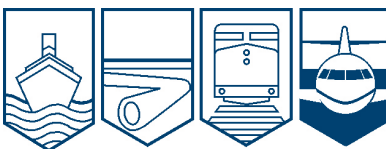




AVIATION INVESTIGATION REPORT

A08A0147



MID-AIR COLLISION

PROVINCIAL AIRLINES LIMITED

DE HAVILLAND DHC-6-300 TWIN OTTER, C-FWLG

AND

AIR LABRADOR

DE HAVILLAND DHC-6-300 TWIN OTTER, C-FGON
NATUASHISH, NEWFOUNDLAND AND LABRADOR

04 NOVEMBER 2008

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

Mid-Air Collision

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Summary

The Provincial Airlines de Havilland DHC-6-300 Twin Otter (serial number 731, registration C-FWLG) and the Air Labrador de Havilland DHC-6-300 Twin Otter (serial number 369, registration C-FGON) were both manoeuvring for final approach to Runway 30 at the Natuashish Airport, Newfoundland and Labrador. Neither flight crew was aware of the other aircraft. At 0947 Atlantic standard time, the two aircraft collided in mid-air. The Provincial Airlines flight crew realized that a mid-air collision had occurred; the Air Labrador flight crew did not. The right aileron of the Provincial Airlines aircraft sustained substantial damage and the left horizontal stabilizer of the Air Labrador aircraft sustained minor damage. Both aircraft landed safely without further incident. There were no reported injuries. Both aircraft were being operated in accordance with visual flight rules.

Ce rapport est également disponible en français.

Other Factual Information

History of the Flight

On the morning of the occurrence, the Provincial Airlines (PAL) DHC-6 Twin Otter (Twin Otter), operating as Speedair 961 (SPR961), departed Goose Bay, Labrador, at approximately 0730 Atlantic standard time.¹ SPR961 was a passenger flight scheduled to travel from Goose Bay to Postville, Labrador, then on to Makkovik, Hopedale, Natuashish, Nain, and then to return to Goose Bay. The Air Labrador Twin Otter, operating as flight 205 (LAL205), departed Goose Bay shortly after SPR961. LAL205 was a cargo flight scheduled to travel from Goose Bay to Nain, Labrador, then on to Natuashish, Hopedale, Makkovik, and then to return to Goose Bay (see Figure 1).

LAL205 departed Nain at 0932 with the first officer as the pilot flying (PF) and the captain as the pilot not flying (PNF). The flight crew were engaged in non-essential communication² throughout the flight. LAL205

approached the Natuashish Airport (CNH2) from the northwest, reaching the five nautical miles (nm) aerodrome traffic frequency (ATF) area sooner than expected. The investigation was unable to determine whether LAL205 broadcast a traffic advisory. At that point, they began preparations to land. To expedite, the PF selected the flaps down, made a steep right turn, and descended rapidly for a straight-in approach. Once on final, the flight crew of LAL205 made a radio broadcast on the frequency 122.8 megahertz (MHz) to indicate their intention to land.

