TSB Recommendation A90-84

Helicopter instrumentation

The Transportation Safety Board of Canada recommends that the Department of Transport require all commercially-operated helicopters to be equipped with appropriate instrumentation for the conduct of basic instrument flying.

Air transportation safety investigation report	90-SP002
Date the recommendation was issued	13 November 1990
Date of the latest response	August 2017
Date of the latest assessment	March 2024
Rating of the latest response	Unsatisfactory
File status	Dormant

Summary of the occurrence

Accidents in which the aircraft was operated under Visual Flight Rules (VFR) into adverse weather conditions occur regularly, claiming a disproportionately high number of fatalities each year. They involve professional pilots, private pilots and business pilots who fly general aviation aircraft and chartered commercial aircraft, including fixed-wing aircraft and helicopters.

The regularity with which these accidents have occurred, and the seriousness of the continuing loss of life, prompted the Canadian Aviation Safety Board (CASB) to initiate a comprehensive and systematic examination of the issue. In March 1990, when this report was nearing completion, the CASB was replaced by the Transportation Safety Board of Canada (TSB), under whose auspices this report was published on 13 November 1990.

During the last two decades, a number of foreign government agencies have undertaken measures to more fully understand these types of accidents. Recent studies emphasize both the complex decisional nature of continued VFR flight into adverse weather and the often fatal consequences. This safety study is the first comprehensive review of the topic in Canada in recent years, and builds upon these earlier works.

The Board authorized the release of Recommendation A90-84 as part of its report entitled *Report of a Safety Study on VFR Flight into Adverse Weather* (90-SP002) on 13 November 1990.

Rationale for the recommendation

The frequency with which helicopters crashed in whiteout conditions led the Board to recommend that commercial helicopter pilots regularly demonstrate sufficient proficiency in basic instrument flying skills (see section 4.5). However, it is well known that many commercial helicopters are not equipped with an artificial horizon, an important instrument for aircraft control when flying by sole reference to instruments. To ensure that commercial helicopter pilots operate aircraft adequately instrumented to escape from whiteout conditions, the Board recommended that

> the Department of Transport require all commercially-operated helicopters to be equipped with appropriate instrumentation for the conduct of basic instrument flying.
>
> **TSB Recommendation A90-84**

Previous responses and assessments

March 1991: response from Transport Canada

Transport Canada has reviewed the report and concluded that the implementation of the recommendations regarding visual flight rules [VFR] would result in a major change of the concepts in the conduct of visual flight operations. The regulatory actions required to institute these changes will require extensive consultation with the aviation community as a normal part of the rule making process.

Transport Canada therefore intends to establish a VFR Working Group to address and develop, in conjunction with suitable representation from the aviation community, the changes required to incorporate the TSB recommendations regarding VFR operations into the Air Regulations.

This working group will be considering the TSB recommendations A90-65, 66, 67, 68, 69, 70 and A90-71 relating to VFR Rules as well as recommendations A90-78 and A90-81 on licence privileges and will also include recommendations A90-83 and A90-84 concerning the mandatory equipment for rotary winged aircraft. Transport Canada will provide the responses to these recommendations when the Working Group has concluded its activities.

June 1991: TSB assessment of the response

The Board reviewed the staff assessment of the Minister's response to recommendations A90-65 to A90-90 forwarded to the Minister as a result of a Safety Study on the topic of VFR-into-IMC accidents.

It was unanimously decided that the Board would withhold their decision/comments until the Minister's VFR Working Group has produced its report.

July 1993: response from Transport Canada

A Transport Canada VFR Working Group (convened specifically to review several of the TSB VFR-into-IMC Study Recommendations) stated that implementation of A90-84 would result in extremely high costs with no return in terms of risk reduction, and that far more could be accomplished with continuing education and training in pilot decision making, mountain flying, whiteout, etc.

September 1993: TSB assessment of the response (Unsatisfactory)

Transport Canada has recommended that this recommendation not be adopted. They state that implementation would result in extremely high costs with no return in terms of risk reduction, and that far more can be accomplished by encouraging and providing continuing education and training in pilot decision making (PDM), mountain flying, whiteout, etc. Again, the staff can appreciate the rationale put forth by the operators; however, whiteout conditions do present an ongoing problem for helicopter operations.

Therefore, the response to Recommendation A90-84 is assessed as **Unsatisfactory**.

