



TSB Aviation Investigation Report A12Q0216

Executive Summary

Collision with terrain of Perimeter Aviation Metro III in Sanikiluaq, Nunavut, on 22 December 2012

History of the flight

Perimeter Aviation Flight 993 was originally scheduled to depart Winnipeg, Manitoba, for Sanikiluaq, Nunavut, on the morning of December 22, 2012, but several issues, including repairs to the cargo door, caused a four-hour delay. After finally taking off, the crew realized they had forgotten key published information for the approach and landing at Sanikiluaq. Rather than return to Winnipeg and lengthen the flight, the captain radioed the company to obtain most of the required information.

The crew's initial plan was to come in on a straight-in visual approach to land eastbound, into the wind on Runway 09 at Sanikiluaq (Figure 1). Weather conditions, however, did not permit this. As there was no published instrument approach procedure for Runway 09, they used the published procedure for Runway 27 and circled around visually to land on Runway 09, as wind favored landing in that direction. But visibility was insufficient, so they circled a second time, only to once more lose sight of the runway.

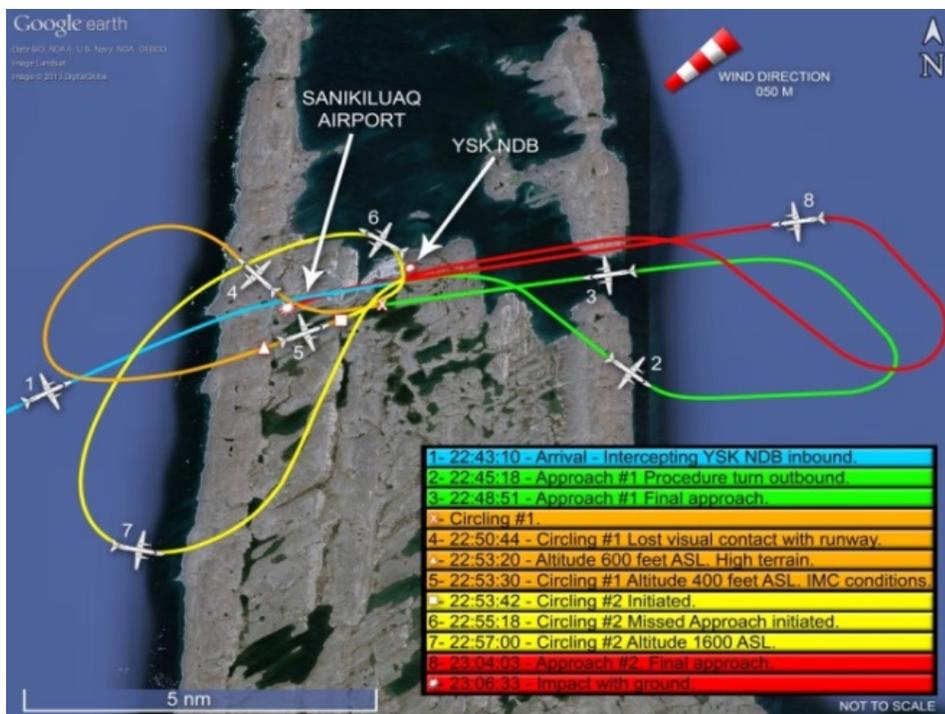
En route, a weather update had revealed that the alternate destination of Kuujuarapik was no longer feasible. Since the weather was still

technically acceptable for landing, the crew decided to continue¹ attempting to land at Sanikiluaq. With the crew feeling increasing pressure to land, there was an increase in stress, workload, frustration and fatigue, resulting in attentional narrowing and a breakdown in crew communication. They made a second attempt, this time to land westbound on Runway 27. A tailwind, however, increased the aircraft's groundspeed, and they came in too high, too steep, and too fast, sighting the runway later than expected. By the time the captain decided to reject the landing it was too late, and the aircraft struck the ground. This is considered an approach-and-landing accident.

The 2 crew and the 6 adult passengers, secured by their seat belts, suffered injuries ranging from minor to serious. A lap-held infant, not restrained by any device or seatbelt, was fatally injured.