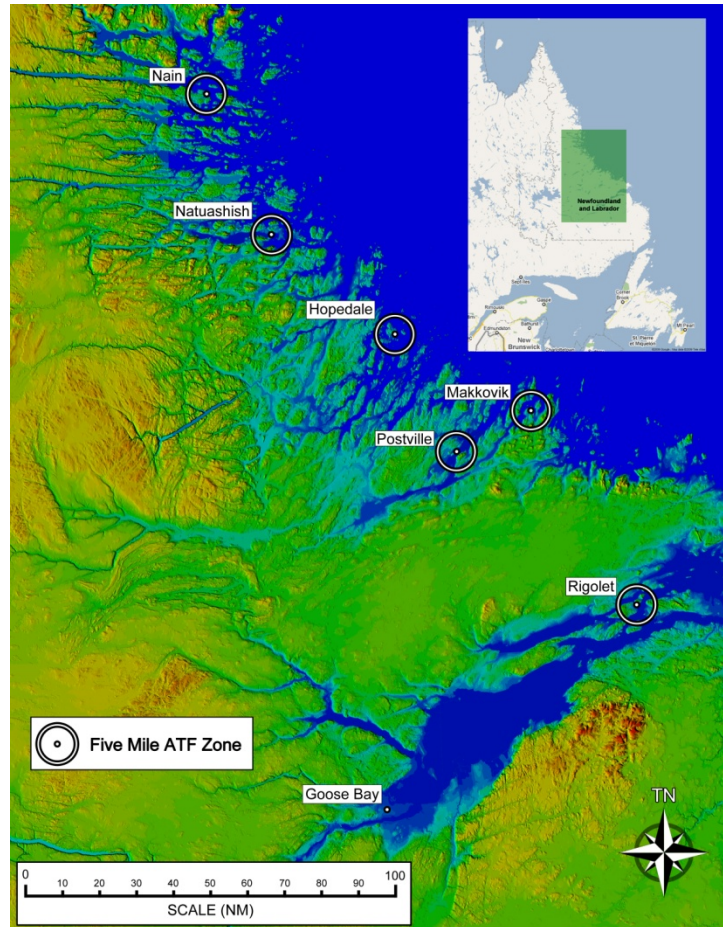


Figure 1. Map of Labrador coastal airports

¹ All times are Atlantic standard time (Universal Coordinated Time minus four hours).

² Communication not related to the flight or the operation of the aircraft.

This transmission was not heard by the flight crew of SPR961. Shortly after turning final, the flight crew of LAL205 felt a sudden shudder in the aircraft and the captain took control. With no control problems and unaware that they had collided with another aircraft, LAL205 continued the descent and landed straight-in.

SPR961, with 10 passengers on board, departed Hopedale, Labrador, at 0926 with the first officer as the PF and the captain as the PNF. Shortly after departure, the PNF became engaged in non-essential communications with the pilot of another aircraft, on frequency 123.4 MHz. About five miles from the Natuashish Airport, the PNF made a radio call to indicate their position and intentions. The flight crew of LAL205 did not hear SPR961's transmission.

SPR961 approached Natuashish from the southeast and turned left onto a three-mile final approach to Runway 30. No further position reports were made, even though the company's standard operating procedures (SOP) required pilots to make a radio call on the published ATF when on final approach. The non-essential communications between the PNF and the pilot of the other aircraft continued during the final approach for the runway until the PF became aware of LAL205 just prior to impact. Following the mid-air collision, the first officer of SPR961 initiated a climb, after which the captain took control and made a left-hand orbit and then landed. During the orbit, the captain of SPR961 made two attempts to contact LAL205 on the radio, but no reply was heard. The SPR961 captain made a third radio call, to which the LAL205 captain responded. The investigation could not confirm that SPR961's radio was tuned to frequency 122.8 prior to this.

Flight Crew Information

Both flight crews were certified and qualified for the flight in accordance with existing regulations and were familiar with local conditions. They were also within the required duty periods and fatigue was not considered a factor. The Air Labrador captain and first officer had approximately 27 000 and 1500 hours total flying time, respectively. The Provincial Airlines captain and first officer had approximately 18 000 and 1070 hours total flying time, respectively.

Weather

The mid-air contact occurred in daylight conditions suitable for visual flight. The position of the sun would have made it more difficult for the LAL205 flight crew to see SPR961. However, both flight crews were focused on the straight-in landing ahead, and not scanning outside for other aircraft. As a result, weather was not considered to be a factor in the accident.

Airport Information

The Natuashish Airport is located within class G uncontrolled airspace and has a single runway. The airport is served by an ATF on 122.8 MHz, which extends up to 3000 feet above sea level and out to five nautical miles from the airport.³ In accordance with paragraph 602.96(3)(c) of the *Canadian Aviation Regulations* (CARs), the visual flight rules (VFR) approach

³ This information is taken from the *Canada Flight Supplement* (CFS).

procedure is via a standard left-hand traffic circuit. The Government of Newfoundland and Labrador (GNL) owns the aerodrome and employs an airstrip operator to maintain the runway and facilities. The operator is provided with a handheld transceiver to monitor the ATF so as to be aware of incoming flights. The transceiver had limited capability and in many cases the airstrip operator would not hear traffic advisories until aircraft were on final approach.

