Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AIR TRANSPORTATION SAFETY INVESTIGATION REPORT A24C0057

LOSS OF CONTROL AND COLLISION WITH TERRAIN

Canadian Fly-in Fishing (Red Lake) Ltd.
De Havilland Aircraft of Canada Limited DHC-2 Mk. I, C-GBZH
Red Lake (Howey Bay) Water Aerodrome (CKS4), Ontario, 2.2 NM SE
16 June 2024

History of the flight

The De Havilland Aircraft of Canada Limited DHC-2 Mk. I float-equipped aircraft operated by Canadian Fly-in Fishing (Red Lake) Ltd. (registration C-GBZH, serial number 1518) was preparing to depart from the Chukuni River, approximately 2.2 nautical miles (NM) southeast of the Red Lake (Howey Bay) Water Aerodrome (CKS4),[1] on a visual flight rules flight to Thicketwood Lake.

At approximately 0653,[2] the aircraft departed with the pilot, 4 passengers, and cargo on board. Winds were observed by the pilot to be from the south. A normal takeoff was conducted with the flaps in the TAKEOFF setting, and with the heading approximately 120° magnetic.

[1] All locations mentioned in the report are in the province of Ontario, unless otherwise indicated.

[2] All times are Central Daylight Time (Coordinated Universal Time minus 5 hours).

The aircraft accelerated and lifted off as planned about halfway down the waterway (approximately 2500 feet downriver). As the aircraft gained airspeed to 80 mph, the pilot initiated a climb.

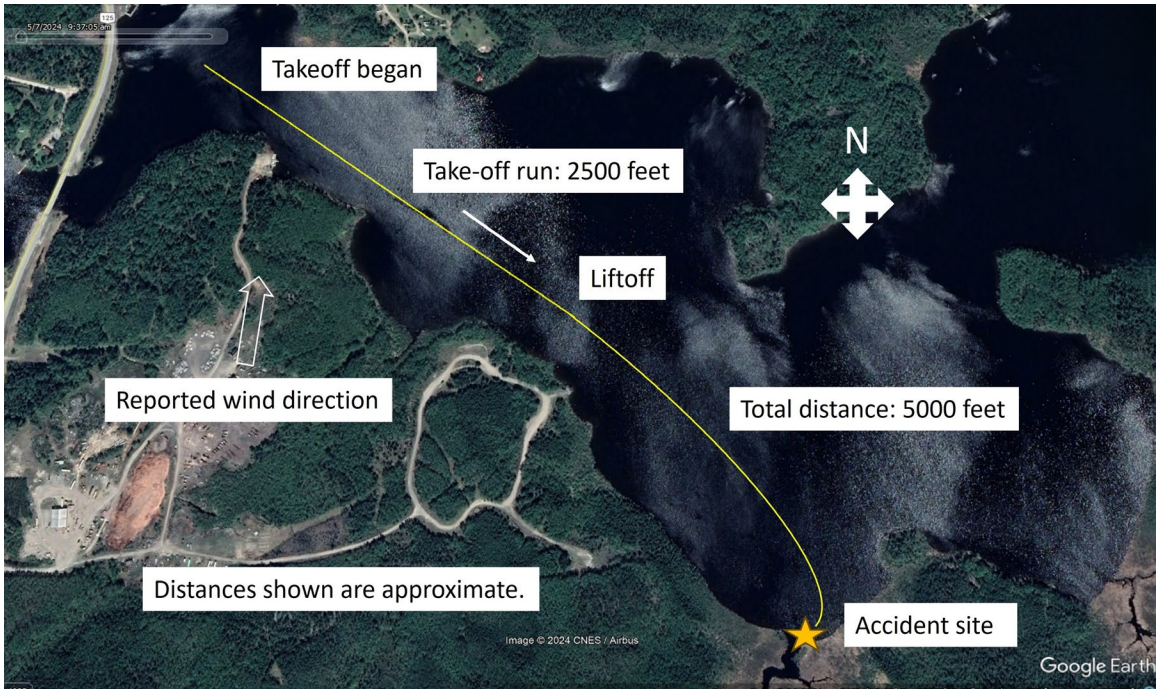
Once the climb was established at approximately 100 feet above water, the pilot reduced the engine power to 30 inches of manifold pressure at 2000 rpm. Along with this power change, the wing flaps were raised from the TAKEOFF position to the CLIMB position.

Shortly thereafter, the pilot noticed the aircraft descending, accompanied by a decrease in airspeed to 60 mph. The pilot pushed forward on the control wheel and simultaneously added full power in an attempt to regain airspeed.

The aircraft's airspeed did not increase, and the pilot made a turn to the right, into the wind. At a height of approximately 80 feet above the water, the aircraft entered an aerodynamic stall, with a roll to the right.

Aircraft control was lost and, at 0655, the aircraft collided with the shoreline in a nose-down, banked attitude (Figure 1).

