Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A04Q0124

RISK OF COLLISION

NAV CANADA
MONTRÉAL AREA CONTROL CENTRE
12 nm SW OF QUÉBEC/JEAN LESAGE INTERNATIONAL AIRPORT, QUEBEC
05 AUGUST 2004

Canada

Aviation Investigation Report

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Montréal Area Control Centre
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Summary

A Cessna 172, registration C-GYQB, was returning to Québec following a visual flight rules (VFR) cross-country flight. The pilot contacted the Québec terminal control unit 28 nautical miles west of the Québec/Jean Lesage International Airport while flying at approximately 3000 feet above sea level (asl). Morningstar Air Express Flight 7069 (MAL7069), a Cessna 208 Caravan, was on an instrument flight rules (IFR) flight from the Québec Airport to Mirabel, Quebec, at a flight planned altitude of 8000 feet. The two aircraft passed within 200 feet vertically and 500 feet laterally of one another as MAL7069 was climbing through 3000 feet asl on departure from the Québec Airport.

Ce rapport est également disponible en français.

Other Factual Information

The Cessna 172 was flown by a student pilot who was on a first VFR solo cross-country flight. The routing of the flight was Québec–Saint-Hubert–Trois Rivières–Québec. The first two legs were uneventful, but the take-off out of Trois-Rivières was delayed due to marginal weather conditions. Prior to take-off out of Trois-Rivières at 1800 eastern daylight time,[1] the student pilot did not complete the entire "Line-up" portion of the checklist, omitting to turn the transponder to the altitude encoding position "ALT." The student pilot made initial contact with the Québec terminal control unit at 1837:42, 28 nautical miles (nm) west of the Québec Airport, while flying at approximately 3000 feet asl[2] (see Appendix A).

On initial contact with C-GYQB, the Québec terminal controller called up the flight plan data entry window on the radar situation display (RSiT)[3] and typed in the aircraft's abbreviated call sign YQB to obtain a valid transponder code. The Québec terminal controller then instructed the student pilot to select code 4522 on the transponder. Although the student pilot entered the appropriate code, the transponder select switch was left in the standby position. As a result, the selected code was not transmitted to the air traffic services (ATS) radar and only a primary radar position symbol, a small inverted Y, was displayed on the controller's RSiT. No data tag information such as transponder code, aircraft call sign, altitude or speed was available.

After a flight plan data entry window is called up on the RSiT, the variable system parameter for this feature causes the flight plan entry window to time out after 30 seconds and automatically disappear from the display. The reference to C-GYQB was now removed from the Québec terminal controller's display. To serve as an additional reminder, the controller had also written a flight data strip for C-GYQB and placed it in front of him below the keyboard. He did not follow up with the student pilot to request the aircraft's position, altitude, or intentions, nor did he take further action to radar identify the aircraft. C-GYQB continued flight toward the Québec Airport without the benefit of a radar advisory service.

Morningstar Flight 7069 (MAL7069) contacted the Québec terminal controller at 1840:07 while climbing through 1700 feet. At 1841:31, the Québec terminal controller radar identified the aircraft and instructed MAL7069 to maintain 3000 feet. At 1843:48, the Québec terminal controller instructed MAL7069 to turn to a heading of 240 degrees magnetic (M). He did not notice that MAL7069 was now heading directly toward the primary radar position symbol for C-GYQB, also at 3000 feet. Other IFR traffic that prevented an unrestricted climb by MAL7069 to the flight planned altitude of 8000 feet was an opposite direction arrival to the Québec Airport descending to 8000 feet, and a south-westbound overflight at 6000 feet.

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1 All times are eastern daylight time (Coordinated Universal Time minus four hours).