Recorder Information

Each aircraft was equipped with a cockpit voice recorder (CVR) capable of storing the last 30 minutes of cockpit sounds. Both CVRs were forwarded to the TSB Laboratory. The crew of SPR961 pulled the circuit breaker for the CVR after landing, thereby preserving the captured audio data for the occurrence. After LAL205 had landed and shut down, the battery master switch was selected back on, causing the CVR to overwrite the occurrence flight data.

Both companies had SOPs requiring aircraft recorded data to be preserved in the event of an accident. However, neither company had procedures or training in place on how to preserve the recorded data.

Radio Installation/Operation

Each aircraft was fitted with two very high frequency (VHF) radios installed in the right side of the centre instrument panel. The radio to be used for broadcasting is selected via the audio selector panel, which is partially obscured by the control yoke (see Photos 1 and 2). The practice of both companies was to have the PNF make the appropriate radio advisories.



Photo 1. PAL Aircraft – left seat



Photo 2. LAL Aircraft – left seat (yoke displaced)

Traffic Alert and Collision Avoidance (TCAS) System

The traffic alert and collision avoidance system (TCAS) is designed to reduce the incidence of mid-air collisions between aircraft. It monitors the airspace around an aircraft, independent of air traffic control, and warns pilots of the presence of other transponder-equipped aircraft that may present a threat of mid-air collision. Neither aeroplane was equipped with a TCAS, nor was such equipment required by regulation.

Impact Details

Being focused on straight-in landings, both flight crews were looking forward just prior to impact. While they converged, the orientation of the two aircraft would have made it difficult for the PF to see the other aircraft. Initially, LAL205 was above, to the right, and behind SPR961. LAL205's approach was steeper and faster than SPR961, which created a blind spot under the belly of LAL205. LAL205 first saw SPR961 following the landing at Natuashish, after being called on the radio by the other captain. SPR961 observed LAL205 just prior to the collision (see Figure 2). The first officer initiated a climb, after which the captain assumed control and initiated an evasive left turn away from LAL205.

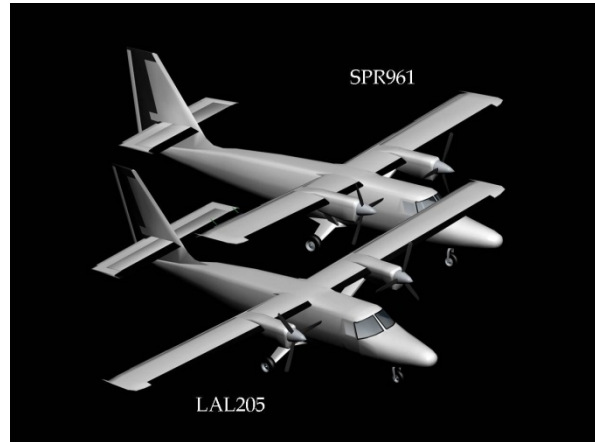


Figure 2. Aircraft Orientation at Impact

LAL205's left horizontal stabilizer impacted SPR961's right aileron. SPR961's aileron was partially crushed in a downward and forward direction. LAL205's horizontal stabilizer's rubber de-ice boot was torn, the boot had scuff marks consistent with SPR961's aileron rivet pattern, and the outer tip of the horizontal stabilizer had localized crushing.

Scheduled Commercial Flight Operations in Remote Locations

Each company operates about 72 scheduled flights per week between eight main destinations in this area. Generally, flights follow the same route each day with relatively few other flights in the area. Flight crews did not consider the risk of collision as being a significant threat to aviation safety. Selection of the landing direction at uncontrolled airports was viewed as the most important aspect of approach planning.