Figure 1. The occurrence flight take-off route and accident site (Source: Google Earth, with TSB annotations)



The aircraft came to rest on its left side, partially submerged in approximately 1.5 m of water, 5000 feet from the start of the take-off run (Figure 2).

Figure 2. The occurrence aircraft following impact with terrain (Source: TSB)

The aircraft was substantially damaged. There was no post-impact fire. The emergency locator transmitter activated.

The aircraft occupants were all partially submerged in water when the aircraft came to rest. The pilot egressed through the right-side door and assisted the front-seat passenger out of the aircraft while the other 3 passengers were assisted from the aircraft by local residents.

Two of the passengers, who had been seated in the left and right back seats, were seriously injured and were airlifted to hospital in Thunder Bay. One of these passengers subsequently died while in hospital. The pilot and the 2 other passengers were medically evaluated at a local hospital and released.

Company information

Canadian Fly-in Fishing (Red Lake) Ltd. is authorized by Transport Canada (TC) to operate under Subpart 703 (Air Taxi Operations) of the *Canadian Aviation Regulations*. It is based in Red Lake and operates a single DHC-2 Mk. I aircraft on floats in support of fly-in fishing camps in northwestern Ontario.

Pilot information

The pilot held a commercial pilot licence with a seaplane rating and, at the time of the occurrence, had accumulated 1773 total flying hours, of which 816 hours were as pilot-in-command of a DHC-2 Mk. I aircraft. The investigation determined that the pilot held the appropriate licences for the flight in

accordance with existing regulations. In April 2023, he completed aircraft underwater egress training[3] as required by regulations. There was no indication that the pilot's performance was affected by medical or physiological factors.

Weather information

At 0600, weather information issued at Red Lake Airport (CYRL), located 2.6 NM northwest of the Chukuni River, indicated an overcast ceiling at 1800 feet above ground level (AGL), with winds from 160° true (T) at 7 knots.

A special weather observation for CYRL issued at 0654 (approximately 1 minute after takeoff of the occurrence flight) indicated an overcast ceiling at 1500 feet AGL. Winds were from 190°T at 9 knots, gusting to 16 knots, and variable from 150°T to 210°T.

Aircraft information

The occurrence aircraft was a 5-seat, single-engine De Havilland Aircraft of Canada Limited DHC-2 Mk. I, built in 1963, and equipped with EDO 4930 floats. At the time of the occurrence, the aircraft had accumulated 13 590.4 hours total time since new.

The aircraft was approved to operate at an increased maximum gross take-off weight of 5370 pounds, per Supplemental Type Certificate (STC) SA98-10.[4] The STC included a limitation that, for structural reasons, all weight above the aircraft's original weight of 5090 pounds (up to 280 pounds) must be from fuel in the wing tip tanks. Therefore, in this occurrence with the empty wing tip tanks, the maximum gross take-off weight was 5090 pounds.

The aircraft did not have an aerodynamic stall warning system and was not required to have one at the time it was built and certified, nor did existing regulations require one.

The aircraft was equipped with safety belts consisting of lap straps and shoulder harnesses in the front seats. The rear seats were equipped with lap straps only. At the time the aircraft was manufactured, the regulations did not require shoulder harnesses on all seats. Inflatable personal flotation devices were provided and worn as a belt pack by all occupants during the occurrence flight.

There were no recorded defects outstanding at the time of the occurrence and no indication that a component or system malfunction played a role in this occurrence.

The aircraft flight manual's take-off procedure states:

> (g) As soon as safe height has been attained, reduce power to 33.5 In.Hg. and 2200 rpm if aircraft is fully loaded, or 30 In.Hg. and 2000 rpm for normal weight.
>
> (h) Slowly increase airspeed to 80 mph and retrim.
>
> (j) At altitude of 500 ft. – flaps to CLIMB and retrim.[5]

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[3] Transport Canada, SOR/96-433, *Canadian Aviation Regulations* (CARs), paragraph 703.98(2)(c.1).

[4] Transport Canada, Supplemental Type Certificate SA98-10 (14 January 1998).

[5] Viking Air Limited (now De Havilland Aircraft of Canada Limited), Product Support Manual (PSM) 1-2-1, *DHC-2 Beaver Airplane Flight Manual*, Revision 11 (08 July 2002), Section II: Normal Procedures, Subsection 2.9: Take-off, paragraph (j), p. 24.

There is no change to the takeoff procedures listed in the flight manual supplement for STC SA98-10.

Stalling speeds are listed in the aircraft flight manual as 60 mph for flaps up and 45 mph for flaps down.[6] Even though the aircraft was modified to increase its maximum gross take-off weight to 5370 pounds, there is no change to the stalling speeds listed in the flight manual supplement for STC SA98-10.

