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

AIR TRANSPORTATION SAFETY INVESTIGATION REPORT A24W0116

FUEL EXHAUSTION

Simpson Air (1981) Limited
De Havilland Aircraft of Canada Limited DHC-2 Mk. I (Beaver) (floatplane), C-GMGD
Fort Simpson Island Water Aerodrome (CEZ7), Northwest Territories, 7 NM W
29 August 2024

History of the flight

On 29 August 2024, the De Havilland Aircraft of Canada Limited DHC-2 Mk. I (Beaver) floatplane (registration C-GMGD, serial number 519), operated by Simpson Air (1981) Limited (Simpson Air), was scheduled for a visual flight rules flight from Fort Simpson Island Water Aerodrome (CEZ7)[1] to Rabbitkettle Lake and back to CEZ7. Rabbitkettle Lake is approximately 165 nautical miles (NM) west of CEZ7. The purpose of the flight was to pick up passengers and gear. The pilot arrived at CEZ7 at approximately 0800,[2] checked the weather, and completed flight planning. At approximately 0815, the pilot drove the fuel truck down to the CEZ7 dock, located on the

[1] All locations mentioned in this report are in the Northwest Territories, unless otherwise noted.

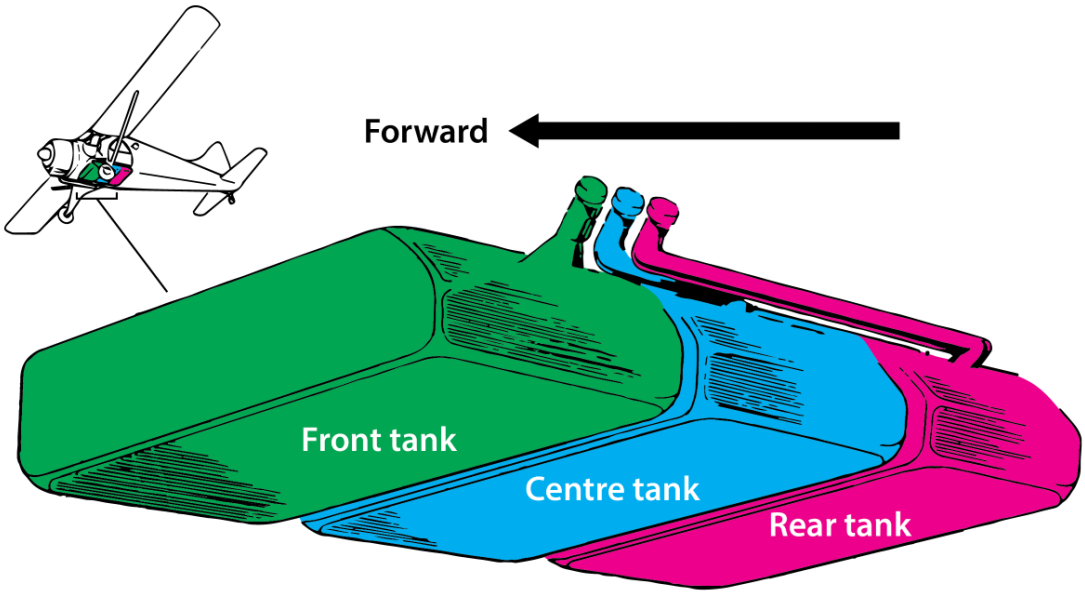
[2] All times are Mountain Daylight Time (Coordinated Universal Time minus 6 hours).

Mackenzie River, to fuel the aircraft. The fuel truck was a pickup truck with a tank in the truck bed that used an electric pump. The pump was not equipped with a fuel meter to indicate how much fuel had been added to the aircraft.

In the pilot's experience, the aircraft fuel gauges usually underread by a few gallons. As a result, to manage fuel, the pilot had adopted the practice of relying primarily on the average burn time of each fuel tank, which he had established through informal testing during a series of flights after the installation of a new engine 2 months earlier. The pilot found that filling the front, centre, and rear main fuel tanks and 1 wingtip fuel tank (a total of 97 imperial gallons)[3] equated to approximately 4 hours and 30 minutes of flight time. The pilot had flown the occurrence route multiple times and knew that it usually took a little less than 4 hours. As a result, the pilot believed that filling those 4 fuel tanks would be sufficient to complete the flight and land with the required 30-minute reserve.[4]

The front, centre, and rear main fuel tanks are under the cabin floor and are serviced through 3 filler necks in a filler compartment located on the left side of the fuselage, adjacent to the cockpit door (Figure 1). The wingtip fuel tanks are serviced through a filler door on the top of each wing. The pilot was aware that patience is required when fuelling while docked, particularly in rough water conditions, because it can take several minutes for the fuel, which is gravity fed, to settle in the main fuel tanks. This is particularly true for the rear fuel tank because of its longer filler neck.

