Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

TSB Aviation Investigation Report A13H0001

Executive Summary

Controlled flight into terrain
7506406 Canada Inc.
Sikorsky S-76A (helicopter), C-GIMY
Moosonee, Ontario
31 May 2013

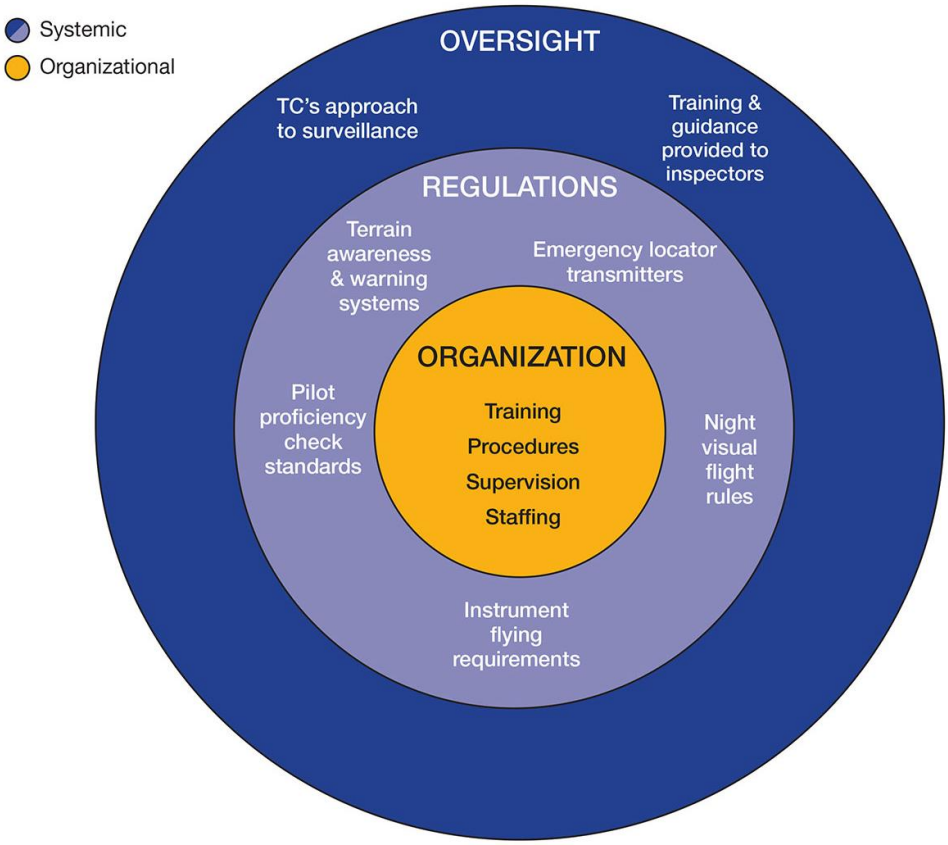
History of the flight

Shortly before 7:00 pm on the evening of May 30, 2013, Ornge Rotor-Wing (RW) received a request for an emergency medevac flight for a patient in Attawapiskat, Ontario; however, poor weather delayed the flight for several hours. At 11 minutes after midnight, the helicopter departed from Runway 06 at Moosonee, with 2 pilots and 2 paramedics on board. The flight was to be conducted under night visual flight rules (VFR), meaning that the pilots would have to maintain "visual reference to the surface" of the ground or water at all times.

As the helicopter climbed through 300 feet above ground into the darkness, the first officer commenced a left-hand turn and the crew began carrying out post-takeoff checks. During the turn, the aircraft's angle of bank increased, and an inadvertent descent developed. As he completed the post-takeoff check, the captain identified the excessive bank angle and the first officer indicated that he would correct it. Seconds later, just prior to impact, the captain recognized that the aircraft was descending and called for the first officer to initiate a climb. However, this occurred too late and at an altitude from which it was impossible to recover before the helicopter struck the ground. A total of 23 seconds had elapsed from the start of the turn until the impact. The helicopter struck the ground approximately one mile from the runway. The aircraft was destroyed by impact forces and the ensuing post-crash fire. There were no survivors.

Why did this accident happen?

The causes of this accident went well beyond the actions of this flight crew. As the crew turned toward Attawapiskat that night, they were turning into an area of total darkness, devoid of any ambient or cultural lighting—no town, no moon, no stars. With no way to maintain visual reference to the surface, they would have had to transition to flying by instruments. Although both pilots were qualified according to the regulations, they lacked the necessary night- and instrument-flying proficiency to safely complete this flight.