2 All altitudes indicated are in feet above sea level (asl).

3 The use of the acronym RSiT implies radar data processing system (RDPS) situation display (RSiT).

At 1845:01, the Québec terminal controller instructed MAL7069 to climb to 5000 feet, and within a few seconds, advised MAL7069 of traffic two miles ahead, of an unknown type and altitude. MAL7069 had commenced the climb to 5000 feet in accordance with the received clearance, but the pilot did not have time to take other evasive action as a result of the traffic information from ATS. Traffic information was not passed to C-GYQB. Although the student pilot sighted the other aircraft, no information was passed back to ATS and no evasive action was taken. At 1845:27, C-GYQB passed approximately 200 feet under and 500 feet left of MAL7069. Visual meteorological weather conditions prevailed at the time of the incident. Both aircraft were communicating with the Québec terminal controller on frequency 127.85 MHz.

The student pilot held a glider pilot licence, which had been obtained the previous summer through the Air Cadets program. The student pilot was selected for private pilot licence training through the Air Cadets program in July 2004, and had commenced training at a flight school located at the Québec Airport. The student pilot had less than 75 hours of total flying time. He had completed the same cross-country flight the day before with an instructor. That flight had been uneventful and the student pilot was authorized to conduct the solo cross-country. The pilot of MAL7069 had a total of approximately 3800 hours of flying time. He held a valid airline transport pilot licence (ATPL) and aircraft type rating.

The Québec terminal controller was licensed and qualified for the position. He qualified as a controller in 1992 and received his IFR qualification in 1994. In 1996, he qualified to work the Québec terminal sector. The date of the incident was the first day of combined operations for the Ottawa and Québec terminal control units, termed the Capitales sub-unit. A number of minor changes to the operational procedures in the Québec sector were introduced at the time of the amalgamation. The Québec terminal controller had been undergoing training in the Ottawa sector earlier in the day, prior to working in the Québec sector.

The Capitales sub-unit consists of three sectors; Québec terminal, and Ottawa arrival and Ottawa departure. Staffing at the time of the occurrence was in accordance with unit guidelines. There were three controllers, one supervisor and a controller-in-training on duty. The traffic level in the Québec sector at the time of the incident was moderate with some complexity due to multiple IFR approaches to the two intersecting runways at the Québec Airport. The Québec terminal controller was controlling seven aircraft. There was also extensive coordination between the Québec terminal and the Québec tower to sequence another aircraft that had previously cancelled IFR. This coordination took a considerable amount of both controllers' time and attention, which affected the Québec terminal controller's scan of the entire RSiT display.

The Québec terminal airspace is comprised of controlled airspace designated either Class B, D, or E in which both VFR and IFR flights are permitted; however, VFR flights require a clearance from air traffic control (ATC) to enter Class B airspace. To the west of the Québec Airport (see Appendix A), Class D airspace starts at 25 nm from 3500 feet to 12 500 feet asl and, within 15 nm, extends upward from 1400 feet. The responsibility for the airspace within 15 nm is divided between the Québec tower and the Québec terminal, with the tower having jurisdiction from 3000 feet and below. The description of the airspace is contained in the *Designated Airspace Handbook* (DAH), and depicted in the *Canada Flight Supplement* (see Appendix B). Both the pilot of C-GYQB and MAL7069 would have had ready access to the latest version of the latter publication in the flight planning phase of their respective flights.

Class D airspace within the Québec terminal area requires that an aircraft be equipped with a functioning transponder with mode C altitude encoding. Aircraft operating in VFR between 7 and 15 nm of the airport and between 1400 feet and 3000 feet are required to contact the Québec tower, and aircraft operating in this area at altitudes above 3000 feet are to contact the Québec terminal. At the time of initial contact by C-GYQB with the Québec terminal, the aircraft was at 3000 feet and 28 nm west of the Québec Airport, flying in Class E airspace.

Section 601.03 of the *Canadian Aviation Regulations* (CARs) states that aircraft shall be equipped with a functioning transponder incorporating an automatic pressure reporting device when operating in airspace designated as transponder airspace. *Aeronautical Information Publication* (A.I.P. Canada), Section RAC 1.9.1, states, "Transponders substantially increase the capability of radar to detect aircraft, and the use of automatic pressure altitude reporting equipment (Mode C) enables controllers to quickly determine where potential conflicts could occur. Proper transponder operating procedures and techniques will provide both VFR and IFR aircraft with a higher degree of safety."

