



## TSB Recommendation A11-05

### Emergency egress for seaplanes

The Transportation Safety Board of Canada recommends that the Department of Transport require that all new and existing commercial seaplanes be fitted with regular and emergency exits that allow rapid egress following a survivable collision with water.

Air transportation safety investigation report	<a href="#">A09P0397</a>
Date the recommendation was issued	17 March 2011
Date of the latest response	January 2023
Date of the latest assessment	March 2023
<a href="#">Rating</a> of the latest response	Satisfactory in Part
<a href="#">File status</a>	Active

### Summary of the occurrence

On 29 November 2009, the Seair Seaplanes Ltd. de Havilland DHC-2 MK 1 (serial number 1171, registration C-GTMC) was departing Lyall Harbour, Saturna Island, for the water aerodrome at the Vancouver International Airport, British Columbia. After an unsuccessful attempt at taking off downwind, the pilot took off into the wind towards Lyall Harbour. At approximately 1603 Pacific Standard Time, the aircraft became airborne, but remained below the surrounding terrain. The aircraft turned left, then descended and collided with the water. Persons nearby responded immediately; however, by the time they arrived at the aircraft, the cabin was below the surface of the water. There were 8 persons on board; the pilot and an adult passenger survived and suffered serious injuries.

The Board concluded its investigation and released report A09P0397 on 17 March 2011.

### Rationale for the recommendation

Seaplane travel is common in Canada, particularly in provinces such as British Columbia where the only rapid means of travel is often by seaplane or helicopter. In the Vancouver Harbour alone, there are about 33 000 floatplane movements per year, carrying approximately 300 000 passengers.

The TSB has found that the risk of drowning for occupants of seaplane accidents is high. The TSB and British Columbia's Coroners Service data show that, over the last 20 years, about 70% of the fatalities in aircraft that crashed and submerged in water were from drowning. Half of the deceased were found in the submerged wreckage. While it could not be determined in all cases, some investigations found that the occupants were conscious and able to move around the cabin before they drowned. These past occurrences validate the probability that able bodied persons can be trapped in sinking aircraft and drown as a result.

This investigation concluded that some passengers survived the impact, but drowned because 2 of its 4 normal exits jammed shut. Had all normal exits been usable or had there been other emergency exits, such as jettisonable windows, there would have been a greater probability of escape from the aircraft and a greater chance of surviving the accident. Optional jettisonable windows for the DHC-2 model have been developed, but this only addresses 1 of the many aircraft types operated from water. Furthermore, there is no regulatory requirement for the installation of such emergency exits.

Therefore, the Board recommended that

the Department of Transport require that all new and existing commercial seaplanes be fitted with regular and emergency exits that allow rapid egress following a survivable collision with water.

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## Previous responses and assessments

### June 2011: response from Transport Canada

Transport Canada (TC) has over the years taken steps to address floatplane safety through safety promotion and awareness campaigns, as well as regulatory actions. TC will run an updated floatplane safety campaign during the summer of 2011.

TC issued Civil Aviation Safety Alert (CASA) on June 06, 2011, with its focus on commercial and private float plane operators and pilots, recommending the following best practices in relation to floatplane safety:

- Upper body restraints to be used by front seat occupants;
- Briefing passengers on the proper usage of floatation devices during emergency egress;
- Underwater emergency egress training for flight crew; and
- Aircraft safety design improvements facilitating egress.

In August 2011, TC will hold a focus group with selected members of industry to determine the most effective means of addressing the recommendations related to rapid egress and the mandatory use of personal floatation devices. The conclusion of the focus group will be presented to the Canadian Aviation Regulation Advisory Council (CARAC) by the spring of 2012 as the basis for amendments to the rules and any proposed rule changes will be consulted

expeditiously. TC will also expedite the implementation of proposed regulatory amendments which have already been consulted, which will provide for increased flexibility in the possible types of Personal Flotation Devices.