It was the role of the operator, Ornge RW, to ensure that the crew was operationally ready for that flight. However, the pilots had not received sufficient and adequate training to prepare them for the challenges they faced that night. Nor did the company's standard operating procedures (SOPs) address the hazards specific to night operations. Compounding this was the issue of insufficient resources, and inexperienced personnel in key positions, which led to some company policies being bypassed and, ultimately, a sub-optimal crew pairing that night.

Transport Canada (TC), meanwhile, was aware that Ornge RW was struggling to comply with regulations and company requirements. However, the training and guidance provided to TC inspectors led to inconsistent and ineffective surveillance. In particular, despite clear indications that Ornge RW lacked the necessary resources and experience to address issues that had been identified months before the accident, TC's approach to dealing with a willing operator allowed non-conformances and unsafe practices to persist.

Key issues in the investigation

Training at Ornge Rotor-Wing

Training is critical to ensuring that pilots are prepared for the normal and abnormal situations they may face. To be effective, training must meet the operational needs of the company, be delivered effectively, and be followed up afterward with ongoing opportunities for skill retention and development.

This investigation found weaknesses in the design of the training conducted at Ornge RW, notably with respect to controlled flight into terrain (CFIT)-avoidance, night visual flight rules (VFR), and crew resource management (CRM). These weaknesses were exacerbated by

ineffective or inconsistent delivery of the material. For example, some pilots, including the occurrence captain, were given little time and/or material to prepare, the training was not always conducted in accordance with company SOPs, nor was it necessarily conducted under conditions considered to be operationally realistic. Afterward, pilots received little in the way of follow-up supervision or training. The crew involved in the occurrence flight, for example, received no additional flight training or checking after completing their simulator training.

As a result, the crew was not operationally ready to safely conduct a flight under the conditions they encountered on the night of the occurrence.

Standard operating procedures

Effective SOPs are a framework for consistent and safe operations. They establish expectations and norms with respect to specific operations, and set parameters that enable detection of deviations from standard flight profiles.

At the time of the occurrence, Ornge RW's SOPs did not contain a dedicated night-flying section. Although there was a specific procedure for "black-hole" departures, it did not apply to Moosonee. As a result, the crew elected to follow the daytime procedure of turning out at 300 feet, as opposed to climbing up to at least 500 feet before turning, which was an informal practice that had been adopted by most of the company's experienced pilots for all night takeoffs.

In multi-crew operations, SOPs also assist in communication, coordination of flight crew duties, and threat-and-error management. Instrument settings are cross-checked, and readbacks of checklist items, instructions, and clearances help to ensure that information is accurate, and that errors are detected and trapped. Ornge RW's SOPs, however, contained very little direction to pilots with respect to cross-checking procedures, nor much in the way of readback requirements.

Many SOPs also embed practical strategies for crew resource management, including the clear definition of roles, especially during critical phases of flight. The SOPs for Ornge RW's S-76As contained very little of this. As a result, the captain's attention was focused on completing the post-takeoff checks and locating the switch for the landing light while the first officer turned left, and neither crew member detected the inadvertent descent in time to recover.

Supervision at Ornge Rotor-Wing

At the time of the accident, there were a number of safety deficiencies related to company supervision of pilots at Ornge RW.

In 2012, for example, Ornge RW eliminated the pilot manager positions at each base in favour of a centralized scheduling system. Knowledge of local operating areas and crews thus was no longer considered when scheduling crews. Since there was no consideration—beyond very basic "green-on-green" crew pairing restrictions—given to pilot experience and proficiency when pairing pilots, the company did not recognize the risks associated with pairing the occurrence pilots together on a mission that they were not operationally ready to conduct.

Moreover, when faced with pilot shortages or staffing pressures, Ornge RW altered or did not use defences that it had previously put in place. These included the decision to employ the captain in a pilot-in-command capacity, despite the concerns noted with regard to his pilot proficiency check (PPC); permitting a newly hired first officer with very little night- and instrument-

flying experience to trade night shifts for day shifts for an extended period, thereby reducing his opportunities to gain instrument flight rules (IFR) and night flight experience; not ensuring that all pilots received operationally realistic black-hole training, or taking action when the captain's lack of black-hole training was identified; and not applying the company's own direct-entry captain procedure to nine new hires, including the occurrence captain.

Staffing at Ornge Rotor-Wing

Ornge RW's department of Flight Operations was under-resourced. Not only were the Operations Manager (who was also interim Chief Pilot until just prior to the accident) and the Chief Pilot (who had been acting as Assistant Chief Pilot until just prior to the accident) new to the management of Emergency Medical Services (EMS) operations, but neither had much support given that a number of key positions were vacant at the time of the accident. These included positions for Manager of Rotor Wing Flight Safety, Manager of Rotor Wing Flight Training and Standards, as well as an assistant to the Manager of Rotor Wing Flight Training and Standards, and an aviation clerk who was to check and track records.