The "See and be Seen" concept is applicable for both VFR and IFR traffic. A.I.P. Canada, Section RAC 6.2, reminds pilots operating in IFR that they must be aware of the need to provide their own visual separation from VFR aircraft when operating in VMC (visual meteorological conditions) in controlled airspace. A.I.P. Canada, Section RAC 2.8.4, and the *Air Traffic Control Manual of Operations* (ATC MANOPS), Section 165, describe Class D airspace as a controlled airspace with the following conditions:

- Both IFR and VFR flights are permitted, but VFR flights must establish two-way communication with the appropriate ATS agency prior to entering the airspace. Unlike Class C airspace rules and procedures, aircraft do not need a clearance to enter Class D airspace.

- ATS separation is provided only to IFR aircraft.

- Aircraft will be provided with traffic information. Equipment and workload permitting, conflict resolution will be provided between VFR and IFR aircraft, and upon request between VFR aircraft.

- A person operating an aircraft in VFR in Class D airspace shall ensure that the aircraft is equipped with radio communication equipment capable of two-way communication with the appropriate ATS unit.

- Controllers shall take whatever action they consider necessary to separate the aircraft concerned if they know that a VFR aircraft is at the same altitude and in the same general area as a radar-controlled aircraft.

Studies have shown that pilots are more likely to see other traffic in their vicinity if they have received information on the other aircraft, such as relative position and altitude.[4]

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[4] See TSB investigation reports A95H0008 and A97H0004 for details

Analysis

Before take-off from the Trois-Rivières Airport, the student pilot did not select the transponder to the "ALT" position. The student pilot's lack of experience most likely contributed to this omission. Without a functioning transponder, C-GYQB's radar position symbol was much less visible on the controller's RSiT, and no code or automatically reported altitude information was available. A similar lack of experience may have contributed to the student pilot not querying the controller to confirm that the aircraft had or had not been radar identified. As a result, C-GYQB continued flight toward the Québec Airport without being provided a radar advisory service.

On initial contact with C-GYQB, the Québec terminal controller did not request any information to determine the aircraft's position, altitude or aircraft type. After issuing a transponder code to C-GYQB, the Québec terminal controller's attention was directed to controlling his inbound IFR traffic and to coordinating the arrival sequence with the tower. He did not associate a primary radar position symbol tracking toward the Québec VOR (very high frequency omnidirectional range) with C-GYQB. The Québec terminal controller forgot about C-GYQB, and as a result, he was unable to provide the required level of radar service to MAL7069 until the two aircraft had flown to within 2 nm of each other at the same altitude. Although traffic information about an unknown aircraft was passed to MAL7069, there was insufficient time for the pilot to locate the traffic visually and take evasive action. The Québec terminal controller's fortuitous timing of a clearance to MAL7069 to climb to 5000 feet moments before the two aircraft passed reduced the risk of a mid-air collision.

The RSiT software programming caused the flight plan data entry window to automatically close 30 seconds after the last keystroke, even though the Québec terminal controller had entered some information. Once the window closed, it could no longer serve as a reminder to the Québec terminal controller that further action with respect to C-GYQB was necessary. Had the window remained active on the RSiT display, it may have prompted the Québec terminal controller to remember that further action was still required with C-GYQB, that is to radar identify this aircraft. It was not until after the two aircraft passed each other that the Québec terminal controller remembered that he had been contacted by C-GYQB. The extra coordination with the Québec tower regarding the integration of VFR and IFR arrivals to Runway 30 increased the Québec terminal controller's work level. This limited the time available to scan the RSiT display and as a result the controller did not notice C-GYQB's radar position symbol on the RSiT or the flight data strip he had placed on the console in front of him.