¹ Commercial instrument flight rules (IFR) flights are required to carry enough fuel to get to an alternate destination in case they are unable to land at their primary destination.

Figure 1. Flightpath of the aircraft



Weather

Before departure, the weather at Sanikiluaq was reported as acceptable to execute an approach. Visibility was reported as 8 miles, with light and drifting snow. The cloud ceiling was overcast at 1400 feet. Weather at the alternate destination of Kuujuarapik was marginal but acceptable if the need to go there arose. Visibility at Kuujuarapik was 3 miles in light snow, and the cloud ceiling was overcast at 600 feet.

Prior to descent and landing, the crew obtained weather updates. Although conditions at Sanikiluaq had deteriorated, they were still considered marginal but acceptable. Weather for the alternate airport of Kuujuarapik, however—in fact, all along the east coast of Hudson’s Bay—had worsened, meaning that there were no longer any backup options within range.

Photo 1. Aircraft wreckage



Instrument approach procedures

When flying in cloud, crews use what’s known as an “instrument approach procedure” to descend and line up with the runway. These are detailed instructions provided by NAV CANADA that show altitudes and courses to be flown, as well as obstacles and terrain. They also list missed-approach procedures and commonly used radio frequencies.

NAV CANADA has published instrument approach procedures for many runways across Canada—but not all. At the time of this

occurrence, there was no published instrument approach procedure for Runway 09, although one was available for Runway 27. It was this document that the crew forgot in Winnipeg.

Unstable approaches

It has long been recognized that a stable approach improves the likelihood of a safe landing. Key criteria such as speed, course, power setting, rate of descent and aircraft configuration need to be controlled, and stabilized, before the aircraft reaches a pre-determined point—usually several miles back from the airport, at 1000 feet above the ground. If the approach is not stable, pilots are generally urged to conduct a go-around.

However, industry research shows that 3 to 4 percent of all approaches are unstable, and that of these, 97 percent are nonetheless continued to a landing—sometimes with fatal consequences.

Air carriers across Canada have some defences in place to prevent unstable approaches. But as research, and this occurrence show, many pilots opt to continue an unstable approach. What's needed, therefore, are *better* defences.

Approach-and-landing accidents is an issue on the 2014 TSB [Watchlist](#), which comprises the safety issues the TSB believes pose the greatest risk to Canada's transportation system.

Crew resource management

After twice circling the Sanikiluaq airport in an attempt to view the runway environment, communication between the two pilots began to break down. Stress, workload, frustration, and fatigue combined to narrow their attention, and they shifted away from well-practised procedures. At times, standard calls were omitted or not responded to, and flight-

parameter corrections were not initiated or made at all.

Crew resource management, or CRM, is supposed to help crews in exactly these kinds of situations. Although each pilot had received CRM training, it was based on an outdated Transport Canada standard, one that does not include the latest concepts and ideas. The TSB has previously issued a recommendation on CRM, urging Transport Canada to make CRM training mandatory for more pilots.² At March 2015, this recommendation had an assessment rating of [satisfactory intent](#). The TSB has also issued a safety concern urging Transport Canada and the airlines to take steps to ensure flight crews work more effectively together on the flight deck.³

Although Transport Canada is now working on a more modern standard, there are still no plans to specify the amount of time spent on each topic, nor to require instructor accreditation. There also needs to be a comprehensive and integrated approach to monitor and reinforce best practices, so that crews will routinely practise effective CRM in the cockpit.

Child restraint systems

In this occurrence, the crew and the adult passengers were all secured by their seat belts. Although they suffered injuries ranging from minor to serious, all were able to exit the aircraft. A lap-held infant, not restrained by any device or seatbelt, was ejected from his mother's arms by the force of the crash, and fatally injured.

Research shows that adults are not strong enough to adequately restrain an infant by holding on. Research has also proven that, just

² TSB Recommendation A09-02

³ TSB Aviation Investigation Report A11H0002

like in an automobile, the standard adult seatbelt isn't suitable for a young child.

There have been other occurrences where crew, adult passengers, and children have sustained injury during unexpected, moderate-to-severe turbulence. A review of these occurrences documents how lap-held infants and children would have likely survived or suffered less severe injury had they been properly restrained.