January 2004: TSB assessment of the response (Unsatisfactory)

In its March 1991 response to TSB, Transport Canada stated that Recommendation A90-84 would be referred to a VFR Working Group for further action. Subsequently, in a July 1993 update, Transport Canada stated that its VFR Working Group had reviewed Recommendation A90-84 and concluded that the recommendation not be adopted. They stated that implementation would result in extremely high costs with no return in terms of risk reduction, and that far more can be accomplished by encouraging and providing continuing education and training in pilot decision making (PDM), mountain flying, whiteout, etc. TSB staff appreciated the rationale put forth by the operators; however, maintained that whiteout conditions do present an ongoing problem for helicopter operations and the basic argument to ensure that commercial helicopter pilots operate aircraft adequately instrumented to escape from whiteout conditions.

There have not been any apparent measures taken since last reassessment. This recommendation is 1 of 15 recommendations still “Active” (out of the original 36) made in the 1980s study of “VFR into Adverse Weather” accidents (ref: Recs A90-65, A90-66, A90-68, A90-69, A90-74, A90-75, A90-77, A90-78, A90-81, A90-83, A90- 84, A90-87, A90-88, & A90-89). Some safety deficiencies associated with original recommendations may not have the same degree of risk and urgency if analyzed by today’s priorities and standards (original study used stats of recreational & commercial flying). It is suggested that these recommendations be treated as a “unit”, their individual assessments remain as stated, identified as FOLLOW-UP status pending statistical research/analysis to determine if the “macro” issue of “VFR into Adverse Weather” continues to be a major safety issue in “today's” Canadian aviation system.

Therefore, the response to Recommendation A90-84 is assessed as **Unsatisfactory**.

March 2005: TSB assessment of the response (Unsatisfactory)

Transport Canada and the helicopter industry have not taken the specific action as recommended by TSB. Yet many of the action/initiatives taken by Transport Canada and the aviation community to prevent VFR-into-IMC accidents in general would apply to helicopter flying. Recent data (1995-2004), however, shows that occurrences with helicopters flying in adverse weather conditions continue to happen (14 out of 74 accidents were helicopters). It could not be determined if the underlying unsafe conditions for these recent accidents would have been rectified by the action specified in A90-84.

Therefore, the assessment remains as **Unsatisfactory**.

Notwithstanding, given that the data used to support A90-84 is now more than 20 years old, the TSB will, through ongoing and/or future investigations, attempt to better define the nature of the unsafe conditions behind the continued helicopter VFR-into-IMC accidents, and if necessary, make "new" recommendations.

As such, **Further Action is Unwarranted** with respect to A90-84 and the status is set to **Inactive**.

April 2014: TSB review of deficiency file status

The Board requested that A90-84 be reviewed to determine if the deficiency file status was appropriate. After an initial evaluation, it was determined that the safety deficiency addressed by Recommendation A90-84 needed to be reassessed.

A request for further information was sent to Transport Canada and a reassessment will be conducted upon receipt of Transport Canada's response.

Therefore, the assessment remains as **Unsatisfactory**.

Consequently, the status of Recommendation A90-84 is changed to **Active.**

Latest response and assessment

August 2017: response from Transport Canada

In 1990, the TSB published the report on a study of accidents involving Visual Flight Rules (VFR) flights that entered Instrument Meteorological Conditions (IMC). The report included three recommendations to reduce the incidence of Controlled Flight Into Terrain (CFIT) by commercially operated helicopters.[1]

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[1] 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.

This recommendation is related to two other TSB recommendations. All attempt to reduce the incidence of CFIT accidents.

> A90-81 The Department of Transport require verification of proficiency in basic instrument flying skills for commercially-employed helicopter pilots during annual pilot proficiency flight checks.
>
> A90-83 The Department of Transport require all helicopters engaged in commercial passenger-carrying operations be equipped with radar altimeters.

The recommendations apply to light helicopters which are certified for VFR flight only. TC referred the recommendations to the VFR Working Group under the Canadian Aviation Regulation Advisory Council (CARAC). The Working Group recommended that TC not adopt the recommendations, concluding that their adoption would impose extremely high cost with no return in terms of risk reduction. The Working Group believed that far more can be accomplished by providing continuing education and training in pilot decision making, mountain flying and whiteout.