Both captains were long-time employees of their respective operators and had been flying these routes for more than 20 years. Due to the close-knit nature of the flying community in the region, pilots would often select one of their radios to frequency 123.4 MHz so they could have general conversations with other pilots in the area. They also used this frequency to pass along weather and aircraft position reports to each other, to supplement the "see and avoid" technique.

In such remote locations, flight crews are completely responsible for following rules and procedures for traffic avoidance without any external assistance.

Uncontrolled Airport Guidance and Procedures

Transport Canada's (TC) *Aeronautical Information Manual* (AIM) provides flight crews with a single source of information concerning rules of the air and the procedures for aircraft operation to comply with those rules. Throughout the AIM, the term "should" implies that TC encourages pilots to conform with the applicable procedure, in accordance with good airmanship practices. The term "shall" implies that the applicable procedure is mandatory because it is supported by regulations.

RAC 4.5.1 of the AIM emphasizes the importance of being alert while operating in the vicinity of an uncontrolled aerodrome. It states "...it is essential that pilots be aware of and look out for other traffic and exchange traffic information when approaching or departing from an uncontrolled aerodrome."

Radio Communication

TC establishes an ATF to ensure that all radio-equipped aircraft operating on the ground or within the area are listening on a common frequency and following common reporting procedures. While typically used around airports, an ATF may also be designated for areas where VFR traffic activity is high and there is a safety benefit to ensuring that all traffic monitors the same frequency. For example, ATFs may be established along frequently flown corridors between uncontrolled aerodromes. TC has established ATF corridors on the west coast of British Columbia and the lower north shore of Quebec to help manage the aircraft traffic and radio frequency selection. TC's Atlantic Region has described the area of operations along the Labrador Coast as being similar to the west coast of British Columbia and the lower north shore of Quebec.

The AIM states that to achieve the greatest degree of safety, it is "essential" that all radio-equipped aircraft monitor the published ATF, and that pilots should follow the reporting procedures specified for use in a mandatory frequency (MF) area. TC designates MFs at selected uncontrolled aerodromes, or aerodromes that are uncontrolled between certain hours. When operating within an area designated as an MF, pilots shall follow reporting procedures specified in CARs 602.97 to 602.103, inclusive.

RAC 4.5.6 of the AIM states "At uncontrolled aerodromes for which an MF or ATF has been designated, certain reports shall be made by all radio-equipped aircraft." However, RAC 4.5.7 of the AIM states that MF procedures "should also be followed by the pilot-in-command at aerodromes with an ATF." Although recommended by TC and considered good airmanship, communicating on an uncontrolled airport's ATF is not mandatory by regulation while operating under VFR.

Neither company had documented radio broadcasting procedures, nor did they have training in place specifically for VFR operations at uncontrolled airports. Neither company was certain whether the airports along the Labrador coast were surrounded by ATF or MF areas, and

treated them as MF areas. Crews typically assessed the likelihood of traffic based on communications heard while monitoring en route channels and frequency 123.4 MHz. In particular, if they did not hear an advisory or did not get a reply to a call that was made, pilots would conclude that there was no traffic and would be less focused on visually scanning for other aircraft. If an aircraft was heard on the radio, both companies indicated that they would be visually alert for the other aircraft and approaches would be coordinated accordingly.

It is not uncommon for a pilot to select the wrong radio for transmission, make the transmission, and not be aware that an error has been made unless another pilot reports the error. Along the Labrador coast, pilots would typically switch between the en route frequency (126.7 MHz), the locally adopted discrete frequency (123.4 MHz), and the ATF frequency (122.8 MHz). This increases the potential for broadcasting on the wrong frequency, and for not hearing another aircraft's broadcast. Additionally, because of the position of the audio selector panel on both aircraft, there was no obvious visual feedback to the pilots. This lack of feedback greatly increases the risk of frequency selection error.⁴ Although not required by regulation, neither company had a policy or procedure in place requiring cross-checking of radio broadcast frequency.