The potential defences against forgetting about C-GYQB, the primary radar position symbol and the flight data strip did not serve as a reminder that further action with respect to this aircraft was still pending. The automatic disappearance from the RSiT display of the flight plan window, although not primarily designed as a reminder, could no longer remind the controller of unfinished action with respect to C-GYQB. The Québec terminal controller relied on the data tag information on the radar display to provide the necessary information to develop his traffic picture.

The regulations and procedures for operating in Class D transponder airspace provide a level of protection against mid-air collisions. When providing a radar service in Class D airspace, controllers are responsible for providing traffic information to all aircraft under their control. This is made easier if all aircraft flying in the airspace are known or readily identifiable, that is the aircraft has a functioning transponder with altitude encoding capability. In a radar environment, pilots may expect to receive information on all aircraft in their vicinity and may not actively search for conflicting traffic, irrespective of the class of airspace. However, pilots of both VFR and IFR aircraft, when operating in VMC, also have the responsibility to search for conflicting traffic and take action to avoid a collision. In this incident, there was a breakdown in aircraft equipment operating procedures, scanning (both pilot and controller) and diversion of attention, which resulted in a near collision between two aircraft.

Findings as to Causes and Contributing Factors

1. The student pilot did not complete the entire "Line-up" portion of the aircraft checklist and omitted to turn the transponder to the altitude encoding position "ALT." Under these conditions, the transponder did not transmit information to the radar system, making the aircraft much less visible on the controller's radar situation display (RSiT).

2. The Québec terminal controller did not radar identify C-GYQB after issuing the transponder code, or request other information to determine the aircraft's position or altitude. As a result, C-GYQB was allowed to penetrate Class D airspace without the required level of radar service being provided. This placed C-GYQB at a risk of collision with MAL7069.

3. The Québec terminal controller's attention was directed to controlling his instrument flight rules (IFR) traffic inbound to the Québec Airport and to coordinating the arrival sequence with the tower. He forgot about C-GYQB and did not notice the developing conflict between this aircraft and MAL7069.

Findings as to Risk

1. The RSiT software programming caused the flight plan data entry window to automatically close 30 seconds after the last keystroke. Once the window closed, it could no longer serve as a reminder to the Québec terminal controller that he still had some further action pending.

2. In a radar environment, while in contact with air traffic services, pilots may expect to receive information on all aircraft in their vicinity and, when operating in visual meteorological conditions, may not search for conflicting traffic and take action to avoid a collision.

Safety Action Taken

As of 29 August 2004, management at the NAV CANADA Montréal Area Control Centre (ACC) had the variable system parameters on the radar situation display (RSiT) changed to ensure that the flight plan information entry window remains on the display until the controller actively closes it. NAV CANADA is reviewing the changes implemented in the Montréal ACC to determine appropriate national direction.

Transport Canada has drafted and will publish an article in *Aviation Safety Letter* titled "Risk of Two Aircraft Colliding in Class D Airspace." This article is scheduled for publication in Edition 1-2006.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 03 November 2005.