There are two schools of thought on how to reduce the risk of helicopter collision with terrain due to loss of visual references. Some believe that learning and occasionally practising basic instrument flying skills will allow a pilot to retain control of the helicopter long enough to return to Visual Meteorological Conditions (VMC). Others believe that the best option is to avoid IMC since the aircraft are too unstable to be reliably controlled by a pilot who possesses only basic Instrument Flight Rules (IFR) skills and is not current.

While TC supports the reduction of CFIT accidents, internal evaluation and consultation with industry concluded that requiring helicopter pilots to acquire minimal instrument flying skills is not a safe or effective option. The positions of both agencies (TC and TSB) have not changed in the past 27 years. The arguments on both sides are summarized well in TSB Report A96W0072 (p. 4).

The risk

Although relatively rare, helicopter CFIT accidents are particularly serious because the fatality rate in these accidents is quite high. Typically they occur at night or in conditions of reduced visibility. Most of the helicopters in Canada are certified for VFR flight only. These rules require the aircraft to be navigated and controlled by visual reference to features outside the cockpit.

Appropriately equipped aircraft can also be navigated and controlled by reference to instruments and displays inside the cockpit. This is called instrument flight and is regulated by IFR.

People use several sensory systems to orient themselves in space. Kinesthetic systems tell us where our limbs are in relation to the body and to each other. Vestibular organs in the ear sense acceleration in three dimensions, telling us which way is up. Vision is a very strong cue to spatial orientation. When external visual cues are absent, due to lack of light or obscured vision,

humans are subject to illusions. These are perceptions that do not match objective reality and in flight can be fatal.

University of Illinois researchers placed pilots without instrument ratings in a flight training device. The experimenters took away all external visual references, a situation like sudden inadvertent entry into IMC. All lost control. The average time from loss of visual reference to Loss of Control (LOC) was 178 seconds[2].

IFR flight requires extensive training and practice. Pilots must learn to trust the instruments, regardless of what they are perceiving at any time. Controlling an aircraft by reference to instruments requires a pilot to:

1. Observe the displays;
2. Interpret each display;
3. Integrate the information to form an understanding of the current situation (altitude, airspeed, bank, and pitch at a minimum); and
4. Project into the future (What must I do to achieve goal?).

Flying solely by reference to instruments is a complex skill, subject to rapid decay unless practiced regularly. If pilots normally fly under VFR, one cannot assume that they can transition to instrument flight in a situation where the window for successful recovery is a matter of a few seconds and the aircraft is already not under control.

Helicopters and IFR flight

More than 80% of commercially operated helicopters in Canada are approved for day or night VFR operations only, and are equipped with the instruments required by regulation for that role. Most of the Canadian registered helicopters are single-engine types and the *Canadian Aviation Regulations* (CARs) do not permit single engine helicopters to fly in IFR conditions or VFR at night with passengers. (CAR 703.22/CASS 723.22 refers.)

Single main rotor helicopter models are inherently unstable, both statically and dynamically, and these aerodynamic qualities demand that a helicopter that is intended for use in instrument conditions must also be equipped with a stabilization augmentation system / autopilot at minimum, to supplement the instruments needed to fly under instrument conditions. Without a stabilization system, a pilot facing a sudden loss of visual references would be forced to immediately transition to instruments without autopilot assistance to maintain pitch, roll and yaw control; a difficult skill that is not practiced regularly in an aircraft intended for VMC flight only and that also cannot be certified for instrument flight lacking this equipment.

Stabilization augmentation systems require airframe and flight control modifications, approvals, installation, maintenance, flight procedure changes and pilot training. Additional

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[2] TC. Take Five ... For Safety. (TP 2228). https://tc.canada.ca/en/aviation/publications/take-fivefor-safety-tp-2228

cockpit instruments for stabilization system monitoring and control and aircraft performance and navigation are also required to permit the pilot to fly in instrument conditions. Stabilization systems and additional IFR cockpit instruments add weight, costs and operational complication, reduce useable payload and are not required for VMC-only flight. VFR operators currently do not install these integrated systems for these reasons.

Because the performance instrumentation is based on aeroplane pitot static systems, the helicopter must be flying forward at a minimum speed to permit control and ensure accurate information is displayed. This minimum instrument flight speed is designated "Vmini" and is typically 60-70 knots or more Indicated Air Speed (lAS). Most helicopter inadvertent IMC accidents occur at low airspeeds, well below Vmini. Accordingly, a pilot who has lost visual references would first have to accelerate to Vmini with limited or even contradictory input from the autopilot due to the effects of rotor downwash on the pitot system and resulting erroneous air data computer inputs.

