Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

Canada

TSB Recommendation A24-02

Technology as a defence against inadvertent flight into instrument meteorological conditions accidents

The Transportation Safety Board of Canada recommends that the Department of Transport require commercial helicopter operators to implement technology that will assist pilots with the avoidance of, and recovery from, inadvertent flight into instrument meteorological conditions

Air transportation safety investigation report	A21C0038
Date the recommendation was issued	15 February 2024
Date of the latest response	September 2025
Date of the latest assessment	March 2026
Rating of the latest response	Satisfactory in Part
File status	Active

All responses are those of the stakeholders to the TSB in written communications and are reproduced in full. The TSB corrects typographical errors and accessibility issues in the material it reproduces without indication but uses brackets [ ] to show other changes or to show that part of the response was omitted because it was not pertinent.

Summary of the occurrence

At approximately 1548 Central Daylight Time on 25 April 2021, the Great Slave Helicopters 2018 Ltd. Airbus Helicopters AS350 B2 (registration C-FYDA, serial number 4157) departed from a remote camp on Russell Island, Nunavut, on a day visual flight rules (VFR) flight to Resolute Bay Airport, Nunavut, located 87 nautical miles to the northeast. On board were the pilot, an aircraft maintenance engineer, and a biologist. The purpose of the flight was to return to Resolute Bay following 12 days spent conducting polar bear research for a client, given that poor weather was forecast in the area for the next several days.

At approximately 1633 Central Daylight Time, the helicopter impacted the snow-covered terrain on Griffith Island, Nunavut, approximately 12 nautical miles southwest of Resolute Bay Airport, on a near-reciprocal track to the intended route. The helicopter was destroyed, and a post-impact fire consumed much of the fuselage area. The emergency locator transmitter was

destroyed during the impact sequence and did not transmit a distress signal. There were no survivors.

In addition to the circumstances that most likely led to the collision with terrain resulting from a loss of visual references in flat light and whiteout conditions, the investigation examined the factors that likely influenced the pilot's decision-making process, the organizational defences in place at Great Slave Helicopters 2018 Ltd., and the regulatory environment.

The Board concluded its investigation and released report A21C0038 on 15 February 2024.

Rationale for the recommendation

A robust approach to preventing accidents resulting from a loss of visual references must include multiple defences that will assist in the avoidance of, and recovery from, inadvertent flight into instrument meteorological conditions (IIMC). This is particularly true for commercial VFR helicopters, which routinely operate at lower altitudes than commercial VFR airplanes. Recommendation A24-01 identifies the need for pilots to possess the skills necessary to recover from IIMC. However, equally important is the need for pilots to be provided with information that will help maximize situational awareness and support pilot decision making (PDM) before or after entering IIMC. There are several ways that technology can be used to prevent IIMC accidents.

In this occurrence, the pilot encountered flat light and whiteout conditions as the helicopter crossed Griffith Island. The helicopter was equipped with flight instruments; however, the pilot relied on the "avoid-at-all-costs" approach to these conditions, which is permitted under the CARs and was part of his training. Thus, the pilot was trained to fly solely on outside visual references in situations of reduced visibility. Additionally, the occurrence helicopter was not equipped with technology capable of alerting the pilot to the helicopter's height above ground or rate of descent. Therefore, the pilot had no way of being warned of the impending collision with terrain that occurred shortly after he likely attempted a visual 180° turn in instrument meteorological conditions.

One of the most basic examples of technology that can help prevent IIMC accidents is flight instrumentation. The CARs outline specific flight instrumentation requirements for aircraft operated under IFR;[1] however, the requirements are significantly lower for aircraft operated under VFR.[2]

Specifically, VFR aircraft are not required to be equipped with flight instruments that are critical to aircraft control in conditions such as flat light and whiteout conditions, which have been repeatedly associated with IIMC accidents,[3] just like in this occurrence.

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1 Transport Canada, SOR/96-433, *Canadian Aviation Regulations* (CARs), section 605.18.

