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

REASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION A96-12

Pilot decision making

Background

The aircraft was en route from Triumph Bay (40 nm south of Kitimat), British Columbia, to the Campbell River Airport. Approaching Campbell River, the pilot requested and received a special visual flight rules (SVFR) clearance to enter the Campbell River control zone. While on an intercept heading for the final approach and in straight-and-level flight, the aircraft crashed into the side of a mountain. The pilot and seven of the passengers received fatal injuries; the other two passengers received serious injuries.

The Board determined that the pilot progressively lost situational awareness while attempting to navigate in conditions of low visibility or in cloud and was unaware of the rapidly rising terrain in his flight path. Contributing to this accident were the existing visual flight regulations and the prevailing industry attitudes and practices which did not provide adequate safety margins. Contributing to the severity of the injuries was the detachment of the passenger seats at impact.

The Board concluded its investigation and released Aviation Investigation Report A95H0012 on 15 August 1996.

TSB Recommendation A96-12 (August 1996)

In accordance with standard investigation practice, accident pilots' decision-making processes are analyzed. The temptation to judge the quality of a pilot's decisions by the outcome, however, must be guarded against. Fairness to the individual and the advancement of transportation safety require that the actions of the pilot be understood within the context in which pilots typically are operating.

Cockpit decisions can be conceived of as having two components: situation assessment and selection of a course of action. Thus, the difficulty involved in decision making depends primarily on the degree of clarity of the cues signifying the problem and the nature of the response options available in the situation.

Cues, or information about the situation, can vary between clear and ambiguous. In situations such as emergency procedures, the cues are so strong that decision options are prescribed and the response is automatic. Sometimes, once a situation is defined or interpreted, the pilot must choose among options, or schedule tasks in the most appropriate order for the conditions. This represents a higher level of complexity. The most demanding decision making involves those situations where there are no pre-determined options. In these cases, pilots must develop their plans by using both their knowledge of the system and their assessment of the situation. The

more complex and difficult a decision is, regardless of whether the difficulties are in the situation assessment component or in the response selection component, the greater the likelihood of a decision that is less than ideal. Consequently, decision tasks in the cockpit differ in the degree to which they are well-structured and thus have an agreed-upon "best" solution.

The accident pilot was familiar with the area and the aircraft. Low ceilings and poor visibility are common occurrences in the area and he had flown many hours in similar meteorological conditions. As he approached Campbell River, the ceiling at the airport was low (about 300 feet), but over the water, the clouds were about 1,000 feet above the surface.

The decision making in this occurrence required that the pilot assess the situation and choose between continuing to the airport or landing on the water at Tyee Spit, which would undoubtedly have entailed some inconvenience for the passengers. He may also have considered climbing and requesting an IFR approach, for which he was qualified and equipped.

As the pilot approached the control zone, the weather in his immediate area was above ceiling and visibility minima. The Campbell River airport reported a ceiling of 300 feet and two miles visibility, but the ceiling had been varying between 300 and 500 feet through the day and an aircraft ahead reported sighting the Campbell River runway from 900 feet asl. The pilot had an SVFR clearance which only required a flight visibility of one mile and the aircraft to remain clear of cloud. The fact that the aircraft was instrument equipped, and that the pilot was qualified for instrument flight and experienced in conducting instrument approaches into Campbell River would likely have further contributed to his confidence in continuing to the airport. The course of action selected by this pilot, based upon the existing regulations and his experience, would have been taken by many pilots with similar experience.

Once the decision to try to land at the airport was made and the aircraft turned inland, the clarity of the visual cues deteriorated. At about 2 1/2 miles from the airport, the pilot apparently changed his plan and attempted to set up an approach from the same direction as the aircraft which had reported sighting the runway from 900 feet. It is doubtful that the pilot would modify his plan as he exited from the control zone; in principle, though, his visibility criteria increased from one mile for SVFR to two miles for VFR in designated mountainous terrain as he crossed an imaginary line at the boundary of the control zone. It is likely that his attention was focused on controlling the aircraft and his workload was heavy at this point, so that both the transition to uncontrolled airspace and the significance of it were probably not recognized at a conscious level. It appears as though he did maintain visual reference with the ground during this time.

In the light of the outcome, changing his plan and returning to Tyee Spit would have been more prudent; but the cues available to the pilot were apparently not compelling enough to change his mental model, or assessment of the situation. Once individuals select a particular course of action, it takes very compelling cues to alert them to the advisability of changing their plan. Indeed, there is a tendency to use these cues to confirm the validity of the intended plan of action. This pilot had control of the aircraft, was maintaining visual contact with the ground, and was able to navigate, probably with the aid of instruments. These cues would be sufficient to lead many professional, safety-conscious pilots to continue the approach to the airport.