Weight and balance

Based on the aircraft's configuration and the most accurate weight information available to the investigation,[7] it was determined that, at the time of takeoff, the estimated weight of the aircraft was 334 pounds over the maximum gross take-off weight of 5090 pounds, but within the correct centre of gravity range. The operator's take-off weight calculation prior to the flight was 5359 pounds as the passenger weights were averaged from a group weigh-in as per the company operations manual[8] approved by TC. The 8 passengers weighed a total of 1812 pounds. The group was then split between 2 aircraft, 4 passengers in each. One of the passengers weighed significantly more than the average for the group and was positioned in the occurrence aircraft, resulting in a gross weight increase that was not accounted for.

Aerodynamic stall warning system

Since 1998, the TSB has investigated 23 occurrences involving a De Havilland DHC-2 aircraft stalling and colliding with terrain and resulting in 47 fatalities.

Although the occurrence aircraft design did not originally include a stall warning system, such a system subsequently became available with the release of an approved modification (MOD 2/973) from De Havilland Aircraft of Canada Limited, which is the current holder of the DHC-2 type certificate. De Havilland Aircraft of Canada Limited has also designed an improved modification (MOD 2/1605) to the previously offered stall warning system that provides a visual and aural warning of an impending stall.

In 2012, the TSB investigated the fatal crash of a DHC-2 Mk. I floatplane,[9] a large number of which operate in Canada. It identified that the frequency and consequences of DHC-2 aircraft accidents following an aerodynamic stall are high, noting in particular that stalls encountered during critical phases of flight often have disastrous consequences. Therefore, the Board issued a concern that the aerodynamic buffet of DHC-2 aircraft alone may provide insufficient warning to pilots of an impending stall.

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6 Ibid., Section IV: Operating Limits, Performance Data and Flight Characteristics, Subsection 4.10: Performance at Maximum Gross Weight – Standard Conditions, Stalling Speeds, p. 40.

7 The actual passenger weights were used by the TSB. The cargo weight information was provided by the operator, but its accuracy could not be verified as the majority of the cargo either sank of floated away following the occurrence.

8 Canadian Fly-In Fishing (Red Lake) Limited, *Company Operations Manual*, Original (15 January 2019).

9 TSB Aviation Investigation Report A12O0071.

In late June 2014, De Havilland Aircraft of Canada Limited published a technical bulletin recommending that stall warning systems be installed or enhanced on all DHC-2s via MOD 2/1605.[10] In addition, TC published a Civil Aviation Safety Alert in 2014 in which it also recommended that all DHC-2 airplane owners incorporate MOD 2/1605 or another approved artificial stall warning system.[11]

In August 2017, following the investigation[12] into the fatal crash of a DHC-2 Mk. I aircraft that stalled during a low-altitude turn while on a sightseeing flight, the Board recommended that

> the Department of Transport require all commercially operated DHC-2 aircraft in Canada to be equipped with a stall warning system.
>
> **TSB Recommendation A17-01**

In its December 2019 response, TC indicated that it had completed an in-depth study to determine the most effective means of addressing the risks associated with stall-related accidents in DHC-2 aircraft. TC concluded that it would not require all commercially operated DHC-2 aircraft in Canada to be equipped with a stall warning system, which it reaffirmed in its December 2020 response. No further action was planned by TC in connection with this recommendation, though it continues to support the voluntary measure identified in Civil Aviation Safety Alert 2014-02.

Even though a stall warning system would not likely have prevented an accident in all the cases studied by TC, a clear indication of an impending stall increases the pilot's situational awareness and reduces the likelihood of a loss of control in flight. However, TC concluded that "[i]n these configurations, even with a stall warning system installed, a stall occurs and gives the pilot little to no time to react and recover."[13] The TSB does not agree with this statement.

As stated in the TSB's most recent assessment of TC's response, in March 2022, until TC establishes new measures to address the risks associated with stall-related accidents in DHC-2 aircraft, the Board believes that the risks associated with the safety deficiency identified in Recommendation A17-01 will remain.

Therefore, the Board assessed the response to Recommendation A17-01 as **Unsatisfactory**.[14]

The TSB recommendation is currently **Dormant**.[15]

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[10] Viking Air Limited (now De Havilland Aircraft of Canada Limited), Technical Bulletin V2/00001: Installation of Improved Stall Warning System (30 June 2014).

[11] Transport Canada, Civil Aviation Safety Alert No. 2014-02: Installation in DHC-2 aeroplanes not originally equipped of an artificial stall warning system (17 July 2014), at tc.canada.ca/en/aviation/reference-centre/civil-aviation-safety-alerts/installation-dhc-2-aeroplanes-not-originally-equipped-artificial-stall-warning-system-civil-aviation-safety-alerts-casa-no-2014-02 (last accessed on 28 April 2025).

[12] TSB Air Transportation Safety Investigation A15Q0120.