2 Transport Canada, SOR/96-433, *Canadian Aviation Regulations* (CARs), section 605.14.

3 See Air Transportation Safety Investigation Report A21C0038, sections 1.18.8.2 Previous investigations, 1.18.8.3 Australian Transport Safety Bureau Investigation AO-2013-216, 1.18.9 TSB statistics on loss of visual

In 1990, the TSB issued Recommendation A90-84 calling on Transport Canada (TC) to require all commercially-operated helicopters to be equipped with appropriate instrumentation for the conduct of basic instrument flying. TC does not support this active recommendation. Therefore, given the lack of progress, the Board considers TC's response to Recommendation A90-84 as **Unsatisfactory**.

During the investigation into this occurrence, the TSB discovered that some Canadian commercial helicopter operators with management staff who possess IFR flight experience consider it essential that VFR helicopters operating above the tree line during the winter months be equipped with flight instruments necessary for IFR, and pilots be trained for IIMC recovery. Some of those operators also consider it vital to equip those aircraft with radar altimeters, and one operator has begun using synthetic vision systems. In contrast, some VFR helicopter operators do not see a need to implement these defences. In the case of GSH, the company's management pilots, who were VFR-only rated pilots, did not feel it was necessary to implement similar defences, even though some pilots had requested it. GSH's management pilots were also aware that, in 2015, the company's predecessor had an accident in flat light and whiteout conditions that resulted in several internal recommendations. However, the absence of formal requirements to equip VFR helicopters with basic flight instruments has likely contributed to a perception among some VFR helicopter operators that the use of basic flight instruments, and the training needed to use them, will not necessarily prevent IIMC accidents. As a result, VFR helicopter pilots continue to be dispatched to areas prone to environmental conditions such as flat light and whiteout without basic flight instrumentation and without training on how to use that instrumentation if all visual references are lost. This places VFR helicopter pilots and the passengers who fly on those aircraft at increased risk of collision with terrain following an IIMC encounter.

In addition to basic flight instrumentation, several technological advances have emerged to enhance pilot situational awareness and, therefore, assist in the reduction of IIMC accidents. Many of these systems can alert pilots to unintended flight profile changes that increase the risk of an IIMC accident. For example, some systems can be used to establish "en-route decision triggers," such as a minimum height above ground, and alert the pilot if the helicopter's height above ground drops below the preset threshold. This can be particularly beneficial in conditions of flat light and whiteout because of their insidious nature, which can make it difficult for a pilot to accurately assess height above ground.

More advanced forms of technology, such as helicopter terrain awareness and warning systems, can also warn of an impending collision with terrain or of excessive rates of descent close to the ground. These types of alerts can help a pilot recognize, in a timely manner, that emergency action must be taken to prevent a collision with terrain. Another form of technology that has become more widespread in recent years is synthetic vision systems, which are capable of providing pilots with a virtual 3-dimensional map on a display in the cockpit, or in a tablet-

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reference accidents, and Appendix F TSB investigations involving loss of spatial awareness during commercial helicopter flights of this report.

based application such as ForeFlight. This same application can, with some minor aircraft modifications, provide the pilot with a set of backup flight instruments like a modern glass cockpit.

The above-mentioned forms of technology help maximize pilot situational awareness by providing the pilot with information that may not otherwise be available if solely relying on outside visual references. With proper training and procedures, these technologies can greatly reduce the risk of IIMC accidents by warning the pilot when safety margins are being eroded or by assisting the pilot to escape IIMC.