Figure 1. Main fuel tanks in the Beaver aircraft (Source: TSB based on figures in De Havilland Aircraft of Canada Limited, *DHC-2 Mk. I & Mk. II Airplane Flight Manual [PSM 1-2-1]*)



The pilot's normal routine when filling 4 of the fuel tanks was as follows:

1. Fill the rear fuel tank until it appeared full.

[3] Fuel tank capacities (in imperial gallons): front (29), centre (29), rear (21), and 1 wingtip tank (18).

[4] Transport Canada, SOR/96-433, *Canadian Aviation Regulations,* subparagraph 602.88(3)(a)(i).

2. Fill the centre fuel tank until it appeared full.
3. Top up the rear fuel tank.
4. Fill the front fuel tank until it appeared full.
5. Top up the rear fuel tank.
6. Fill the right wingtip fuel tank until it appeared full.[5]

Because of the orientation of the aircraft at the CEZ7 dock, the pilot was required to manage the hose while standing on the left float and visually verify the fuel levels through the filler door on the left side of the aircraft. Simpson Air's chief pilot arrived at the dock after the pilot had fuelled the main fuel tanks. He held the ladder while the pilot fuelled the right wingtip fuel tank and cautioned him that the main fuel tanks may not be as full as they appeared.

On the day of the occurrence, the Mackenzie River water level at the CEZ7 dock was low and the winds were from the northwest above 10 knots. This created a swell that was hitting the aircraft from the left rear at approximately 45° (Figure 2) to the aircraft's longitudinal axis. This condition can give the appearance of the fuel tank being full at the filler neck. During fuelling, the swell was sufficient to cause fuel to be sloshed and splashed onto the pilot's clothes. The pilot normally checks the fuel gauges before taking off but could not recall if that was completed for the occurrence flight.

Figure 2. The occurrence aircraft at the Fort Simpson Island Water Aerodrome dock (not on the day of the occurrence). The arrow depicts the direction of the swell on the day of the occurrence (Source: Simpson Air [1981] Limited)

At 0850, the engine was started, and the warm-up and run-up were carried out. At that point, fuel was being drawn from the front fuel tank. At 0901, the aircraft took off westbound toward Rabbitkettle Lake. The aircraft was carrying no passengers and no cargo, so the pilot climbed at

[5] The left wingtip tank is not normally accessible because of the aircraft's orientation at the dock at CEZ7.

cruise power (28 inches of manifold pressure [MP] and 1800 rpm with the mixture leaned). Because there was a strong headwind at higher altitudes, the pilot stayed lower and followed the terrain as it rose westbound, eventually climbing as high as 6500 feet above sea level (ASL) to clear the hills before descending to Rabbitkettle Lake.

During the flight, the pilot waited until the front fuel tank indicated 8 imperial gallons remaining and then transferred the fuel from the right wingtip fuel tank into the front fuel tank. During the pre-landing check, the front fuel tank was reading near empty, so the pilot switched to the centre fuel tank. This was consistent with his previous experience flying to Rabbitkettle Lake. He normally obtained from 1 hour and 45 minutes to 1 hour and 55 minutes flying time on the front fuel tank and 1 wingtip fuel tank. The aircraft landed at Rabbitkettle Lake at 1040.

Two passengers and approximately 550 pounds of gear were loaded onto the aircraft. Simpson Air has a remote fuel cache at Rabbitkettle Lake; however, the pilot had decided before departing CEZ7 that additional fuel was unnecessary and therefore did not refuel the aircraft.

At 1112, the aircraft departed for the return flight and climbed for approximately 15 minutes at a power setting of 30 inches MP and 2000 rpm with the mixture rich until it reached an altitude of 7500 feet ASL. At Simpson Air, the climb is normally performed at 29 inches MP and 1900 rpm with the mixture leaned, or at cruise power at 28 inches MP and 1800 rpm with the mixture leaned; however, the pilot used a slightly higher power setting to expedite the climb owing to the rising terrain along the track (see Table 1 for post-occurrence fuel calculations).