[13] Transport Canada, December 2019 response to TSB Recommendation A17-01, at www.tsb.gc.ca/eng/recommandations-recommendations/aviation/2017/rec-a1701.html (last accessed on 28 April 2025).

[14] TSB Recommendation A17-01: Stall warning systems – DHC-2, at tsb.gc.ca/eng/recommandations-recommendations/aviation/2017/rec-a1701.html (last accessed on 28 April 2025).

[15] The TSB defines a dormant recommendation as one for which the assessment determines that there is a residual risk but no further action is planned and continued assessment will not likely yield further results.

Survivability

The pilot, seated in the front left seat, and a passenger seated in the front right seat, were each wearing a safety belt with shoulder harness. The remaining 3 passengers, seated in the rear seats, were each wearing a lap strap. Injuries sustained by the passengers in the left and right rear seats were consistent with their torsos being unrestrained.

Safety belt recommendations

In a 1985 safety report, the U.S. National Transportation Safety Board noted the following: "Shoulder harness use is the most effective method of reducing fatal and serious injuries in general aviation airplane accidents."[16]

The TSB has previously recommended (TSB recommendations A94-08 and A92-01) that small commercial aircraft be fitted with safety belts with shoulder harnesses in all seating positions. Following these recommendations, changes to regulations were made to require shoulder harnesses in all commercial cockpits and on all seats in aircraft manufactured after 1986 with 9 or fewer passengers.[17] This regulatory change did not address the vast majority of the commercial seaplane fleet, which was manufactured before 1986.

The TSB considers that, given the additional hazards associated with accidents on water, such as an inability to exit the aircraft due to incapacitation, shoulder harnesses for all seaplane passengers will reduce the risk of an incapacitating injury, thereby improving the likelihood of exiting the aircraft.

Following an investigation into a fatal crash of a DHC-2 Mk. I Beaver floatplane,[18] the Board recommended that

> the Department of Transport require that all seaplanes in commercial service certificated for 9 or fewer passengers be fitted with seatbelts that include shoulder harnesses on all passenger seats.
>
> **TSB Recommendation A13-03**

In its January 2014 response, TC indicated that it did not agree with the recommendation, stating that the structures and interior designs of most of these older aircraft are not robust enough to support shoulder restraints and may hinder egress. Also, in its latest response, in September 2020, TC stated that better occupant restraint "would not produce a significant reduction in fatalities and would not offset the cost of modifying multiple models of seaplanes to install shoulder harnesses."[19] TC did not plan to take further action in response to this recommendation.

The TSB's March 2021 reassessment of TC's response stated that the risk presented by inadequate occupant restraint is well known to exist, is reflected in current airworthiness standards, was found to

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[16] National Transportation Safety Board, Safety Report, PB85-917002, NTSB/SR-85/01, General Aviation Crashworthiness Project, Phase Two – Impact severity and potential injury prevention in General Aviation accidents (15 March 1985), p. 15.

[17] Transport Canada, SOR/96-433, *Canadian Aviation Regulations* (CARs), section 605.24.

[18] TSB Aviation Investigation Report A12O0071.

[19] TSB Recommendation A13-03: Passenger shoulder harnesses, at tsb.gc.ca/eng/recommandations-recommendations/aviation/2013/rec-a1303.html (last accessed on 28 April 2025).

have caused or contributed to fatal injuries in previous TSB investigations, and was detailed in safety studies completed by both the TSB and the U.S. Federal Aviation Administration. Therefore, it was not clear why TC indicated that, because the relative influence of this hazard cannot be quantified precisely, action would not be taken to address the safety deficiency. Therefore, the Board considered the response to Recommendation A13-03 to be **Unsatisfactory**.

The TSB recommendation is currently **Dormant**.

Safety messages

Artificial stall warning systems can help pilots to reduce the risks when aircraft are operated at high angles of attack, such as during takeoffs and landings. Regulators, manufacturers, and owners of aircraft originally certified without artificial stall warning systems may wish to consider the installation of an approved aftermarket system when they are available.

Regulators, manufacturers, and owners of aircraft with safety belts without shoulder harnesses may wish to consider the installation of shoulder harnesses to reduce the potential for serious flail injuries in the event of an accident.

Pilots are reminded that the aircraft operating instructions contained in aircraft flight manuals and supplements from modifications provide critical information for the safe operation of aircraft. It is imperative that pilots follow these instructions, particularly for critical manoeuvres with a high angle of attack, like takeoffs and landings.

As seen in this occurrence, underwater egress training for flight crews has been shown to improve survivability outcomes.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 22 May 2025. It was officially released on 05 June 2025.

ABOUT THIS INVESTIGATION REPORT

This report is the result of an investigation into a class 4 occurrence. For more information, see the Policy on Occurrence Classification at www.tsb.gc.ca

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