In 2002, following a series of accidents involving VFR helicopters in flat light, the U.S. National Transportation Safety Board issued a safety recommendation calling for the installation of radar altimeters in commercial helicopters operating in areas where flat light or whiteout conditions routinely occur.[4] After several additional accidents involving these conditions, the U.S. Federal Aviation Administration chose to expand the scope of this recommendation and amended the *Federal Aviation Regulations* to require all commercial helicopters be equipped with a radar altimeter or a device that incorporates a radio altimeter. According to the Federal Aviation Administration, "radio altimeters help increase situational awareness during inadvertent flight into instrument meteorological conditions (IIMC), night operations, and flat-light, whiteout, and brownout conditions."[5]

In 1990, the TSB issued Recommendation A90-83 calling on TC to require all helicopters engaged in commercial passenger carrying operations be equipped with radar altimeters. TC did not support this recommendation. In September 2012, given the lack of progress addressing the safety deficiency associated with Recommendation A90-83, the Board considered TC's response to be **Unsatisfactory** and changed the recommendation status to dormant.

The TSB has previously attempted to address safety issues related to helicopter collision with terrain accidents, calling for increased requirements for flight instrumentation and other systems such as radar altimeters. To date, TC has not taken the measures needed to address these recommendations, which were issued more than 30 years ago. The Board believes that more must be done to reduce the incidence of loss of visual reference accidents, which are more than twice as likely to involve a helicopter than they are to involve an airplane. Many forms of technology now exist that, if required by regulation, could greatly reduce the risk of IIMC accidents, particularly in areas prone to flat light and whiteout conditions. Because there is no requirement for VFR helicopters to be equipped with technology that can assist pilots with the avoidance of, and recovery from, IIMC, the pilots and passengers who fly on those helicopters remain at increased risk of collision with terrain.

Therefore, the Board recommended that

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4 National Transportation Safety Board (NTSB), Safety Recommendation A-02-35, dated 07 October 2002.

5 Federal Aviation Administration (FAA), *Federal Register*, Part II, Vol. 79, No. 35 (21 February 2014), p. 9933.

> The Department of Transport require commercial helicopter operators to implement technology that will assist pilots with the avoidance of, and recovery from, inadvertent flight into instrument meteorological conditions.
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> **TSB Recommendation A24-02**

Previous responses and assessments

May 2024: response from Transport Canada

Transport Canada (TC) agrees in principle with the Transportation Safety Board (TSB)'s recommendation and acknowledges the potential safety enhancements associated with the integration of additional instruments into commercial helicopter operations. While TC has already initiated efforts in this direction, it is essential to thoroughly assess various components before proceeding. TC understands the critical importance of ensuring that any new instruments added indeed maximize safety benefits, and we are committed to conducting a comprehensive evaluation to achieve this objective effectively.

In 2023, TC published Notice of Proposed Amendment (NPA) 2023-005 - *Minimum Visual Meteorological Conditions for VFR flight in Controlled and Uncontrolled Airspace – Parts I, IV, VI, VII of the CARs and Associated Standards*[6] for consultation on the Canada Aviation Regulation Advisory Council (CARAC). The purpose of this NPA is to amend Sections 602.114 and 602.115, along with other areas in Parts I, IV, VI, VII of the CARs and associated Standards to facilitate the introduction of Night Vision Imaging Systems (NVIS) and for the increased requirements for Night VFR rating and currency. These enhancements encompass augmented criteria for instructor and pilot training and qualification within Part IV, specifically pertaining to night VFR operations. Furthermore, the NPA proposes the reinforcement of Part VI through expanded equipment requirements, as outlined below:

- **CAR 605.14 –** Increased equipment requirements for helicopters operating in reduced visibility operations in Day VFR to be equipped with the equipment required for night VFR flight under section 605.16 of the CARs.
- **CAR 605.16 –** Increased equipment requirement for helicopters operating in reduced visibility operations in Night VFR to require (under subsection 4) use of GPS or Electronic Flight Bags (EFB) peripheral for aircraft. For rotorcraft, a minimum of two axis, SAS (Stability Augmentation Systems) or autopilot capable of returning the helicopter to straight and level flight at the push of one button. Addition of new subsection (5) to require use of NVIS in night VFR flight or by Specific Approval in an approved Night VFR program detailed in the company Standard Operating Procedures.