Circuit Joining

CAR 602.96(3)(c) states that the pilot-in-command of an aircraft operating at or in the vicinity of an aerodrome shall:

...make all turns to the left when operating within the aerodrome traffic circuit, except where right turns are specified by the Minister in the *Canada Flight Supplement* (CFS) or where otherwise authorized by the appropriate air traffic control unit.

CAR 602.96(3)(b) highlights the requirement to “conform to or avoid the pattern of traffic formed by other aircraft in operation.” It does not specifically state at which location an aircraft may join the circuit pattern.

⁴ J. Nielsen, *Usability Engineering*, page 20, Morgan Kaufmann, San Francisco, 1999

The AIM provides guidance regarding circuit joining procedures at uncontrolled aerodromes (see Figure 3). RAC 4.5.2 (a) of the AIM states that for uncontrolled aerodromes not within an MF area:

...Once the pilot has ascertained without any doubt that there will be no conflict with other traffic entering the circuit or traffic established within the circuit, the pilot may join the circuit on the downwind leg.

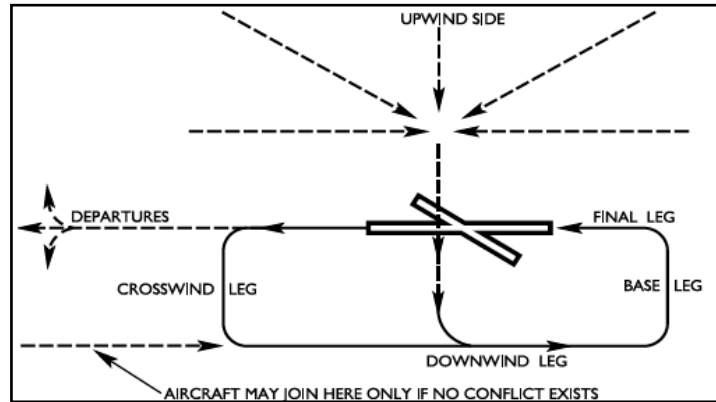


Figure 3. Standard left-hand traffic circuit, VFR approach
Source: AIM RAC 4.5.2

The AIM makes no reference to aircraft joining straight-in to the base or final legs at aerodromes served by an ATF.

According to information provided by TC, as long as an approaching aircraft knows where the other traffic at the airport is and can avoid the traffic, joining the circuit on final does not violate the CARs.

Both companies believed that it was quicker and easier to land straight-in rather than join the traffic circuit. Personnel at both companies did not have a clear understanding of whether or not they were required to fly the traffic circuit pattern to be compliant with the CARs. Neither company had documented circuit-joining procedures or training in place specifically for VFR operations at uncontrolled airports along the Labrador coast.

Safety Management Systems

As both companies were operating under Subpart 705, they began implementation of their safety management systems (SMS) in 2005. Both companies had voluntarily adopted SMS for their Subpart 704 - Commuter operations on a voluntary basis.

Transport Canada guidance document TP 13739 describes SMS as:

A safety management system is a businesslike approach to safety. It is a systematic, explicit and comprehensive process for managing safety risks. As with all management systems, a safety management system provides for goal setting, planning, and measuring performance. A safety management system is woven into the fabric of an organization. It becomes part of the culture, the way people do their jobs.

Among other elements, TC requires that a safety management system include:

- (a) A process for identifying hazards to aviation safety and for evaluating and managing the associated risks;

- (b) A process for ensuring that personnel are trained and competent to perform their duties; and
- (c) A process for the internal reporting and analyzing of hazards, incidents and accidents and for taking corrective actions to prevent their recurrence.

An operator with a functioning SMS will employ both reactive and proactive schemes for identifying safety hazards throughout its organization, utilizing reporting systems such as voluntary incident reporting. Incident or hazard reports must be carefully reviewed to identify organizational vulnerabilities and safety deficiencies, which can then be addressed by appropriate mitigation strategies.

