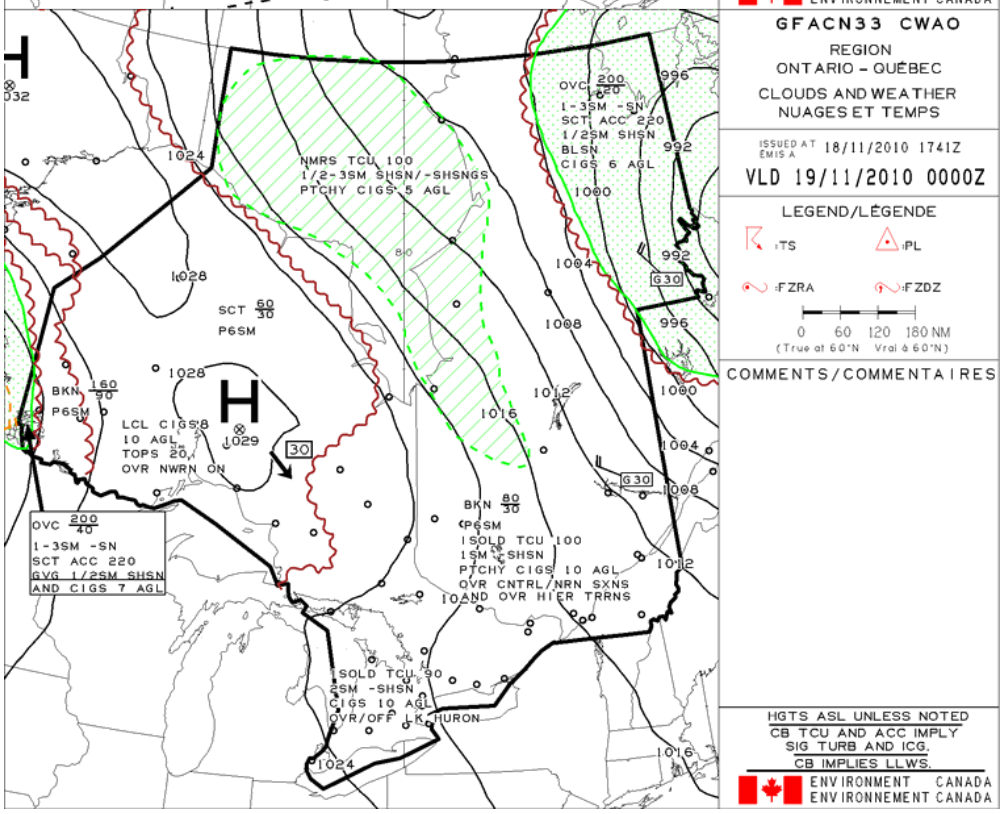
LLJ 50KT
PTCHY 120/40 MXD
PTCHY 60/30 RIME
SFC
025


GFACN33 CWAO
REGION
ONTARIO – QUÉBEC
CLOUDS AND WEATHER
NUAGES ET TEMPS
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(True at 60°N Vrai à 60°N)
COMMENTS/COMMENTAIRES
HGTS ASL UNLESS NOTED
CB TCU AND ACC IMPLY SIG TURB AND ICG.
CB IMPLIES LLWS.
ENVIRONMENT CANADA
ENVIRONNEMENT CANADA
OVC 200/20
1-3SM -SN
SCT ACC 220
1/2SM SHSN
BLSN
CIGS 6 AGL
NMRS TCU 100
1/2-3SM SHSN/-SHSNGS
PTCHY CIGS 5 AGL
SCT 60/30
P6SM
BKN 160/90
P6SM
LCL CIGS 8
10 AGL
TOPS 20
OVR NWRN ON
OVC 200/40
1-3SM -SN
SCT ACC 220
OVC 1/2SM SHSN
AND CIGS 7 AGL
BKN 80/30
P6SM
ISOLD TCU 100
1SM -SHSN
PTCHY CIGS 10 AGL
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AND OVR HIER TRRNS
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CIGS 10 AGL
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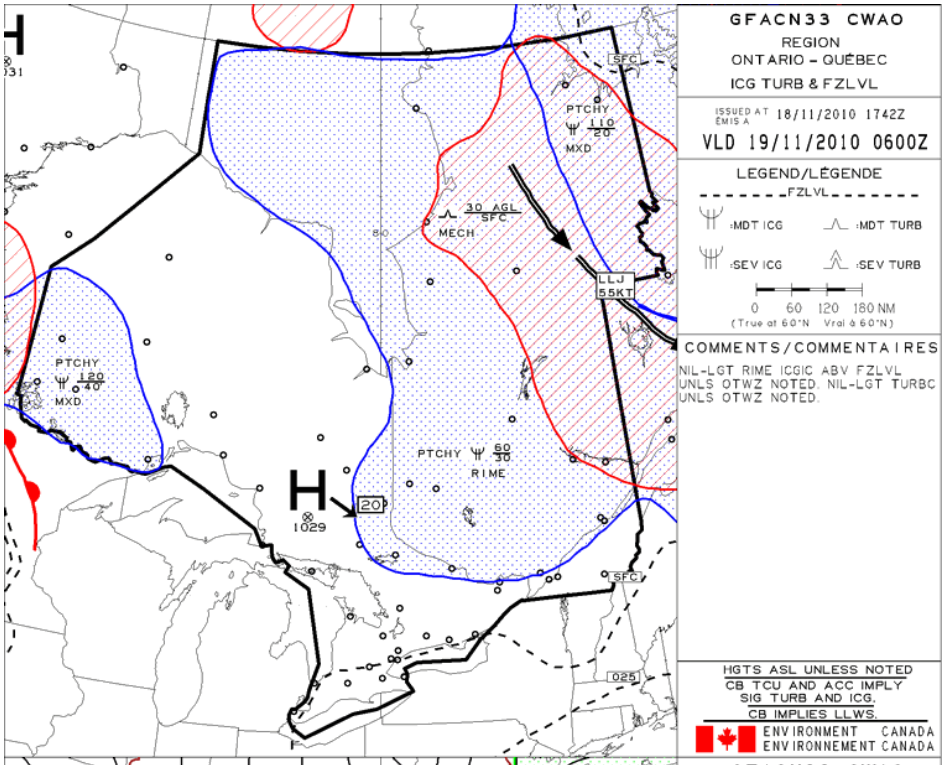