#### **July 2011: TSB assessment of the response (Satisfactory Intent)**

In its response, TC indicated that it will hold a focus group, in part, to determine the most effective means of addressing the recommendation related to rapid egress from seaplanes following a survivable collision with water. The conclusions of the focus group will be presented to CARAC by the spring of 2012 as the basis for amendments to the rules and any proposed rule changes will be consulted expeditiously. In the meantime, TC is continuing its safety promotion and awareness campaigns and encourages operators and flight crews to voluntarily adopt best industry practices in relation to floatplane safety.

The conclusions of the focus group and the following CARAC process may result in changes to the rules related to commercial seaplanes exits requirements. This could substantially reduce or eliminate the safety deficiency. However, for the present, the action has not been sufficiently advanced to reduce the risks to transportation safety.

Therefore, the response is assessed as **Satisfactory Intent**.

#### **September 2011: response from Transport Canada**

##### **September 2011 update**

Transport Canada initiated a focus group during the summer of 2011 with industry stakeholders to review recommendations A11-05 and A11-06 related to the installation of regular and emergency exits that would allow rapid egress following a survivable collision with water and to review the proposal for occupants of commercial seaplanes to wear a device that provides personal flotation following emergency egress.

These proposals were subsequently examined in depth and agreed-to by TC senior management at a CARC meeting in early September. The process is currently underway to initiate the drafting of appropriate regulations, using an accelerated procedure.

#### **March 2012: response from Transport Canada**

On 28 March 2012, TC submitted an update stating the following:

Transport Canada Civil Aviation (TCCA) has initiated the drafting of instructions to amend the *Canadian Aviation Regulations* (CARs) to:

- Modify existing training programs, for operators involved in floatplane/seaplane operations to include initial underwater egress training for flight crew (Part VI, Division VIII);
- Develop a formal floatplane type rating within its crew licensing regulations.

TCCA will initiate international discussions aimed at enhancing egress from new type design aircraft used in float plane operations.

TCCA is further considering to:

- Have initial and recurrent Pilot Decision Making Training (contemporary Crew Resource Management (CRM) training standard) to replace the existing CRM training standard in subsection 725.124(39) of the Commercial Air Services Standards, and to extend a CRM training requirement to Subparts 703 and 704 of the CARs);
- Placard each emergency exit location with luminescent markings.

This proposal for luminescent markings is currently being further investigated by specialists.

TC has initiated an extensive review of past TSB reports of water-related accidents over the past several years, as well as other information and studies on the subject. This will allow TCCA to ascertain/assess the factors affecting underwater evacuation in order to identify if there are viable design options to improve underwater egress performance for in-service seaplanes and for new type designs.

The results of this work, which will take at least several months to complete, are anticipated to indicate the kind of regulatory approach that would be needed to address this recommendation.

In addition, TC provided an explanation of its accelerated rulemaking process.

Recommendations A11-06, A11-05 and A11-04, A11-03 are part of a pilot project initiated by TCCA introducing an accelerated rulemaking process. Two risk analysis focus groups were formed (involving industry representatives) resulting in recommended actions. As part of the next steps, CARAC members received a Notice of Intent indicating what regulatory changes are proposed and were invited to provide comments. The drafting of the proposed regulations by the Department of Justice and the public consultation take place simultaneously; the proposed regulations are finalized only after the public consultation period has closed and comments have been disposed of.

#### **March 2012: TSB assessment of the response (Satisfactory Intent)**

In its response, TC indicated that during the summer of 2011 it has initiated a focus group with industry stakeholders, in part, to review recommendation A11-05, which is related to the installation of regular and emergency exits that would allow rapid egress following a survivable collision with water.

The response indicates that, as a result of the focus group, proposals were presented to TC senior management during a CARC meeting. After an in-depth review, TC senior management agreed with the proposals. While TC indicated that a process is currently underway to initiate the drafting of appropriate regulations, using an accelerated procedure, it did not provide a timeframe for these actions.

Proposed actions may result in improved emergency egress from commercial seaplanes. This could substantially reduce or eliminate the safety deficiency. However, for the present, the action has not been sufficiently advanced to reduce the risks to transportation safety.

The response is considered **Satisfactory Intent**.