The most common scenarios for helicopter inadvertent IMC accidents are:

- on takeoff or approach, where recirculating air blown by the main rotor causes a loss of references in loose snow (sometimes called the snowball);
- whiteout, which happens during flight over areas where the horizon is no longer discernible; and
- penetration of a weather system where the visibility and ceiling is seen to be getting worse, but the pilot continues into it at ever-decreasing altitude and airspeed.

Whiteout on approach or departure occurs very close to the ground, at speed well below Vmini, and generally provides little or no time for recovery. These accidents typically result in a rollover. The instrumentation is affected by rotor downwash at lower speeds, and the autopilot cannot respond correctly to the corrupted inputs from turbulent airflow. As well, sideways or backward flight cannot be detected on the instruments.

Whiteout that occurs in cruise flight is subtle, and although the aircraft may be at a speed above Vmini, the pilot is generally not aware of a gradual descent into the ground until contact is made, at which time it is too late for any recovery manoeuvre.

Loss of visual references caused by continuing into an area where visibility and ceiling are obviously decreasing is also subtle. Pilots quickly get used to flying lower and more slowly during the flight. As they progress, there is a strong tendency to continue and attend to cues that support continuation while ignoring or discounting cues that indicate a change in plan is warranted. They may then enter an area where all visual references are suddenly lost, typically at very low speed and altitude. At that point, it is very difficult to transition to unpracticed, non-recent instrument flight. All of these emergency situations will be worsened by inevitable stress and, possibly, panic.

Unless able to regain VMC quickly, the pilot will need to transition to instrument flight, climb to a safe altitude and eventually conduct an instrument approach at a known facility within reach

of the helicopter's fuel range. In many areas of Canada, this option does not exist, and it is unlikely that the necessary approach plates and route charts would be carried onboard. Some advocate a 180° turn to return to VMC, but there is no assurance that VMC still exists and the turn is a very challenging manoeuvre. At low speed, with non-functional instruments and lacking a stability augmentation system, a 180° turn without visual references would most likely lead to a LOC.

The accident record

The preceding discussion of single engine helicopters and IFR flight represents TC's long-held position on the issue. TC has always believed that the most effective way to prevent collision with terrain accidents is to avoid flight into IMC. To test this position and support a comprehensive evaluation of Recommendation A90-84, the Aviation Safety Analysis and Commercial Flight Standards Divisions undertook a comprehensive review of helicopter accidents involving collision with the surface. The purpose of this review was to determine whether installing instruments and requiring periodic verification of basic instrument flying skills would have prevented accidents. A search of the Aviation Safety Information System (ASIS) identified 465 helicopter accidents characterized as collision with terrain between 1988 and 2016 inclusive. The analysts were able to locate and review 55 investigation reports (Class 3, 2, or equivalent).

Results

Accidents were grouped according to salient features. The following grouping were identified:

- Engine failure 57;
- Unknown 8;
- Visibility related collision with terrain 68; and
- Collision with terrain not related to visibility 332.

Collisions with terrain following an engine failure were assessed as unrelated to visual references and were eliminated from further consideration.

There were five accidents where there was insufficient information to determine what likely led to the accident. These were eliminated from further consideration.

The bulk of the occurrences had enough information to support reasonable conclusions about the accident and whether instrumentation and IFR training were likely to have changed the outcome. These were all analyzed. Of these, 332 were found to be unrelated to visibility and 68 occurred in reduced visibility or challenging light conditions. Many of the non-visibility related collisions with terrain included rotor strikes in confined areas or descending under power in VMC.

"Other" occurrences were unique, but unrelated to visibility. For example, one collision with terrain happened because a jacket became entangled with the tail rotor pedals. In another case

control was lost when a passenger put weight on a skid during a toe-in landing. Visual references were poor, but the LOC was not due to visibility.

Each of the 68 visibility-related collisions with terrain occurrences was then assessed by a human factors specialist and an experienced helicopter pilot to determine whether the presence of instruments and basic skills could have prevented the accident. Final investigation reports were available for 16 of these accidents. The remainder were assessed on the basis of the narrative summary included in the ASIS long report.

Eight accidents occurred when the visibility was below the regulated minimum for VFR flight. Since the object of this analysis is to determine how many accidents are likely to be prevented by requiring more instrumentation and requiring annual demonstration of instrument skills, accidents resulting from wilful violations of minimum visibility regulations were eliminated from further analysis. These cases are identified in Table 1.