A recent analysis by the National Transportation Safety Board (NTSB) in the US involving 37 accidents showed that, when faced with Go/No-Go decisions, 66% of the crews continued with their current plan in the face of cues which suggested they should have abandoned it.

"However, in many of these cases the cues were ambiguous and it was difficult to assess with great confidence the level of risk inherent in the situation."

Inexperience, lack of knowledge, imprecise guidelines, and ambiguous cues will continue to make some pilot decision-making circumstances difficult. However, strategies to maximize the quality of decisions can be learned, and include such things as situation assessment, risk assessment, planning, resource management, communicating, and the identification of special skill requirements.

Of note, increasing the SVFR minima could change the nature of decisions to be made in occurrences like the Campbell River accident. If there had been a greater minimum visibility requirement, or rules requiring a combination of ceiling and visibility, the pilot would have been faced with an easier decision. Had the previous SVFR rules been in force, the only option would have been to land at Tyee Spit. Thus, the need to re-assess the adequacy of current VFR weather minima (recommended above) should be considered in the light of normal pilot decision-making processes.

The accident pilot was operating in an environment which accepted as "normal operations" flights into marginal weather conditions, when other options, such as landing at Tyee Spit, were available. Typically, pilots involved in VFR CFIT accidents have not had any special training in decision making. At the same time, pilots flying in small air carrier operations are arguably the most exposed to such ambiguous situations with the least decision-making support. They often operate as single-person crew into a variety of unfamiliar locations with minimal infrastructure and are self-dispatched, and the aircraft do not usually possess sophisticated instrumentation or control systems.

The Board has previously recommended that Transport Canada develop and implement a means of regularly evaluating the practical decision-making skills of commercially employed pilots in small air carrier operations (TSB A90-86). TC's response in part stated:

It has been Transport Canada's position that the benefits of this training were intrinsic in the enhanced performance of the pilot and that a properly planned and executed Pilot Proficiency Check would provide a practical and realistic assessment of a pilot's ability to make reasoned and timely decisions when faced with a simulated emergency situation. We will continue to keep abreast of developments in the field of decision-making training and assessment and will not hesitate to introduce improvements in our present system should they become available.

National and regional carriers have broadly embraced the concepts of Cockpit Resource Management (CRM) and Pilot Decision Making (PDM) training, and under the new Canadian Aviation Regulations, airline operators will be required to complete initial and recurrent CRM training. However, for other commercial operators, formal programs are being introduced on a voluntary basis. The Board believes that, given the natural human limitations in interpreting distances in marginal visibility conditions, natural human tendencies in complex decision making in the presence of changing and ambiguous cues, and the CFIT accident record involving small commercial operators, further counter-measures are required to facilitate safe crew decision making. Therefore, once again, the Board recommends that

> The Department of Transport require that pilots involved in air-taxi and commuter operations receive specialized training, including skills development, in making prudent decisions under deteriorating operational conditions.
>
> **TSB Recommendation A96-12**

Transport Canada's response to Recommendation A96-12 (December 1996)

Transport Canada, in consultation with the aviation community through the Canadian Aviation Regulation Advisory Council (CARAC) process, will task the Commercial Air Services Technical Committee to study and develop whatever additional specialized training requirements may be required so that pilots involved in air taxi and commuter operations are fully capable of making prudent decisions under deteriorating conditions.

TSB assessment of Transport Canada's response to Recommendation A96-12 (January 1997)

Transport Canada will task the Canadian Aviation Regulation Advisory Council (CARAC) to study and develop whatever additional specialized training may be required so that pilots involved in air taxi and commuter operations are fully capable of making prudent decisions under deteriorating operational conditions.

Given that TC's action could result in enhanced decision making by the pilots involved in air taxi and commuter operations, the response is considered to be "**Satisfactory Intent**".

The deficiency file is assigned an **Active** status.

Transport Canada's response to Recommendation A96-12 (April 1999)

Commercial Air Service Standard (CASS) 722, 723 and 724 were modified to include requirements for updated PDM. Air Taxi ops were under review with formation of SATOPS Task Force. Task Force conducted meetings in all regions, inviting participation from air operators, pilots, aircraft maintenance engineers, air traffic service personnel and TC Regional and HQ reps. Focus of the Task Force was what air operators are doing to prevent accidents within their companies, what they are doing to promote safety within their companies and to identify what can contribute to unsafe operating practices, both within and external to the company. SATOPS report is complete and includes 71 recommendations. SATOPS Implementation Plan was issued March 5, 1999. Training was addressed through SATOPS. The requirement of having completed a PDM program to operate in reduced visibility was included. As a result of SATOPS, TC is investigating ways to improve on the PDM requirement of the applicable CASS. The draft implementation plan includes proposed actions in this regard, however, at this time it is more inclusive than only a PDM program for pilots to operate in reduced visibility. The end result will be to improve the safety culture in those operations.