#### **December 2012: response from Transport Canada**

“TC has initiated an extensive review of past TSB reports of water-related accidents over the past several years, as well as other information and studies on the subject. This will allow TC to ascertain/assess the factors affecting underwater evacuation in order to identify if there are viable design options to improve underwater egress performance for in-service seaplanes and for new type designs. The results of this work, which will take at least several months to complete, are anticipated to indicate the kind of regulatory approach that would be needed to address this recommendation.

In addition, TC is introducing a requirement for egress training for flight crews of fixed wing seaplanes used in commercial operations. TC is reviewing the need to clarify the current requirement for pilots to wear shoulder harnesses wherever they are installed.

Recommendations A11-05 and A11-06 are advancing together for planned publication in the *Canada Gazette* in 2014.”

#### **March 2013: TSB assessment of the response (unable to assess)**

TC’s response is unclear as to how or if it will meet the intent of the TSB recommendation. Proposed actions may or may not result in improved emergency egress from commercial seaplanes. However, for the present, the action has not been sufficiently advanced to reduce the risks to transportation safety.

The response is considered **Unable to Assess**.

#### **November 2013: response from Transport Canada**

Transport Canada has not been able to identify any feasible and effective method to require "all new and existing seaplanes be fitted with regular and emergency exits". Findings indicate that the cost of adding or designating additional emergency exits does not justify the benefit, in that in the event of severe structural damage, existing or additional exits could be compromised. In some cases, it was found that perfectly serviceable available exits were not utilized. To meet the intent of the recommendation and to increase the probability of successful egress, Transport Canada:

- launched an annual promotion each summer that includes distributing to operators the pamphlet "Seaplane/Floatplane - A Passenger’s Guide" ;
- published a CASA clarifying the regulatory requirement to wear shoulder restraints;
- anticipates pre-publishing proposed regulations in the *Canada Gazette*, Part I in summer 2014 that include the requirement for egress training for pilots of commercial seaplanes.

#### April 2014: TSB assessment of the response (Unsatisfactory)

TC's response indicates it has not been able to identify any feasible and effective method to require "all new and existing seaplanes be fitted with regular and emergency exits". While TC's proposed actions may result in some improvement in emergency egress from commercial seaplanes, no action has been taken or proposed that will reduce or eliminate the underlying safety deficiency.

The response is considered **Unsatisfactory**.

#### March 2015: response from Transport Canada

Transport Canada agrees with the intent of the recommendation, but not the recommendation itself.

Transport Canada anticipates pre-publishing proposed regulations in the *Canada Gazette*, Part I in summer 2015 that include the requirement for egress training for pilots of commercial seaplanes. Transport Canada believes that when pilots trained in egress are able to assist occupants, the probability of successful egress will be increased.

Transport Canada (TC) believes that it has addressed the intent of the recommendation.

TC agrees with the TSB assessment that egress from floatplanes after an accident on water is an important safety issue. However, based on the evidence available, TC believes that operational approaches will lead to greater risk reduction.

That is why the department has studied the problem extensively. In 2006, following a risk assessment on survival issues in floatplanes that failed to identify significant enhancements of floatplane passenger safety, the Director of Aircraft Certification asked the staff of the Aircraft Certification Division, Atlantic Region to conduct further study of the issue.

Specifically the study group was tasked to:

1. Generate a list of the normal category aircraft types known to operate in float configurations. True seaplanes do not need to be included, as they do not seem to have the same propensity to flip, presumably because of the lower center of gravity;
2. Categorize the aircraft types by number of passengers, number of exits, and any other parameters considered to be relevant. Reference should be made to the TSB report on Floatplane egress issues;
3. Identify the aircraft types that are more critical based on the TSB results (C-185s and Beavers) and their correlation with other similar configurations; and
4. Identify potential design solutions that you consider practical for those aircraft configurations.

The group considered options such as jettisonable doors, pop-out windows, emergency exit lighting, emergency underwater breathing apparatus, and underwater egress training. The

department concluded the additional work done, from a different perspective, did in fact confirm there was no readily identifiable solution that would have a major impact on the existing level of floatplane safety.