Infants and children who are not properly restrained are at risk of injury and possibly death. They may also cause injury or death to other passengers as they can become projectiles. Currently, they are not offered an equivalent level of safety compared to adult passengers.

While Transport Canada and air carriers recommend that infants and young children travel in an approved child restraint system during flights—one appropriate to their age and size; these systems are not yet mandatory.

Findings

Investigations conducted by the TSB are complex—an accident is never caused by just one factor. This report identified **11 distinct causes and contributing factors**, many of them influencing one another.

1. The lack of instrument approach charts negatively affected the crew's situational awareness.
2. Weather made landing at the alternate airport unlikely and put pressure on the crew to land in Sanikiluaq.
3. Stress, workload, frustration, and fatigue resulted in attentional narrowing and a shift away from well-learned, highly practiced procedures.
4. Due to the lack of an into-wind instrument approach on the favourable runway, the

crew chose to land with a significant tailwind, resulting in an unstable approach.

5. The final descent was initiated beyond the missed-approach point and, combined with a strong tailwind, resulted in the aircraft remaining above the desired descent path.
6. The Ground Proximity Warning System (GPWS) warnings were not heard; the focus was on landing to the exclusion of other alternative actions.
7. The final approach was unstable; the aircraft, halfway down the runway, was too high and too fast.
8. A go-around was initiated when the aircraft was close to the ground and in a low energy landing regime.
9. A combination of a change in aircraft configuration and a possible easing off on the controls to gain speed may have affected aircraft climb performance.
10. A sufficient rate of climb was not established to clear terrain, and the aircraft impacted the ground.
11. The infant passenger was not restrained, resulting in fatal injuries.

This report also contains **14 findings as to risk**. Although these did not lead directly to the accident, they are related to unsafe acts, unsafe conditions, or safety issues with the potential to degrade air safety. Some of the risks that need to be addressed are

- the risk of hindering evacuation if seated by emergency exits while assisting another;
- the increased risk of controlled flight into terrain (CFIT) if temperature corrections are not applied to all altitudes on the approach chart;
- the risk of injury or death to infants and to other occupants if restraint is not provided;
- the risk of inappropriate actions in executing a low energy go-around if training and procedures are not aligned;

- the risk that a company’s safety management system (SMS) may not identify all risks in a timely manner ; and
- the risk that Transport Canada’s present oversight of companies may miss important issues.

Safety action following the accident

In the weeks and months following the accident, Perimeter Aviation enhanced flight crews’ access to instrument approach charts, making them available 24 hours a day as well as online via the company’s intranet site. A Flight Dispatch Center has been added and is available to assist all company operations. Perimeter also changed the procedure for passenger briefings to ensure uniformity in how these are delivered. The company then added a section on stabilized approaches to its operations manuals, along with more complete procedures for missed approaches and go-arounds.

In 2013, Perimeter introduced more detailed training aimed at increasing flight crews’ understanding of the various warnings provided by Ground Proximity Warning Systems and the necessary action to be taken. The company also used reports from its own Safety Management System, along with crew input, to build more realistic examples of crew interactions for its CRM training.

TSB recommendations

Recommendation	Status
A15-01 (June 2015) Transport Canada must require commercial air carriers to collect and report, on a routine basis, the number of infants (under 2 years old), including lap-held, and young children (2 to 12 years old) travelling.	NEW
A15-02 (June 2015) Transport Canada must work with industry to develop age- and size-appropriate child restraint systems for infants and young children travelling on commercial aircraft, and mandate their use to provide an equivalent level of safety compared to adults.	NEW
A09-02 (2009) Transport Canada must require commercial air operators to provide contemporary crew resource management (CRM) training for air taxi pilots and commuter pilots.	Satisfactory Intent (at March 2015)

Conclusion

This tragedy was not caused by one single person, action or organization—many factors played a role. While issues surrounding approach-and-landing accidents have been previously identified, it’s time that action for the introduction of appropriate child restraint systems in commercial aircraft be undertaken. The TSB will monitor action on the two new recommendations and will report publicly on any progress—or lack of progress—until the issues have been addressed.