Common Practices

It was common practice for pilots on the north coast of Labrador to be involved in non-essential communications on the flight deck and between aircraft during flight. Pilots were often paired together for long periods of time, so social relationships would develop and conversation was considered a routine aspect of day-to-day flight operations. Flight crews at both companies spent a great deal of time flying in uncontrolled airspace, where radio communication requirements were considerably less rigid than in controlled airspace. Because of a perception that the risk of collision was low for this type of operation and geographic location, certain practices had emerged at both companies. When radio congestion increased, some pilots had developed the habit of either turning down the radio volume or switching to another frequency to reduce unwanted radio chatter.

Company Incident Reporting and Investigation Practices

Local pilots were comfortable operating around other aircraft in the vicinity of an airport and considered the risk of collision to be low. At both companies, there had been previous instances where aircraft had come in close proximity to one another due to omitted radio broadcasts. Unless aircraft got dangerously close together, these events were not considered potential safety issues worthy of formal investigation. Often, pilots tended not to identify or communicate such events to management, or they were handled informally.

Approximately five months prior to the accident at Natuashish, there was an occurrence reported by a local operator, also involving an Air Labrador Twin Otter on a scheduled flight that landed without reporting its intentions. The incident was reported to the Air Labrador safety officer. The safety officer discussed the event with the captain of the Twin Otter; however, Air Labrador did not conduct a formal SMS review of this occurrence.

At the time of the accident, both companies were developing their hazard reporting systems and encouraging staff to make proactive reports of potential hazards. One company now requires the completion of a hazard report for every flight, whether or not a specific hazard could be identified. Provincial Airlines completed its SMS review of this accident in January 2009. Air Labrador completed its SMS review in February 2009.

Company Supervision of Flight Operations

The chief pilots from both companies were based in St. John's, Newfoundland. Neither could accurately define the circuit joining and radio communication procedures specific to the VFR operations at uncontrolled airports along the Labrador coast. One chief pilot did not have any experience flying VFR on the north coast of Labrador.

Both companies relied on their Goose Bay senior pilots to provide on-site supervision related to flight crew airmanship, monitoring/auditing of radio communications, and circuit-joining procedures. Line indoctrination flights and pilot proficiency check (PPC) rides were carried out by Goose Bay qualified senior pilots, such as the captain of the Provincial Airlines flight in this occurrence and the Air Labrador air safety manager. Supervisory flights (for example, PPCs) were typically conducted within the Goose Bay controlled airspace and did not include radio communication and circuit-joining procedures applicable to VFR operations at uncontrolled airports.

The operations manuals from both companies made reference to flight crew responsibilities as they pertain to general airmanship practices. Because most of these practices were viewed as integral aspects of flying, they were not specifically covered during company indoctrination or aircraft type training. New pilots were expected to learn company norms and expected behaviours during line indoctrination and while paired with senior pilots.

Similar Accidents

TSB investigation reports A99P0056 and A07A0118 involved mid-air collisions in the vicinity of uncontrolled airports. In these occurrences, the findings included non-adherence to published procedures and ineffective communications.

Analysis

There was nothing found to indicate that system malfunctions or weather played a role in this occurrence. This analysis focuses on communication and airmanship, regulations and guidance, safety culture, and supervision.

Although SPR961 made a radio call about five miles back from the airport, the frequency used could not be determined. LAL205's call on final approach was not heard by SPR961. After the mid-air collision, the first two calls made by SPR961 to LAL205 were not heard by the flight crew of LAL205. It is unclear whether SPR961 was monitoring or broadcasting on the ATF at the time of the occurrence.

Arriving sooner than expected, the flight crew of LAL205 were late beginning preparations to land. As a result, they first broadcast their position and intentions while making a steep right descending turn to final. This would have made it difficult to be seen by other aircraft or to see other aircraft operating in the traffic circuit.

Engaged in non-essential communications and having not heard any other aircraft on the ATF, the flight crews focused their attention forward for their straight-in landings. This focusing of attention likely resulted in a degraded visual scan, which contributed to the crews' inability to detect the other aircraft prior to the mid-air collision.