Table 1. Wilful violations of minimum visibility regulations

Occurrence Number	Summary
A94H0001	Wilful violation. Flew into IMC in heavy snow.
A94Q0182	Wilful violation. Medical evacuation. Flew at night. Encountered cumulonimbuses. Loss of control
A99P0105	Visibility at the site was about 75'. Aircraft was operated in IMC. Wilful violation.
A00O0082	Departed at 0311 EDT. Dark night. Overcast and below VFR minimum visibility. Airspeed below Vmini at impact.
A01Q0118	Pilot flew a short distance and hit trees 30' above ground. Witnesses report thick fog at the time. Likely wilful violation.
A04C0051	Cross-country flight Regina to Swift Current. Encountered IMC Continued. Controlled flight into terrain 3.8 miles short of destination. Wilful violation
A07O0238	Continued flight in darkness and IMC. Violation
A15C0130	Conducted flight into deteriorating weather conditions and darkness. Wilful violation.

Twenty-two accidents were due to rotor-induced whiteout while manoeuvring over snow at low altitude and low airspeed, most happened during approach and landing. At such low speeds, the pitot-static instruments would not function accurately and would, therefore, not provide the pilot with useful information to control the aircraft. Even if some useful information was made available, it is unlikely that the pilot would be able to transition from visual references to instruments in time to prevent the accident. To illustrate the difficulty of these conditions, the aircraft in occurrence A13C0182 was fully instrumented, and the flight crew held current instrument ratings.

Table 2. Loss of visual references in rotor-induced whiteout (snowball)

Occurrence Number	Summary
A93P0003	B 212. Heli-skiing. Reduced visibility. Maintained heading & reduced speed. Landed and rolled
A94P0029	Vertical takeoff to hover. Moved over a gully & aircraft descended. Then visibility reduced to 0. Struck trees.
A91W0046	Landing on frozen lake. Aircraft rolled over.
A96Q0203	Landing in confined area. Downwash blew snow up reducing visibility. Tail rotor strike
A97P0207	Landing on snow. Lost visual references, struck trees.
A98P0054	Landing. At 10' lost visual references in rotor-induced whiteout.
A99P0030	Heli-skiing. Lost visual references in rotor-induced whiteout.
A01W0102	Slinging. Picking up load from frozen lake. Lost all visual references. Loss of control
A03C0109	Cross-country flight. Snow squall. Elected to land on gravel clearing. On approach, rotor induced whiteout. Dynamic roll-over.
A03Q0189	Landing. Whiteout. Aircraft drifted. Main rotor strike.
A04P0395	Lost visual references in snow & blowing snow. Attempted to land. Hard landing. Substantial damage.
A05Q0008	Landing. Whiteout conditions. Conducted vertical descent. A skid dug in. Aircraft rolled. Main rotor strike.
A05P0044	Heli-skiing. In approach to pick up skiers, lost visusal references, but still seeing skiers, continued toward them. Tail rotor strike.
A09P0060	Avalanche control. Wind gust & downwash created whiteout and blew aircraft into the slope.
A10P0004	Heli-skiing. On approach, whiteout.
A10P0073	Heli-skiing. Whiteout on landing.
A13C0182	Whiteout in landing on snow. IFR aircraft and crew.
A14W0105	On short final visual contact lost. Aircraft hovered, drifted and main rotor struck a tree.
A15P0049	Downhill & downwind takeoff. Aircraft started to settle, encountered whiteout (snowball). Main rotor struck tree.
A16P0223	Heli-skiing. Landed at unprepared site. Rotor-induced whiteout. Skid dug in. Aircraft rolled.
A11C0038	Operating at 150' following survey line. Encountered whiteout & lost visual reference to Frozen lake.
A16Q0166	Flying slow (5 mph.) and low (1'). Raised snow. Lost visual references. Main rotor strike on a tree.

Some light conditions, while not obscuring vision, like fog or blowing snow, make flying by visual references very challenging. Haze or uniformly coloured terrain against a white

atmospheric background can make it very difficult to maintain a constant height. A smooth water surface, termed glassy water, can make it impossible to perceive height above the water. Such challenging conditions can be insidious. Visibility may be excellent so pilots may have no cues to alert them that conditions are conducive to collision with terrain or LOC. At night pilots are subject [to] "Black hole illusion", which leads them to believe their aircraft is higher than it is.