Review of TSB investigation reports from 1990 to 2009 revealed that most passengers who successfully escaped from accidents on water were aided by their pilot. Therefore, lacking a design solution to the problem, TC concentrated on other risk reduction strategies. It was decided to require flight crew to take underwater egress training. To reduce the incidence of pilot incapacitation, rendering the pilot unable to aid passengers, and possibly blocking egress, TC is actively promoting the use of shoulder restraints by front seat occupants.

### **March 2015: TSB assessment of the response (Unsatisfactory)**

The intent of the TSB recommendation is to reduce the risk of persons being trapped when some or all exits are jammed as a result of an accident.

While TC's anticipated pre-publishing of regulatory requirements for mandatory egress training for the crew may result in some improvement in emergency egress from commercial seaplanes, no action has been taken or proposed that will reduce or eliminate the underlying safety deficiency.

The response is considered **Unsatisfactory**.

### **November 2015: response from Transport Canada**

Stakeholders were consulted on a Notice of Proposed Amendment in summer 2014. The regulatory proposal was adjusted following stakeholder comments. Due to the 2015 Federal Elections, the expected publication date in the *Canada Gazette*, Part I is now spring 2016.

### **2014 update**

Transport Canada agrees with the intent of the recommendation, but not the recommendation itself.

In 2006 and 2008, TC conducted detailed reviews of floatplane safety to determine if there were means of improving occupant safety and survivability in floatplane accidents. These reviews included the collection and review of relevant data from all floatplane accidents since 1990, as well as a review of TSB safety studies and recommendations regarding floatplanes. The 2006 review included a regional investigation by engineering staff of possible design-related solutions for egress from submerged floatplanes. The department's reviews did not identify any specific solutions that could be clearly shown without further study to improve floatplane safety.

In the summer of 2011, TC held a focus group comprised of representatives from the seaplane industry, aircraft manufacturers, and TC inspectors, to determine a strategy to improve levels of safety for commercial seaplane operations. The focus group concluded that the implementation

of emergency exits that allow rapid egress following a survivable collision with water (TSB Recommendation A11-05) was not viable at the present time and recommended that seaplane pilots should receive egress training to ensure that they are aware of the hazards that can impede escape from a sinking aircraft and that all occupants of commercial seaplane operations should wear a personal flotation device.

The 2011 focus group report advised that there are two major factors that must be considered in deciding on whether existing aeroplanes should be retrofitted with additional/better emergency exits: whether this is feasible/practical, and whether benefits are likely to accrue. There are many types/models of commercially-operated seaplanes in the Canadian fleet, most of which are in the normal/utility category (Part 23 / CAR 3). The cabin designs/configurations of most of these likely do not readily lend themselves to the desired changes without substantial aeroplane redesign and/or structural modification and reinforcement. From the benefit perspective, fitting additional/better exits should improve evacuation capability. Most of the subject aeroplanes typically already offer a high “passenger-to-exit” ratio comparable to that of similar-sized transport category (Part 25) aeroplanes. However, available exits are sometimes not used due to the dynamics of collisions with water (e.g. aeroplane upside-down in water, structural deformation/damage and obstruction of exits by loose items or baggage/cargo, etc.). In addition, available exits are also sometimes not used due to passenger incapacitation. In view of the preceding, it is considered that fitting additional/better exits are not likely to significantly improve the overall safety of the types of accidents under consideration.

Transport Canada anticipates pre-publishing proposed regulations in the *Canada Gazette*, Part I in summer 2015 that include the requirement for egress training for pilots of commercial seaplanes. Transport Canada believes that when pilots trained in egress are able to assist occupants, the probability of successful egress will be increased.

Transport Canada believes that it has addressed the intent of the recommendation.

### **March 2016: TSB assessment of the response (Unsatisfactory)**

As stated in the March 2015 reassessment, the intent of the TSB recommendation is to reduce the risk of persons being trapped when some or all exits are jammed as a result of an accident.