Communication in the vicinity of an airport is a critical defence against mid-air collisions. The use of "shall" in RAC 4.5.6 of the AIM implies that supporting regulation requires certain communication reports be made at aerodromes served by an ATF. However, later in the AIM, the word "should" is used when referring to communication requirements within an ATF. While recommended by TC, there is no requirement in the CARs for mandatory communications while operating under VFR at uncontrolled airports served by an ATF. This lack of unambiguous guidance and regulation pertaining to radio communication and circuit-joining procedures at uncontrolled airports served by an ATF increases the risk of collision.

The aerodrome traffic circuit is another defence to mitigate the risk of collision. The level of predictability it provides decreases the likelihood of a collision when pilots have not visually located or used radio communications to identify other aircraft in the vicinity. In this occurrence, neither flight crew followed the standard left-hand traffic circuit.

The wording and application of CAR 602.96(3)(b), as it applies to circuit-joining at uncontrolled airports served by an ATF, lacks explicit direction to help ensure standardization. The AIM clearly establishes recommended procedures for joining the circuit. It does not depict entry from the base or final legs. This creates a certain expectation of where traffic will join the circuit and could potentially confuse pilots, who expect others to follow the guidance contained in the AIM.

Neither company conducted any formal training or had any established procedures or practices pertaining to VFR operations at uncontrolled airports. As a result, flight crews were unsure of the proper VFR traffic circuit-joining and radio communication procedures when operating in the vicinity of an airport served by an ATF. Routine in-flight supervision, as well as formal line indoctrination and PPCs, were conducted by senior pilots from the Goose Bay base. The chief pilots for both companies were located in St. John's and did not play an active supervisory role in ensuring that pilots were employing proper radio communication and circuit-joining procedures.

In light of the low volume of traffic along the Labrador coast, flight crews at both companies perceived the risk of conflict with other aircraft as very low. As well, each company's safety culture did not actively promote sound airmanship and flight discipline during VFR flight operations. For example, flight crews routinely engaged in non-essential communications during flight, senior level personnel condoned turning radio volumes down, or off, if they became congested, and there were no company procedures or practices for cross-checking frequency selections. The norms that developed increased the risk of communication errors due to wrong frequency selection or simply not hearing a transmission.

At the time of the occurrence, both companies were in the final stages of implementing their SMS. In this occurrence, several of the potential safety deficiencies mentioned above were not recognized by either company as a serious risk to flight operations. In addition, some previous incidents were not investigated. As a result, the benefits of SMS were not fully realized.

The location of the audio selector panel on both aircraft made it difficult for flight crews to visually confirm proper radio selection. In this occurrence, the PNF of SPR961 would have lacked obvious cues to indicate whether or not the correct radio and/or frequency had been selected.

Flight operations along the Labrador coast closely resemble those along the lower north shore of Quebec, where an ATF corridor has been established to reduce the risk of collision. Establishing an ATF corridor along the Labrador coast would reduce the risk that the wrong radio or frequency is selected as a result of switching between the ATF and en route frequency.

Each company's follow-up of incident reports tended to be informal, unless the incident was considered to be fairly serious. Other reportable incidents were not fully investigated; thus, opportunities for the two companies to learn valuable safety lessons were missed. In addition, critical CVR data from one aircraft was lost. This is likely due to the lack of company standard operating procedures to follow in the event of a reportable occurrence.

Neither aircraft was equipped with a TCAS, nor was it required by regulation. TCAS would have given the aircraft crew an additional level of awareness of other aircraft in the vicinity and would reduce the chance of a similar incidents occurring in the future, particularly in airspace where radar control is not available.

The following TSB Laboratory reports were completed:

LP 150/2008 – Orientation of Aircraft at Impact

LP 151/2008 – Global Positioning System (GPS) Examination

These reports are available from the Transportation Safety Board of Canada upon request.