During the climb, fuel was still being taken from the centre fuel tank. The en-route time calculated by the GPS (global positioning system) was approximately 1 hour and 35 minutes back to CEZ7. The pilot normally obtained around 1 hour and 15 minutes of flying time on the centre fuel tank. After approximately 58 minutes of total flying time (including the inbound portion to Rabbitkettle Lake) on the centre fuel tank, the fuel pressure started to decrease, signifying that the centre fuel tank was nearing empty. This occurred sooner than the pilot expected; however, it was not deemed abnormal because of the additional weight and the higher power used during the climb to 7500 feet ASL. The pilot switched back to the front fuel tank to burn any residual fuel.

At around 1215, after approximately 10 minutes on the front fuel tank, the fuel pressure again began to decrease, so the pilot switched to the rear fuel tank. He recalled seeing the rear fuel tank indicating full; however, that could not be confirmed by the investigation. It was estimated that the switch to the rear fuel tank occurred approximately 75 NM from CEZ7, which was approximately 6 minutes (10 NM) earlier than for previous Rabbitkettle Lake return flights conducted by the pilot. He noted this to be unusual. The GPS indicated approximately 40 minutes of flight time remaining.

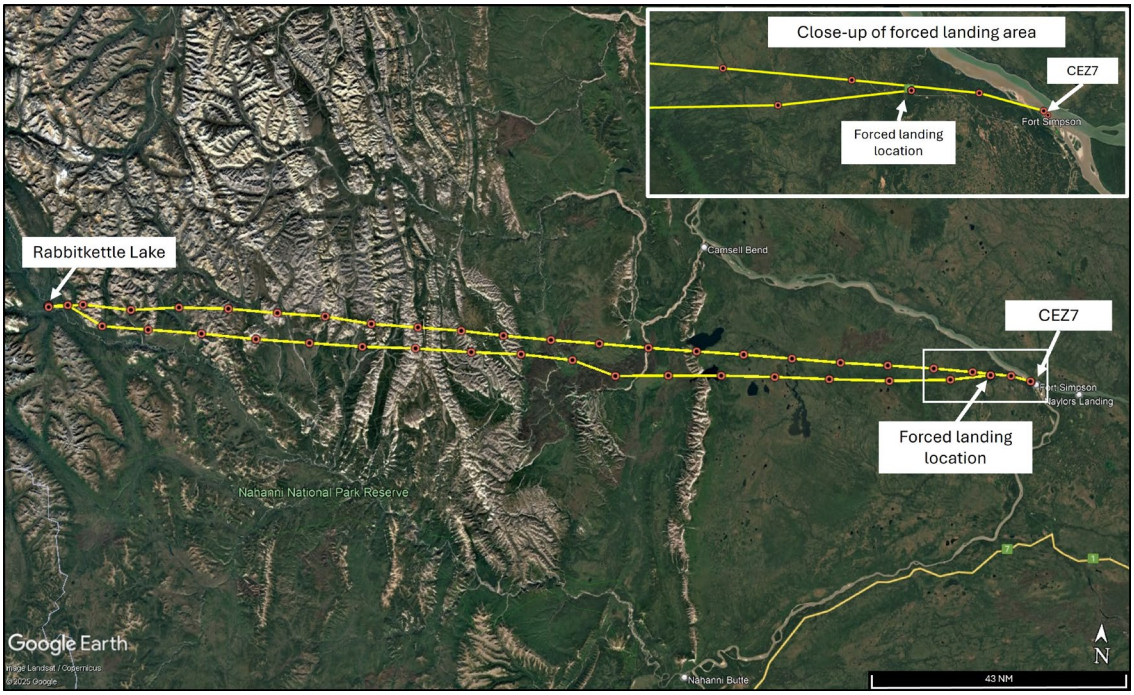
Because the pilot had previously noted that a full rear fuel tank would usually supply the engine for 58 to 64 minutes, he estimated that he would land back at CEZ7 with approximately 20 minutes fuel reserve remaining.

At approximately 1220, the aircraft passed overhead Little Doctor Lake. At around that point, the pilot recalled a fuel reading of approximately 16 imperial gallons. This was less than he expected

to see; however, based on the short time flown on that fuel tank, he suspected the gauge was underreading and elected to continue toward CEZ7 rather than land at Little Doctor Lake, where the company had a fuel cache.

At approximately 1240, the pilot recalled that the fuel gauge showed empty. Again, this happened sooner than he expected. At that point, he began considering options in the event the fuel gauge was accurate. In the absence of other viable options, the pilot turned toward, and followed the Mackenzie Highway in case an emergency landing was required. When the aircraft was approximately 8 NM west of CEZ7 and at around 1500 feet above ground level (AGL), the engine[6] experienced a complete loss of power. The pilot was able to carry out a forced landing on the highway, landing at approximately 1250, 7 NM west of CEZ7 (Figure 3).