Since the 2011 meeting of the TC focus group, emergency door release mechanisms, better door handles and push-out windows for different aircraft types have been developed. Some floatplane operators have installed these modifications. The TSB recognizes that it may not be economically viable to retrofit all aircraft in commercial operation.

TC believes that the actions proposed in the Notice of Proposed Amendment will address the intent of the recommendation, and the regulatory requirements for mandatory egress training for the crew may result in some improvement in emergency egress from commercial seaplanes. However, these requirements will not reduce or eliminate the underlying safety deficiency of Recommendation A11-05.



Therefore, the response to Recommendation A11-05 is considered **Unsatisfactory**.

#### **January 2017: response from Transport Canada**

TC supports the goal of improving passenger egress from floatplanes following a mishap on water. In 2006, an engineering team at TC conducted an evaluation of egress from submerged seaplanes and suggested possible enhancements of occupant safety following an accident on water, but did not identify any potential design modifications. The group report was submitted to the Director of National Aircraft Certification. After additional work to evaluate the team's suggestions, the Director, National Aircraft Certification concluded that additional work conducted confirmed that there was no readily identifiable design solution that would have a major impact on the existing level of floatplane safety.

TC's review of the accident record showed that most passengers who successfully exited inverted or sunken floatplanes did so with the assistance of their pilot. Therefore, lacking a design solution, TC elected to require underwater egress training for commercial floatplane pilots and mandate other enhancements to floatplane safety. A new set of regulations will be published in the *Canada Gazette*, Part II in 2017.

TC will continue to monitor floatplane safety to identify potential enhancements of floatplane safety, but will not devote further activity to this recommendation.

#### **March 2017: TSB assessment of the response (Satisfactory in Part)**

As stated in the previous reassessment, the intent of the TSB recommendation is to reduce the risk of occupants being trapped when some or all exits are jammed, as a result of an accident.

Emergency door release mechanisms, better door handles, and push-out windows have been developed for certain types of floatplanes. Even though some floatplane operators have installed these modifications, many have not.

Regulatory requirements for mandatory egress training for commercial floatplane pilots may result in some improvement in emergency egress from commercial seaplanes. However, if the regulator does not mandate or promote voluntary modifications to normal exits, seaplanes will continue to operate with exits that could become unusable following an impact, diminishing the chance of occupants to exit the aircraft following a survivable accident.

Therefore, the response to Recommendation A11-05 is assessed as **Satisfactory in Part**.

## Latest response and assessment

### January 2023: response from Transport Canada

Transport Canada (TC) agrees in principle with the recommendation.<sup>1</sup>

Since the recommendation was issued in 2011, TC ran a floatplane safety campaign and published a Civil Aviation Safety Alert (CASA No. 2011-03)<sup>2</sup> to encourage all commercial and private floatplane operators to voluntarily adopt floatplane safety best industry practices.

Subsequently in 2011, TC created a focus group to address the recommendation and other floatplane safety issues. The focus group concurred that the cost associated with structural redesign and subsequent re-certification to implement this recommendation was too high, did not justify the benefit and was unsustainable for the industry.

Although TC has determined implementing the letter of this recommendation to be impracticable, we continue to take other steps to meet the intent of the recommendation and to increase the probability of successful egress following a float plane occurrence. Starting in 2013, TC launched an annual promotion campaign each summer that includes distributing to operators the pamphlet “Seaplane/Floatplane: A Passenger's Guide”<sup>3</sup>. The pamphlet contains information how to find and use exits and life preservers and about underwater egress.

To further mitigate the risks associated with egress raised in the recommendation, the focus group conducted in 2011 proposed regulatory changes requiring commercial floatplane operators to provide initial underwater egress training for flight crews since most passengers who successfully exited inverted or sunken floatplanes did so with the assistance of their pilot. A new set of regulations was published in the *Canada Gazette*, Part II in March 2019<sup>4</sup>, and have since fully come into force. The objective of the regulations is to enhance the level of safety for seaplane operations in Canada to increase survival rates for commercial seaplane occupants following a seaplane impact with water. The new regulations require mandatory underwater egress training for commercially operated seaplanes (both Subparts 703 and 704 operations), with recurrent training every three years.