The following 25 accidents occurred in such challenging light conditions. The difficulty of flying in such conditions is illustrated by the fact two fully instrumented helicopters with instrument rated crews flew their machines into the ground (A08O0029, A13H0001). Basic instrument skills and augmented instruments would not likely have prevented these accidents.

Table 3. Challenging light conditions

Occurrence Number	Summary
A03O0344	Aerial survey. Turning. Glanced at radio altimeter. Watched GPS in the turn. Manoeuvring struck frozen lake surface.
A88A0223	Helicopter took off after dark for a cross-country flight. Collided with high terrain.
A91A0062	Visibility deteriorated. Tried to turn around. Lost visual references. Struck ice.
A93A0060	B 206. Over ice at low level to observe seals. Whiteout. Struck surface.
A93W0019	Whiteout. Slowed to 40-45 mph. Skid dug in. Aircraft rolled.
A94C0015	Crossing frozen lake. Checked instruments. Lost visual reference and struck surface and rolled.
A95C0046	Overcast 300'. Visibility OK, > 8 mi. Encountered fog. Whiteout. Aircraft struck the ice surface
A96W0072	CFIT. Probable whiteout.
A96C0087	Aircraft struck ice at approx normal cruising speed and straight and level attitude
A97P0298	Visibility 2 mi in rain & fog. Glassy water. CFIT into water.
A98C0089	Takeoff. Transitioned from hover to forward flight. Aircraft descended and struck terrain. Overcast. Moderate snow
A01P0173	Glassy water. After takeoff, low rotor RPM warning. Aircraft struck water.
A04C0190	IFR flight. Despite being IFR, aircraft struck terrain shortly after takeoff in whiteout conditions.
A05P0262	Glassy water landing. Aircraft touched before pilot expected. Floats dug in. Aircraft rolled.
A02P0256	Terrace to Sandspit Island. Low clouds. Glassy water. CFIT
A07C0094	Cross-country flight. Ceiling and visibility OK at takeoff. Encountered whiteout. Struck ground at very low airspeed. No injuries
A08O0029	IFR rated crew. Instrumented aircraft. Landed short on dark night approach to heli-pad.
A08W0162	Departed over water. Vision possibly obscured by glare. Possible somatogravic illusion.

A08P0288	Flying over glacier. Flat light. Struck surface.
A09Q0111	Continued flight in adverse weather conditions and unfamiliar topography. Pilot considered self expert in low visibility flying.
A10Q0133	Undetermined. Aircraft struck surface of the sea in low ceilings. Likely VMC, but reduced visual references possible.
A13H0001	Ornge. Fully instrumented aircraft and IFR rated pilots. CFIT.
A10O0145	Continued flight in area of low ceiling and visibility. Did not obtain all the weather conditions for the route. Struck tower at very low height.
A13C0073	Likely IMC in smoke & rain. Lost orientation & struck lake surface. High speed impact indicates pilot believed he had VMC.
A13W0073	Deteriorating weather conditions. Diverted. Struck trees while manoeuvring at low airspeed.

The final group is a set of 12 accidents involving VFR flight into IMC. In each case, it is most likely that the aircraft was flying at a low airspeed, as evidenced in A01W0241, A06W0066, A10Q0148, and A12P0079. In these cases, the aircraft was operating below Vmini and the pitot static instruments were inaccurate. The transition from VFR to IFR control, even for a current instrument pilot, takes time, and it is unlikely that the transition could be made in time to maintain control of an inherently unstable aircraft.

Table 4. VFR into IMC

Occurrence Number	Summary
A97P0009	Loss of control. Probable low visibility in mountains. Airspeed estimated below Vmini at impact.
A97P0207	Loss of control in IMC. Low time pilot. Looking for landing pad, probably below Vmini.
A99A0127	Visibility ¾ to 1 mi. XC flight following a road at 500'. Entered fog. Lost visual references. Loss of control
A00C0099	XC flight. After takeoff at 400’ turned. Realized inadequate visual references. Began turn to regain visual references. Loss of control.
A01W0241	VFR flight. Ran into deteriorating weather conditions. Struck trees at 20'. No injuries.
A05A0155	Encountered heavy snow shower and became disoriented, reduced airspeed to 60 knots. 30 knot winds.
A06W0066	Ferry flight. Encountered deteriorating weather conditions. Precautionary landing. Main rotor strike.
A10Q0132	Continued flight in marginal VFR, probably IMC. Struck rising ground at low airspeed -26 knots.
A10Q0148	Precautionary landing due rain & thunderstorms. On final lost visual references due to rain on windscreen.