TSB assessment of Transport Canada's response to Recommendation A96-12 (April 1999)

TC is preparing a notice of proposed amendment (NPA) that will require PDM training annually for companies (CARs 702, 703 and 704 helicopters) that hold an operations specification for operations in reduced visibility.

Therefore, the response to Recommendation A96-12 remains as **Satisfactory Intent**.

TSB review of Recommendation A96-12 deficiency file status (April 2014)

The Board requested that Recommendation A96-12 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 A96-12 still 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 **Satisfactory Intent**.

Consequently, the status of Recommendation A96-12 is changed to **Active.**

Transport Canada's response to Recommendation A96-12 (October 2017)

TC agrees with the recommendation.

The new standards for the Crew Resource Management (CRM) applicable to aerial work, air taxi, commuter and airline operations have been published on the CARAC Activity Reporting website on July 28, 2017 and can be found at the following locations: http://wwwapps.tc.gc.ca/Saf-Sec-Sur/2/NPA-APM/actr.aspx?id=15&aType=1&lang=eng and http://wwwapps.tc.gc.ca/Saf-Sec-Sur/2/NPA-APM/actr.aspx?id=15&aType=1&lang=fra (last link on the page entitled 'Standard – Crew Resource Management').

Industry stakeholders were briefed prior the publication and the new standards will come into effect on 31 January 2019.

The amendments will be incorporated into the actual standards on the CARs website as part of the December 2018 CARs amendment (30 days before the amendments become effective).

The amendments to the standard and guidance material are designed to require all commercial operators to provide contemporary CRM training. Contemporary CRM integrates technical skill development with communications and crew coordination training and operational risk management by applying Threat and Error Management (TEM) concepts. The new standard is summarized in Table 1.

Table 1: New CRM Training Standard

Initial	
1.	Threat and Error Management
2.	Communications
3.	Situational Awareness
4.	Pressure and Stress
5.	Fatigue
6.	Workload Management
7.	Decision Making
8.	Leadership and Team Building
9.	Automation and Technology Management
10.	Relevant Case Study

Annual training in safety and emergency procedures shall comprise of a joint participation of flight crew, flight attendant, dispatchers/flight followers, ground crew and maintenance personnel, as applicable, and shall cover the following items:	
1.	Threat and Error Management
2.	In-depth Review of a Minimum of three Additional Core Elements as found in Items 2 - 9 above
3.	Relevant Case Study
4.	Review and Discussion of Current Safety Trends within the Operator's Specific Operations and Industry
5.	Crew Member Evacuation Drills including Debriefing

In the meantime, there will be a new link added to the CARs Index page for 'Approved Standards Not Yet in Effect' when the next CARs amendment is released. The new link will take you to a page providing the text of the amended/new provisions that are not yet in effect. The CARs Index page is at the following link: http://www.tc.gc.ca/eng/acts-regulations/regulations-sor96-433.htm.

TC plans no further action on this recommendation.

TSB reassessment of Transport Canada's response to Recommendation A96-12 (March 2018)

TC's response indicates that the new crew resource management (CRM) standards will come into effect on 31 January 2019, under subparts 722, 723, 724 and 725 of the *Commercial Air Service Standards* (CASS), and apply to aerial work, air taxi, commuter and airline operators. Under these new standards, air operators are required to provide contemporary CRM training to flight crews, flight attendants, dispatchers/flight followers, ground crew and maintenance personnel, on an initial and annual basis.

These new standards will integrate contemporary CRM by applying threat and error management concepts for commercial air operators. In order to validate CRM skills, the new standards also require an assessment for non-technical skills, such as cooperation, leadership and managerial skills, situational awareness, and decision making. The training will provide knowledge and skills, which can assist flight crews in recognizing risks, such as those associated with making prudent decision under deteriorating operational conditions.

The new CRM standards have been published on the Canadian Aviation Regulation Advisory Council (CARAC) Activity Reporting website. Additionally, TC published Advisory Circular 700-042, which provides guidance to the industry for compliance with the new standards, as well as an article in its Aviation Safety Letter, Issue 4/2017, regarding the need for commercial air operators to prepare for the new CRM standards.

The Board considers that the actions taken by TC will substantially reduce the risk associated with the safety deficiency identified in Recommendation A96-12, once the new CRM standards come into effect.

Therefore, the response to Recommendation A96-12 is assessed as **Fully Satisfactory.**

Next TSB action

The deficiency file is **Closed.**