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[6] Transport Canada (2023). NPA 2023-005 - Minimum Visual Meteorological Conditions for VFR flight in Controlled and Uncontrolled Airspace – Parts I, IV, VI, VII of the CARs and Associated Standards. Available on the CARAC website at: https://tc.canada.ca/en/corporate-services/acts-regulations/list-regulations/canadian-aviation-regulations-sor-96-433/canadian-aviation-regulation-advisory-council-carac (last accessed on 14 June 2024).

Due to a reorganization of priorities driving TC's Forward Regulatory Plan[7], the amendment is yet to be scheduled for publication in the *Canada Gazette*, Part I. Once the new regulations come into force, TC intends to assist flight schools, general aviation, and commercial operators in adapting to these changes. It is anticipated that these proposed modifications will yield a discernible enhancement in aviation safety, leading to a significant mitigation of accident risks.

To further enhance our understanding and readiness, TC aims to complete a comprehensive review of the equipment and various technologies available on the market and assess retrofit options suitable for Canadian helicopters by mid 2025. This proactive approach will empower TC to make a well-informed decision on the appropriate course of action for the next TSB update, ensuring a more robust and effective strategy moving forward.

August 2024: TSB assessment of the response (Satisfactory in Part)

In its response, Transport Canada (TC) indicated that it agrees in principle with the recommendation.

The Board is pleased that TC acknowledges the potential safety enhancements associated with the integration of additional instruments into commercial helicopter operations. TC stated that it is committed to conducting a comprehensive evaluation of the safety benefits associated with the integration of additional instruments into commercial helicopter operations, and it plans to complete the evaluation and assess retrofit options suitable for Canadian helicopters by mid-2025. The Board awaits the outcome of this evaluation.

The Board notes that Notice of Proposed Amendment (NPA) 2023-005: *Minimum Visual Meteorological Conditions for VFR flight in Controlled and Uncontrolled Airspace – Parts I, IV, VI, VII of the CARs and Associated Standards* outlines several enhancements to regulatory requirements pertaining to night visual flight rules (VFR) and reduced-visibility operations. It is likely that the changes, as proposed in NPA 2023-005, will increase safety for operators engaged in reduced-visibility and/or night VFR operations. However, the proposed changes only address a subset of the larger commercial helicopter community, namely those helicopter operators authorized to conduct reduced-visibility operations in uncontrolled airspace.

Moreover, as noted in the Board's assessment of TC's response to TSB Recommendation A24-01, the NPA is yet to be scheduled for publication in the *Canada Gazette*, Part I and no timeline was provided. Given the often-precarious nature of inadvertent flight into instrument meteorological conditions (IIMC) accidents, and the typical operating environment of commercial helicopter operators, it is vital that those operations also benefit from the addition of technology that will assist with the avoidance of, and recovery from, IIMC.

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[7] Transport Canada (2024). *Forward Regulatory Plan*. Available at: https://tc.canada.ca/en/corporate-services/acts-regulations/forward-regulatory-plan?pedisable=false&wbdisable=true (last accessed on 14 June 2024).

The proposed actions indicate TC's commitment to thoroughly assess the feasibility of available technologies and to consider implementation of such technologies that will assist pilots with the avoidance of, and recovery from, IIMC. However, at this time, TC's proposed regulatory changes are directed solely at operators engaged in reduced-visibility operations. If these enhancements to the current regulations are not extended to all commercial helicopter operations, TC's proposed actions will reduce, but not substantially reduce or eliminate, the safety deficiency associated with this recommendation. Furthermore, the Board remains concerned by the absence of timelines to publish the proposed regulatory changes in NPA 2023-005. Therefore, the Board considers the response from TC to Recommendation A24-02 to be **Satisfactory in Part**.