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<sup>1</sup> All responses are those of the stakeholders to the TSB in written communications and are reproduced in full. The TSB corrects typographical errors 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.

<sup>2</sup> Transport Canada (2011). Civil Aviation Safety Alert (CASA) No. 2011-03 – Voluntary Adoption of Floatplane Safety Best Industry Practices. Available at: <https://tc.canada.ca/en/aviation/reference-centre/civil-aviation-safety-alerts/service-difficulty-advisories/voluntary-adoption-floatplane-safety-best-industry-practices-civil-aviation-safety-alerts-casa-no-2011-03>

<sup>3</sup> Transport Canada (2013). Transport Canada Publication (TP) No. 12365 - Seaplane/Floatplane - A Passenger's Guide. Available at: <https://tc.canada.ca/en/aviation/publications/seaplane-floatplane-passenger-s-guide-tp-12365>

<sup>4</sup> Government of Canada (2019). *Canada Gazette*, Part II, Volume 152, Number 5 – *Regulations Amending the Canadian Aviation Regulations* (Parts I, VI and VII — Seaplane Operations). Available at: <https://gazette.gc.ca/rp-pr/p2/2019/2019-03-06/html/sor-dors49-eng.html>.

To support the regulatory requirement for mandatory underwater egress training for commercially operated seaplanes, TC is proposing to amend the Commercial Air Service Standards (CASS) through the Notice of Proposed Amendment (NPA) 2022-004<sup>5</sup>. The *Amendments to the CASS subparts 723 and 724 - Seaplane Pilot Underwater Egress Training* were published through Canadian Aviation Regulation Advisory Council (CARAC) in April 2022. The proposed amendments to the CASS aim to define the requirements that air operators must meet when establishing an underwater egress training program as required by the Regulations. The NPA addresses training standards for subparts 703 and 704 operators to provide initial and recurring underwater egress training (ground and practical) for seaplane pilots pursuant to subparagraphs 703.98(2)(c.1) and 704.115(2)(a.1) of the *Canadian Aviation Regulations* (CARs) to ensure pilots have the necessary skills to egress from an overturned seaplane.

The consultation period for NPA-2022-004 ended May 27, 2022. Stakeholder comments are currently being studied, and work on the standards amendments is ongoing.

### **March 2023: TSB assessment of the response (Satisfactory in Part)**

In its latest response, Transport Canada (TC) stated that it agrees in principle with the recommendation, although it has determined that implementing the letter of this recommendation to be impractical.

Since TC's last response, regulations have come into effect that require underwater egress training for commercially operated seaplanes (for both *Canadian Aviation Regulation* Subpart 703 and Subpart 704 operations), with recurrent training required every three years. In addition, in support of these regulations, TC proposed amendments to subparts 723 and 724 of the *Commercial Air Services Standards* titled *Seaplane Pilot Underwater Egress Training*, which were published through the Canadian Aviation Regulation Advisory Council in April 2022. TC is studying the stakeholder comments and will continue to work on the standards amendments.

While the regulatory requirements for mandatory egress training for commercial seaplane pilots may result in some improvement in emergency egress from commercial seaplanes, they do not address the case where some or all exits cannot be opened. If there is no requirement to modify normal exits, seaplanes will continue to operate with exits that could become unusable following an impact, and the risk of occupants being unable to exit an aircraft following a survivable accident will continue.

Therefore, the Board considers the response to Recommendation A11-05 to be **Satisfactory in Part**.

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<sup>5</sup> Transport Canada (2022). Notice of Proposed Amendment (NPA) No. 2022-004 – Amendments to the Commercial Air Service Standards 723 and 724: Seaplane Pilot Underwater Egress Training. Available through 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>.

## **File status**

The TSB will continue to monitor the progress of TC's actions to mitigate the risks associated with the safety deficiency identified in Recommendation A11-05, and it will reassess the deficiency on an annual basis or when otherwise warranted.

This deficiency file is **Active**.