GFACN33 CWAO

REGION
ONTARIO – QUÉBEC

ICG TURB & FZLVL

ISSUED AT / ÉMIS À 18/11/2010 1742Z

VLD 19/11/2010 0600Z

LEGEND/LÉGENDE

FZLVL

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:SEV ICG :SEV TURB

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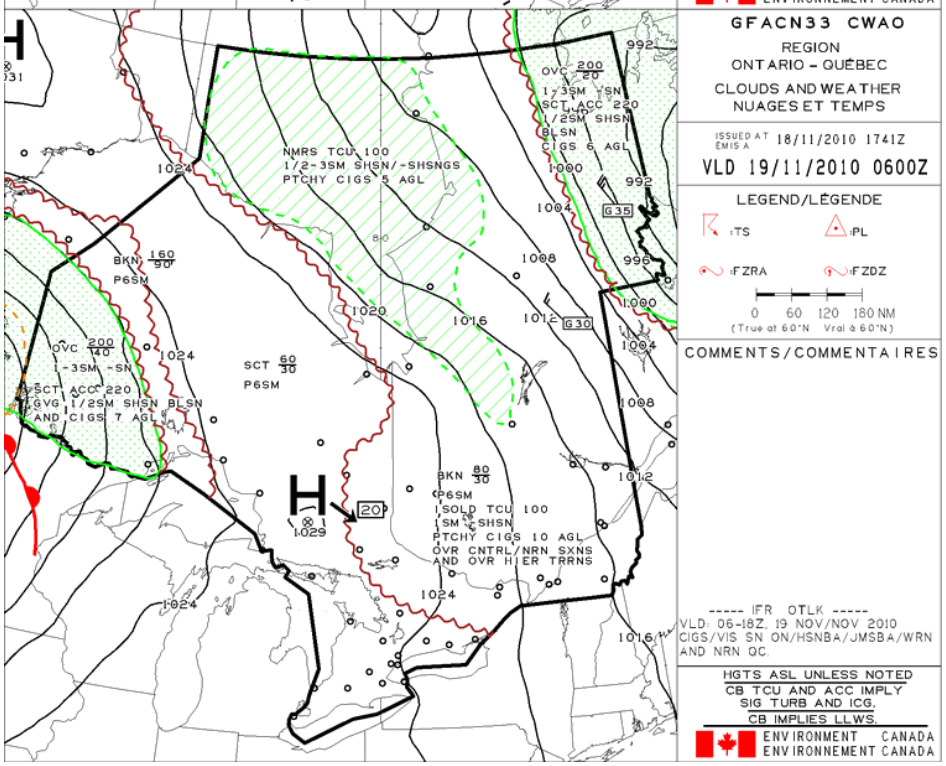
(True at 60°N Vrai à 60°N)

COMMENTS/COMMENTAIRES

NIL-LGT RIME ICGIC ABV FZLVL UNLS OTWZ NOTED. NIL-LGT TURBC UNLS OTWZ NOTED.

HGTS ASL UNLESS NOTED
CB TCU AND ACC IMPLY SIG TURB AND ICG.
CB IMPLIES LLWS.

ENVIRONMENT CANADA
ENVIRONNEMENT CANADA



GFACN33 CWAO

REGION
ONTARIO – QUÉBEC

CLOUDS AND WEATHER
NUAGES ET TEMPS

ISSUED AT / ÉMIS À 18/11/2010 1741Z

VLD 19/11/2010 0600Z

LEGEND/LÉGENDE

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(True at 60°N Vrai à 60°N)

COMMENTS/COMMENTAIRES

----- IFR OTLK -----
VLD: 06-18Z, 19 NOV/NOV 2010
CIGS/VIS SN ON/HSNBA/JMSBA/WRN AND NRN QC.

HGTS ASL UNLESS NOTED
CB TCU AND ACC IMPLY SIG TURB AND ICG.
CB IMPLIES LLWS.

ENVIRONMENT CANADA
ENVIRONNEMENT CANADA