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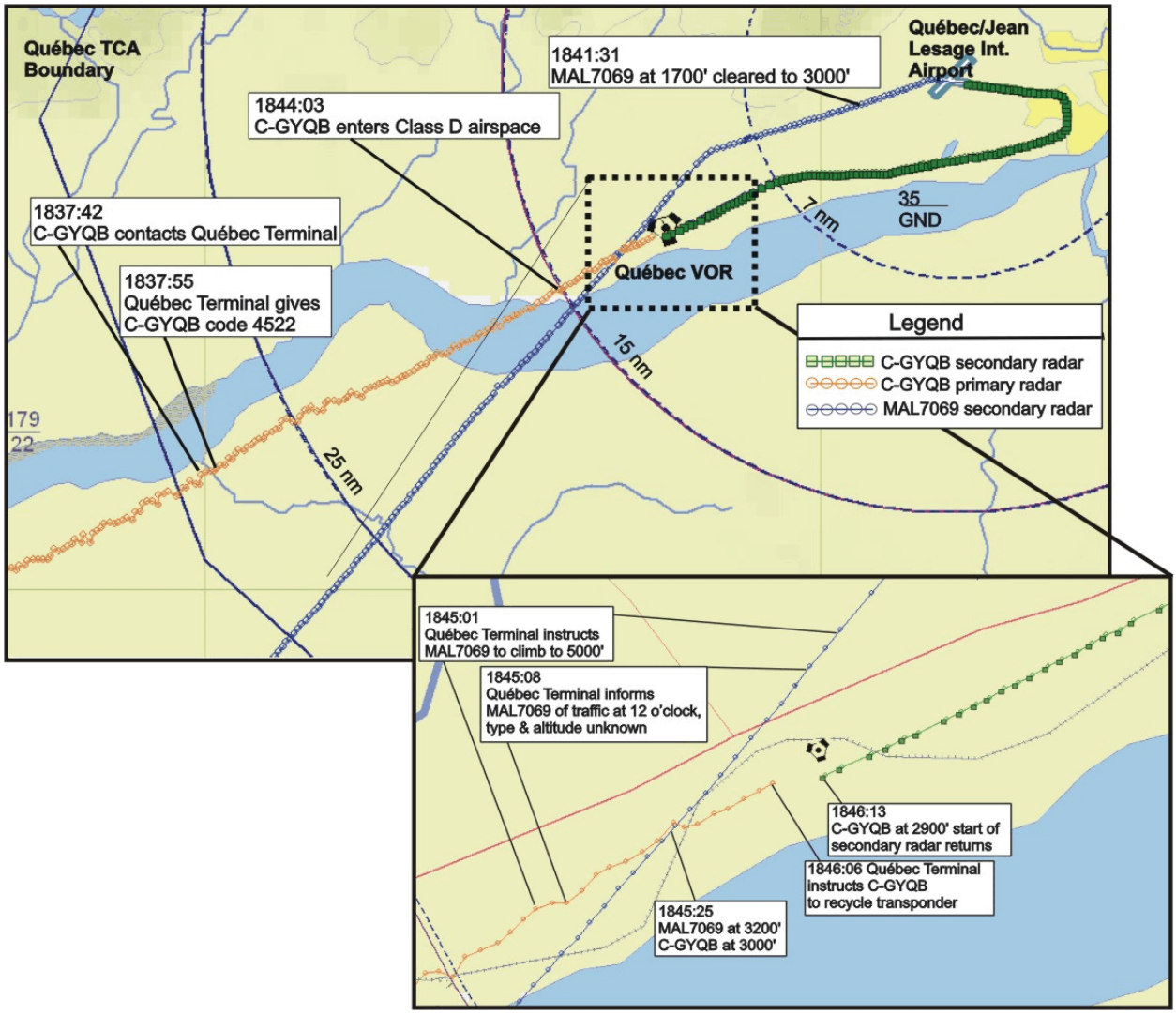
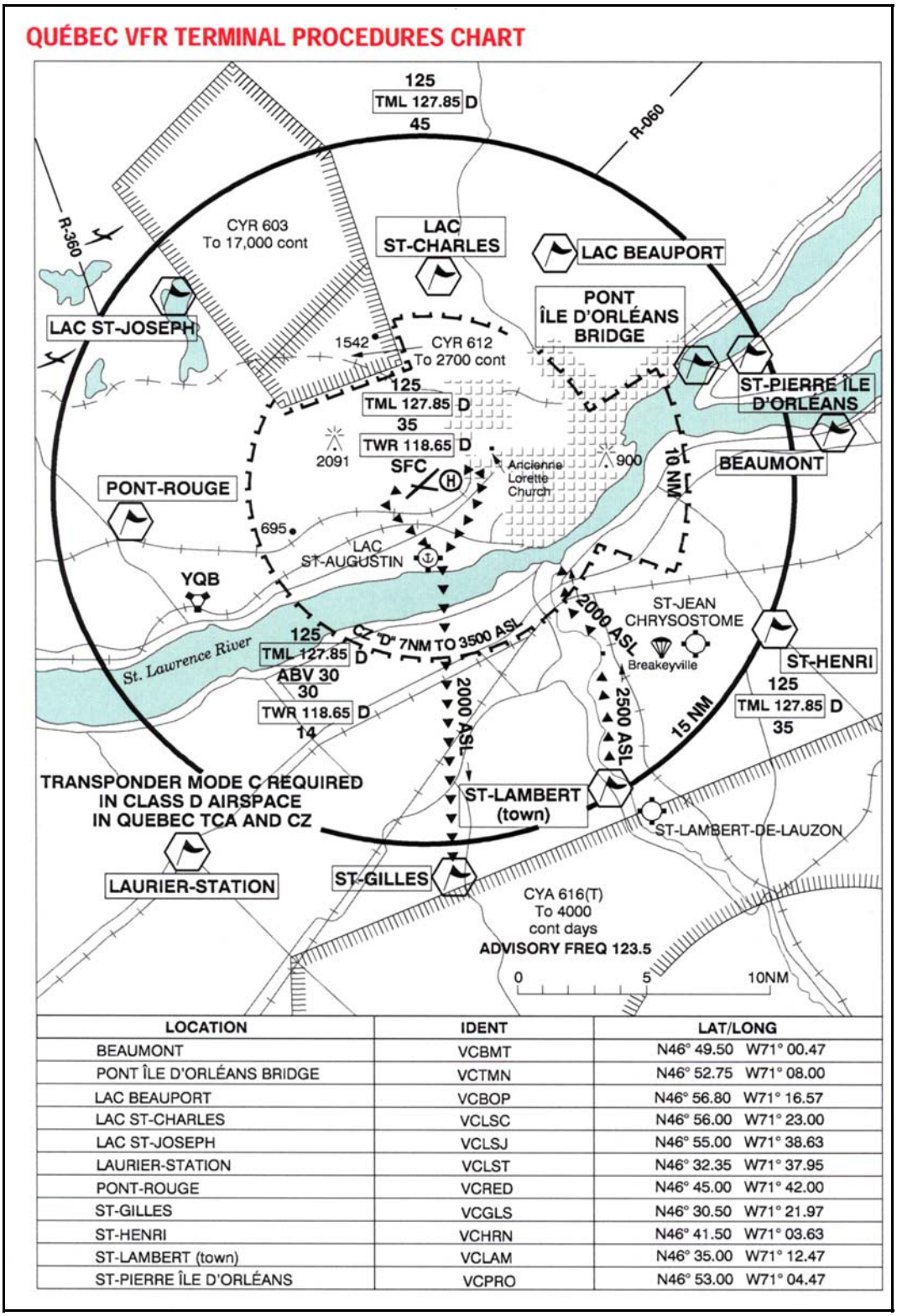
Appendix A – Radar Trajectory



Appendix B – Canada Flight Supplement



LOCATION	IDENT	LAT/LONG
BEAUMONT	VCBMT	N46° 49.50 W71° 00.47
PONT ÎLE D'ORLÉANS BRIDGE	VCTMN	N46° 52.75 W71° 08.00
LAC BEAUPORT	VCBOP	N46° 56.80 W71° 16.57
LAC ST-CHARLES	VCLSC	N46° 56.00 W71° 23.00
LAC ST-JOSEPH	VCLSJ	N46° 55.00 W71° 38.63
LAURIER-STATION	VCLST	N46° 32.35 W71° 37.95
PONT-ROUGE	VCRED	N46° 45.00 W71° 42.00
ST-GILLES	VCGLS	N46° 30.50 W71° 21.97
ST-HENRI	VCHRN	N46° 41.50 W71° 03.63
ST-LAMBERT (town)	VCLAM	N46° 35.00 W71° 12.47
ST-PIERRE ÎLE D'ORLÉANS	VCPRO	N46° 53.00 W71° 04.47