A11P0025	Heli-skiing. Encountered marginal VMC. Tried to descend through break in cloud. Aircraft struck snow. Pilot uninjured. Below Vmini.
A11W0152	Continued flight in IMC. Went above cloud and had to descend through cloud. Did not request assistance from ATS.
A12P0079	Likely encountered IMC. Lost spatial orientation. Ground speed 45 knots.

Conclusion

This review of 465 accidents did not find a single accident that would likely have been prevented by having a complete set of instruments installed and acquisition of basic instrument flying skills by VFR pilots. The challenge is illustrated by the fact that the accident record includes fully instrumented helicopters with instrument rated crews who were unable to maintain control in challenging conditions. TC believes that adoption of this and its associated recommendations would not enhance light helicopter safety.

Since implementation of Recommendations A90-84, A90-81 and A90-83 are unlikely to enhance helicopter safety, TC does not agree with them and will provide no further updates on them.

March 2024: TSB assessment of the response (Unsatisfactory)

Transport Canada (TC)'s response addresses the following three recommendations made in TSB's Aviation Safety Study 90-SP002:

> The Department of Transport require verification of proficiency in basic instrument flying skills for commercially-employed helicopter pilots during annual pilot proficiency flight checks.
>
> **TSB Recommendation A90-81**
>
> The Department of Transport require all helicopters engaged in commercial passenger carrying operations be equipped with radar altimeters.
>
> **TSB Recommendation A90-83**
>
> The Department of Transport require all commercially-operated helicopters to be equipped with appropriate instrumentation for the conduct of basic instrument flying.
>
> **TSB Recommendation A90-84**

In its last formal response in 2017, TC stated that it did not agree with these recommendations and reiterated that the most effective means of mitigating the underlying safety deficiencies was to avoid flying helicopters into adverse weather conditions when operating under visual flight rules. TC's response was mainly grounded on the conclusions of its analysis of 465 helicopter accidents that occurred between 1988 and 2016, which TC believed would not have been prevented by recommendations A90-81, A90-83, and A90-84.

The TSB disagrees with TC's assessment. There continues to be occurrences involving commercial helicopters flying into inadvertent instrument meteorological conditions. The TSB

has identified loss of spatial awareness in 13 investigations involving commercial helicopter flights conducted between 2010 and 2018.

One such occurrence is the Airbus Helicopters AS 350 B2 accident in Griffith Island, Nunavut, on 25 April 2021 (A21C0038), which led to the issuance of four recommendations, three of which are directed towards commercial helicopter operations. These are as follows:

> The Department of Transport require commercial helicopter operators to ensure pilots possess the skills necessary to recover from inadvertent flight into instrument meteorological conditions.
>
> **TSB Recommendation A24-01**
>
> 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.
>
> **TSB Recommendation A24-02**
>
> The Department of Transport enhance the requirements for helicopter operators that conduct reduced-visibility operations in uncontrolled airspace to ensure that pilots have an acceptable level of protection against inadvertent flight into instrument meteorological conditions accidents.
>
> **TSB Recommendation A24-04**

Despite recommendations A90-81, A90-83, and A90-84 being issued over three decades ago, TC has yet to implement adequate measures to address the safety deficiencies outlined therein. The recent occurrences involving commercial helicopters flying into instrument meteorological conditions underscore the ongoing relevance and urgency of these recommendations.

Therefore, the responses to recommendations A90-81, A90-83, and A90-84 are assessed as **Unsatisfactory**.

File status

TC has indicated that no further action will be taken to address these recommendations, yet the safety deficiencies have not been sufficiently mitigated, and the safety risks associated with commercial helicopter operations persist. These safety issues are articulated in more recent recommendations (A24-01, A24-02, and A24-04), which supersede recommendations A90-81, A90-83, and A90-84. The TSB urges TC to swiftly implement safety measures in response to these new recommendations and will be closely monitoring its actions and progress to mitigate the safety deficiencies identified in the new recommendations.

The Board will reconsider the status of this deficiency file once TC has provided its initial response to these three most recent recommendations.

This deficiency file is **Dormant**.