Latest response and assessment

September 2025: response from Transport Canada

Transport Canada (TC) agrees in principle with the recommendation and acknowledges the potential safety enhancements associated with the integration of additional instruments into helicopter operations. TC is committed to carefully evaluating options before moving forward, with a focus on ensuring that any future measures truly enhance safety. This includes considering how best to support pilots in understanding and navigating visibility conditions, reinforcing clarity around flight condition terminology, and strengthening awareness of the visual requirements for safe operations. The overarching goal is to improve pilot preparedness and reduce risks associated with challenging weather or visibility conditions.

To begin addressing this issue, TC published a Notice of Proposed Amendment (NPA) 2023-005, *Minimum Visual Meteorological Conditions for VFR Flight in Controlled and Uncontrolled Airspace – Parts I, IV, VI, VII of the CARs and Associated Standards*[8], for consultation through the Canada Aviation Regulation Advisory Council (CARAC) in 2023. The NPA proposed amendments to Sections 602.114 and 602.115, along with other related provisions in Parts I, IV, VI, VII of the CARs and associated Standards to facilitate the introduction of Night Vision Imaging Systems (NVIS) and for the increased requirements for Night VFR rating and currency. These enhancements encompass augmented criteria for instructor and pilot training and qualification within Part IV, specifically pertaining to night VFR operations, and both Part VI and VII have been reinforced with heightened training and currency prerequisites.

TC has reviewed extensive feedback on the NPA, which raised concerns from industry and private operators around training requirements, equipment costs, and compliance timelines. While timelines and next steps are still being considered, Transport Canada is evaluating additional stakeholder consultation to ensure any future amendment both strengthens aviation

[8] Transport Canada (2023). NPA 2023-005 - Minimum Visual Meteorological Conditions for VFR flight in Controlled and Uncontrolled Airspace – Parts I, IV, VI, VII of the CARs and Associated Standards. Available on the CARAC website at: https://tc.canada.ca/en/corporate-services/acts-regulations/list-regulations/canadian-aviation-regulations-sor-96-433/canadian-aviation-regulation-advisory-council-carac (last accessed on 20 April 2026).

safety and aligns Canadian requirements with international best practices in pilot training and operational risk management.

March 2026: TSB assessment of the response (Satisfactory in Part)

In its response, Transport Canada (TC) reaffirmed that it agrees in principle with the recommendation.

TC's response refers to Notice of Proposed Amendment (NPA) 2023-005; however, this NPA focuses primarily on updating definitions for visual meteorological conditions and regulatory changes applicable to night flying and reduced visibility operations in uncontrolled airspace. The enhanced technology requirements in the NPA, if passed into regulation, will help reduce the risk of inadvertent flight into instrument meteorological conditions (IIMC) accidents in night flying and reduced visibility operations; however, the proposed changes only address a subset of the larger commercial helicopter community, namely those helicopter operators authorized to conduct night visual flight rules (VFR) operations and reduced-visibility operations in uncontrolled airspace. The NPA makes no mention of mandating equipment, such as radar altimeters, synthetic vision, or terrain awareness and warning systems (TAWS), which could prove vital in the avoidance of, and recovery from, an IIMC encounter.

The Board notes that TC previously indicated that it planned to complete a comprehensive review of the equipment and various technologies available and to assess retrofit options suitable for Canadian helicopters by mid-2025. The Board awaits the outcome of this review, which was not referred to in TC's latest response.

A robust in-depth defence approach against IIMC accidents requires that pilots have appropriate training, technology, and procedures. TC's proposed actions, with regards to technology, will reduce but not substantially reduce or eliminate the risk associated with the safety deficiency identified in this recommendation. Until TC requires all commercial helicopter operators to implement technology that will assist pilots in the avoidance of, and recovery from, inadvertent flight into IMC, the safety deficiency will persist.

Therefore, the Board considers the response to Recommendation A24-02 to be **Satisfactory in Part**.

File status

The Board will monitor the progress of NPA 2023-005, as well as TC's review of the equipment and various technologies available for all commercial helicopter operations, not just those engaged in reduced-visibility operations in uncontrolled airspace.

This deficiency file is **Active**.