Moreover, in 2012, pilot manager positions at helicopter bases had been eliminated, and most of those positions' responsibilities were also transferred to the Chief Pilot position, which further increased the workload on the individual filling that position.

This workload was too high for two individuals, a finding noted by TC in its January 2013 inspection of Ornge RW. The workloads were then exacerbated when both individuals were required to help develop the Corrective Action Plans that resulted from that same inspection. As a result, many safety-related tasks went either incomplete or were not started, including: the rectification of training-related problems; support for pilot trainees; tracking/verification of training records, pilot qualifications, and pilot currencies; updating and approving company SOPs and company publications; and hiring more staff.

As a result of these staffing challenges, unsafe conditions persisted—with the ultimate result that the company was not ensuring that its pilots were qualified and adequately prepared for operational duty.

Regulatory oversight

All transportation companies have a responsibility to manage the safety risks within their operations. However, given that companies will inevitably have varying degrees of ability or commitment to doing so, the purpose of regulatory oversight is to encourage companies to be proactive, while intervening when necessary to ensure, at a minimum, regulatory compliance.

In the year preceding this accident, TC identified non-conformances related to Ornge RW's pilot-training program on multiple occasions. Although Ornge RW was on each occasion provided with the opportunity to develop corrective action, the problems persisted. Despite knowing this, TC did not change its approach or modify the level of surveillance, and the non-conformances remained.

Over the past decade, TC's approach to oversight has moved away from a traditional "inspect-and-fix approach." The new model is a systems-level approach whereby, in addition to verifying a company's compliance with regulations, its internal processes are examined to verify that there is also an effective system in place to proactively manage the risks associated with its operations. Done properly, such a transition should result in improved safety—

addressing not only any identified problems, but also the reasons behind them.

Initially, TC's move toward systems-level oversight was intended to coincide with a requirement that the entire aviation industry adopt safety management systems (SMS), a powerful, internationally recognized tool to help companies identify and manage risks. However, in the intervening years, TC has delayed requiring SMS for many smaller operators. Its oversight philosophy, meanwhile, remains predicated on all operators having the ability to proactively identify safety deficiencies and the capability to rectify them—something TC cannot be assured of if companies are not required to have an assessed SMS in place.

To address the issues identified in this section, the TSB is making the 3 following recommendations:

that Transport Canada require all commercial aviation operators in Canada to implement a formal safety management system. (A16-12)

that Transport Canada conduct regular SMS assessments to evaluate the capability of operators to effectively manage safety. (A16-13)

that Transport Canada enhance its oversight policies, procedures and training to ensure the frequency and focus of surveillance, as well as post-surveillance oversight activities, including enforcement, are commensurate with the capability of the operator to effectively manage risk. (A16-14)

Flying at night

Flying at night is much more challenging than flying during the day, and brings with it a number of hazards. Foremost among these is a significant reduction in visual cues and potential sensory illusions that can lead to spatial disorientation.

The rules governing night flights are designed to reduce the risks associated with these challenges. Pilots flying visually (under VFR), for example, require strict weather and visibility minima as set out in the Canadian Aviation Regulations (CARs). Pilots must also maintain "visual reference to the surface" at all times. However, this phrase is not defined by the CARs. As such, any pilots flying over a dark, featureless landscape—much like the area north of Runway 06 at Moosonee Airport—would have difficulty maintaining visual reference to the surface without some alternate means (such as night-vision goggles), even in otherwise acceptable weather.

To address the risks associated with this safety deficiency, the TSB is recommending that

Transport Canada amend the regulations to clearly define the visual references (including lighting considerations and/or alternate means) required to reduce the risks associated with night visual flight rules flight. (A16-08)

Instrument flying

When pilots cannot see the surface of the ground or water, they must transition to flying via instruments. This, however, is a perishable skill and, as a result, the transition can be challenging for those who have not done so in a while. Nonetheless, regulations continue to allow some pilots who have not flown using instrument procedures for up to 12 months to be considered current.

As a result of the risk posed by the current instrument currency regulations, the TSB is recommending that

Transport Canada establish instrument currency requirements that ensure instrument flying proficiency is maintained by instrument rated pilots, who may operate in conditions requiring instrument proficiency. (A16-09)

Standards for pilot proficiency checks

In order to ensure they possess the skill requirements to fulfill their assigned roles on a specific aircraft type, commercial pilots at Ornge RW are required to pass an annual pilot proficiency check (PPC).