Figure 3. Occurrence aircraft's flight path and forced landing location, with a close-up view of the forced landing area in inset (Source of main image and inset: Google Earth, with TSB annotations)



There were no injuries. Aside from some minor scratching to the underside of the floats, there was minor damage to the left wing from going through some shrubs (Figure 4). The aircraft's emergency locator transmitter did not activate. During the forced landing, the pilot was able to make a Mayday call on the Fort Simpson Airport (CYFS) mandatory frequency (122.2 MHz) as well as the company's discrete frequency. Shortly after landing, a company aircraft flew overhead and informed Simpson Air that the occurrence aircraft was safely on the ground. Approximately 20 minutes later, rescue personnel from Fort Simpson arrived on the scene.

[6] The engine is a Pratt & Whitney-USA, R-985-AN-14B.

Figure 4. The occurrence aircraft after the forced landing (Source: Simpson Air [1981] Limited)

Pilot information

The pilot held a Canadian commercial pilot licence — aeroplane, endorsed for landplanes and seaplanes, and a valid Category 1 medical certificate. The licence and rating were appropriate for the flight in accordance with existing regulations. He joined Simpson Air in May 2023 and had approximately 1300 hours of flight experience, including approximately 500 hours on Beaver aircraft. One of his company duties was to train other pilots and dock hands on Beaver aircraft fuelling procedures.

Post-occurrence inspection

After the occurrence, the company made the following observations:

- The engine showed no signs of mechanical failure.
- There was no fuel remaining in any of the fuel tanks.
- The rear fuel tank was filled incrementally, and the gauges appeared to be working and possibly underreading, which may have been due to aircraft attitude on the trailer used to transport the aircraft back to the aerodrome.
- A successful ground run was conducted, and no mechanical issues were noted.
- The fuel in the fuel truck was tested by the company, and no sign of contamination was found.

Post-occurrence fuel calculations

The investigation conducted an estimate of the fuel required for the return flight to Rabbitkettle Lake based on aircraft flight manual fuel consumption information (Table 1).

Table 1. Projected fuel burn requirements for the return flight to Rabbitkettle Lake

Routing	Phase of flight	Flight time	Average fuel burn (imperial gallon/hour)*	Fuel requirements based on average fuel burn (imperial gallon)
CEZ7 to Rabbitkettle Lake	Entire flight	1 hour 54 minutes	20.8	39.5
Rabbitkettle Lake to CEZ7	Climb (increased power)	15 minutes	23.1	5.8
	Remainder of flight	1 hour 27 minutes	20.8	30.1
Total estimated fuel required				75.4
Unaccounted fuel (97 imperial gallons - total estimated fuel required)				21.6

* Based on data taken from De Havilland Aircraft of Canada Limited, *DHC-2 MK. I & MK. II Airplane Flight Manual (PSM 1-2-1)*, Appendix 14 Operating data charts, Cruise power chart, p. v.

In the absence of indications to suggest a fuel-system-related malfunction, it is likely that the aircraft departed with less fuel than required to complete the planned flight. This condition went undetected until the latter stages of the occurrence flight.

Previous fuel management occurrences

In the past several years, there have been multiple occurrences involving commercial aircraft that had insufficient fuel to complete the planned flight.[7]

Safety action taken

Following the occurrence, the company

- published a memorandum reminding pilots of the importance of ensuring sufficient fuel is uploaded and that fuel burn must be closely monitored;
- implemented a 45-minute fuel reserve requirement for all flights;
- added a fuel meter to the fuel truck at CEZ7;
- created a new checklist for Beaver aircraft with additional fuel checks; and
- installed satellite trackers with 2-way text capabilities on all aircraft.

Safety messages

It is vital that pilots maintain a clear understanding of their actual versus required fuel amounts. In a float plane, this may involve strategies such as using fuel meters, waiting for calm water

[7] TSB air transportation safety investigation reports A23C0104 (ongoing), A21W0098, A19Q0146, and A19C0038, as well as TSB aviation occurrences A23W0159, A23W0090, A23O0092, A22W0099, A22C0077, A20C0068, and A19O015.

conditions that allow for an accurate visual inspection, cross-checking fuel gauges throughout the flight, and uploading additional fuel during en-route stops.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 13 August 2025. It was officially released on 19 August 2025.

ABOUT THIS INVESTIGATION REPORT

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