Findings as to Causes and Contributing Factors

1. Neither aircraft was aware of the other's presence.
2. Engaged in non-essential communications and having not heard any other aircraft at the Natuashish Airport, the attention of both flight crews was focused on landing and not actively scanning to ensure collision avoidance.
3. Neither flight crew followed the standard left-hand traffic circuit, which placed LAL205 in a position that would have made it difficult for the crew to see or be seen by the crew of SPR961.

Findings as to Risk

1. Arriving sooner than expected, LAL205 did not communicate its position and intentions on the aerodrome traffic frequency (ATF) until established on final. This increased the risk of collision due to potential conflict with other aircraft on final or established in the traffic pattern.
2. The lack of explicit guidance and regulation in the *Aeronautical Information Manual* (AIM) and the *Canadian Aviation Regulations* (CARs) pertaining to radio communication and circuit-joining procedures increases the risk of collision due to potential misinterpretation by pilots.
3. Neither company had formal policies, procedures, or training in place related to visual flight rules (VFR) radio communication and circuit-joining procedures at uncontrolled airports. This resulted in increased risk of collision due to flight crew uncertainty regarding ATF procedures.
4. Each company's safety culture did not actively promote sound airmanship and flight discipline during VFR flight operations at uncontrolled airports. As a result, flight crews adopted practices that increased the risk of missed, omitted, or incorrect radio transmissions.
5. The audio selector panels on both aircraft were partially obscured from the pilots' direct line of sight. This increased the risk of missed or inadvertent transmissions due to incorrect radio selection.

Other Findings

1. Flight operations along the Labrador coast require frequent radio changes between en route and aerodrome traffic frequency (ATF) frequencies. This area of operations shares many of the same characteristics as the west coast of British Columbia and the lower north shore of Quebec, two areas where ATF corridors have been established.
2. Neither company had documented procedures or training in place for the preservation of cockpit voice recorder (CVR) data following an occurrence. This likely contributed to the loss of critical CVR data from one aircraft.
3. Previous incidents were not fully investigated by the companies, depriving them of opportunities to learn valuable safety lessons.
4. Traffic alert and collision avoidance systems (TCAS) reduce the probability of mid-air collisions, particularly in airspace where radar coverage is not available.
5. It is unclear whether SPR961 was monitoring or broadcasting on the correct ATF.

Safety Action

Provincial Airlines

Provincial Airlines conducted an internal review and investigation of the accident and the following safety actions have been taken:

- An internal directive has been issued, which reinforces the continued emphasis on look, listen, talk, and proper procedures.
- A request has been forwarded to NAV CANADA and Transport Canada for the establishment of a frequency corridor (122.8 MHz) between Rigolet and Nain, Labrador. The request is presently outstanding.
- All flight crews have been directed to report any deviations observed by any aircraft flying that could affect flight safety.

Air Labrador

Air Labrador issued an internal memo to pilots implementing the following safety actions:

- Flight crews are to maintain a listening watch on both 126.7 MHz and 122.8 MHz.
- En route advisories are to be given on the frequency 126.7 MHz.
- Within five nm of all coastal airports, flight crews will broadcast on 122.8 MHz and all of these airports will be treated as having an mandatory frequency (MF).
- The Twin Otter standard operating procedures (SOPs) have been amended to include sterile cockpit procedures during all ground operations, including taxi, take-off and landing, and all other flight operations below 5000 feet, except for cruise flight. Until the SOPs are amended, all flight crews are to adhere to the sterile cockpit procedure.
- Flight crews must devote their undivided attention to a good lookout and radio listening watch during this phase of flight.
- Unnecessary chatter on discreet frequencies is not approved.
- A request has been forwarded to NAV CANADA and Transport Canada for the establishment of a frequency corridor (122.8 MHz) between Rigolet and Nain, Labrador. The request is presently outstanding.

Transport Canada

Transport Canada believes there is a benefit to implementing an aerodrome traffic frequency (ATF) corridor along the Labrador coast and NAV CANADA is considering the possibility of working towards this goal.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 27 April 2010.