Under the current regulations, helicopter captains and first officers are both held to the same PPC standard. For example, there is no such thing as a "first officer PPC" or a "captain PPC"; rather, a passing grade allows a pilot to perform either role. Yet given the complexity of some multi-crew helicopter operations, such a standard may not allow for the determination of whether a pilot is adequately prepared to act as a pilot-in-command.

In this occurrence, the captain had passed his PPC two months prior to the accident. Afterward, the evaluator expressed concerns about two key performance areas: flying via instruments and multi-crew operations. These concerns were noted on the signed evaluation form, and the company was advised that the captain should be employed only as a first officer until he was able to gain some additional experience.

Ornge RW, however, employed the captain as a pilot-in-command without any additional training or supervision—with the result that he was not adequately prepared to carry out his duties on the night of the occurrence.

The TSB is therefore recommending that

Transport Canada establish pilot proficiency check standards that distinguish between, and assess the competencies required to perform, the differing operational duties and responsibilities of pilot-in-command versus second-in-command. (A16-11)

Terrain awareness and warning systems

A large number of commercial helicopters routinely conduct flight operations at night and/or in meteorological conditions that require flying by means of instruments. Without the benefit of a terrain awareness and warning system, or TAWS, they are at significantly greater risk of controlled flight into terrain (CFIT), in which a serviceable aircraft is unintentionally flown into the ground or water.

Helicopters, however—unlike commercially operated aeroplanes and some private ones—are not required by regulation to be equipped with TAWS. This means they are not afforded an equivalent level of safety, thereby placing crew and passengers who travel on these commercial helicopters at night or in instrument meteorological conditions at increased risk of CFIT.

The TSB is therefore recommending that

Transport Canada require terrain awareness and warning systems for commercial helicopters that operate at night or in instrument meteorological conditions. (A16-10)

Emergency locator transmitters (ELTs)

An emergency locator transmitter, or ELT, is a tracking transmitter that aids in the detection of aircraft and people in distress. International standards require ELTs to transmit at a frequency of 406 MHz. Since 2009, the former frequency of 121.5 MHz is no longer monitored by Cospas-Sarsat, the international satellite-based search-and-rescue (SAR) system. Despite this, Canadian regulations only require ELTs to transmit on 121.5 MHz. Currently, more than half of the approximately 27 000 Canadian registered aircraft that require an ELT are equipped with one that cannot be detected by SAR system.

In addition, this investigation also examined a number of issues related to the crashworthiness of ELTs, and the ability of ELTs to function properly following an accident. In particular, the investigation identified safety deficiencies related to the overall crashworthiness of the current ELT design standards, the time it takes for the first signal to be transmitted, and the manner in which ELTs are secured on the aircraft. In this occurrence, a distress signal was not transmitted to the SAR system because the antenna was compromised before the first transmission could be sent by the ELT system. In addition, the ELT came free of its hook-and-loop fastener, which represents another risk that may prevent an ELT distress signal from being transmitted.

To address the issues identified above, the TSB is recommending

that Transport Canada require all Canadian-registered aircraft and foreign aircraft operating in Canada that require installation of an emergency locator transmitter (ELT) to be equipped with a 406-MHz ELT in accordance with International Civil Aviation Organization standards. (A16-01)

that the International Civil Aviation Organization, the Radio Technical Commission for Aeronautics, the European Organisation for Civil Aviation Equipment, and Transport Canada establish rigorous emergency locator transmitter (ELT) system crash survivability standards that reduce the likelihood that an ELT system will be rendered inoperative as a result of impact forces sustained during an aviation occurrence. (A16-02, 03, 04, and 05)

that Cospas-Sarsat amend the 406-megahertz emergency locator transmitter first-burst delay specifications to the lowest possible time frame to increase the likelihood that a distress signal will be transmitted and received by search-and-rescue agencies following an occurrence. (A16-06)

that Transport Canada prohibit the use of hook-and-loop fasteners as a means of securing an emergency locator transmitter to an airframe. (A16-07)

Safety action following the accident

Following the accident, Transport Canada created a national Oversight Office and an Oversight Advisory Board to provide support for addressing concerns and processing complex oversight decisions quickly. TC has also clarified the guidance provided to inspectors to carry out their duties.

Following the accident, Ornge RW also took significant safety action to improve the safety of its operations. The company has enhanced its standard operating procedures, begun the transition to the use of night-vision goggles, enhanced training to its pilots, and has taken steps to address experience and staffing issues at the management level.