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

Air Transportation Safety Investigation Report A20P0105

PILOT FATALLY INJURED DURING GROUND OPERATIONS

Wilderness Seaplanes Ltd.
de Havilland DHC-2 Mk. I, C-FDSG
Port Hardy Water Aerodrome, British Columbia
07 December 2020

History of the flight

On 07 December 2020, the pilot of the Wilderness Seaplanes Ltd. de Havilland DHC-2 Mk. I[1] aircraft (registration C-FDSG, serial number 892) planned to transport 3 passengers from Port Hardy Water Aerodrome (CAW5), British Columbia (BC), to a local logging camp.

At approximately 0745,[2] the pilot arrived on the dock to begin preparing the aircraft for departure at 0830. The pilot turned the aircraft battery master switch on and the aircraft electrical system momentarily flickered, but it did not stay powered up. The pilot suspected the battery was dead and, per the company operations manual,[3] he notified the dispatcher and the person responsible for maintenance (PRM).

A closed-circuit television camera from a nearby building, located approximately 140 metres south-southwest of the aircraft, recorded the pilot moving to the front of the aircraft at 0759. The propeller was manually rotated, causing the engine to momentarily fire and accelerate the propeller. The pilot was struck by the propeller and then fell into the water at 0759:35.

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1 Viking Air Ltd. is the current type certificate holder for the DHC-2 aircraft.

2 All times are Pacific Standard Time (Coordinated Universal Time minus 8 hours).

3 Wilderness Seaplanes Ltd., *Company Operations Manual,* Amendment 5 (01 October 2019), section 3.10.4: Aircraft Defects, p. 3-19.

Between 0800 and 0806, the 3 passengers arrived at the CAW5 parking lot and unpacked their luggage. At 0813, one of the passengers walked down to the dock and found the pilot face down in the water. The passengers recovered the pilot from the water, contacted 911, and administered first aid with guidance from the 911 operator. An ambulance arrived at 0823 and transported the pilot to the hospital. The pilot died from his injuries 32 hours later.

Water aerodrome information

CAW5 is located 5 nautical miles west-northwest of the Port Hardy Airport (CYZT), BC, and is a registered water aerodrome for public use. The single dock has access to aviation fuel, fresh water, and electrical shore power.

The aircraft was moored on the right side of the dock with a plank spanning the front of the floats (Figure 1).

There were no other people or aircraft at the water aerodrome at the time of the occurrence.

Figure 1. Photo of the occurrence aircraft at the Port Hardy Water Aerodrome, taken 56 minutes after the occurrence, showing the position of the plank (Source: Royal Canadian Mounted Police)

Pilot information

The pilot had been employed by Wilderness Seaplanes Ltd. from June 2019 to October 2019 and then returned in November 2020. He held a commercial pilot licence - aeroplane with a valid Category 1 medical certificate and had accumulated 2853.2 total flight hours with approximately 1388.1 flight hours on the DHC-2 aircraft.

The pilot also held a Transport Canada (TC) aircraft maintenance engineer licence; however, he was not working for the company in this capacity, and was only authorized to perform elementary work[4] on the occurrence aircraft.

Weather information

The nearest aviation weather reporting station to the occurrence site is CYZT. The aerodrome routine meteorological report issued at 0800 for CYZT indicated a temperature of 9 °C, a dewpoint of 8 °C, a few clouds at 2000 feet above ground level (AGL), and a ceiling of 5300 feet AGL. Sunrise occurred approximately 18 minutes after the occurrence, at 0818.

Weather was not a factor in this occurrence.

[4] All tasks considered elementary work are listed in the *Aircraft Equipment and Maintenance Standards*. (Source: Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, Standard 625, Appendix A: Elementary Work)

Aircraft information

The occurrence aircraft was manufactured by de Havilland Aircraft of Canada Ltd. in 1953 and was equipped with a Pratt & Whitney USA R-985-AN-14B engine and EDO 679-4930 floats. Records indicate the aircraft was equipped and maintained in accordance with existing regulations.

The aircraft ignition system is independent of the battery master switch and the battery system. The ignition system uses 2 magnetos that are coupled to the engine crankshaft and an ignition switch that is mounted in the cockpit. The rotary ignition switch has 4 positions: OFF (OFF for both magnetos), R (ON for the right magneto), L (ON for the left magneto), and BOTH (ON for both magnetos). Under normal operations, there are only 2 conditions that must be met for one or both of the magnetos to function:

- The engine crankshaft must be rotating.
- The ignition switch must be in one of the ON positions.

When the ignition switch is in one of the ON positions, the engine crankshaft rotation and, consequently, the magneto rotation enable the magneto(s) to generate a high voltage and create the spark required for ignition. Therefore, the engine can be started with manual rotation of the propeller regardless of the position of the battery master switch or the charge of the battery.

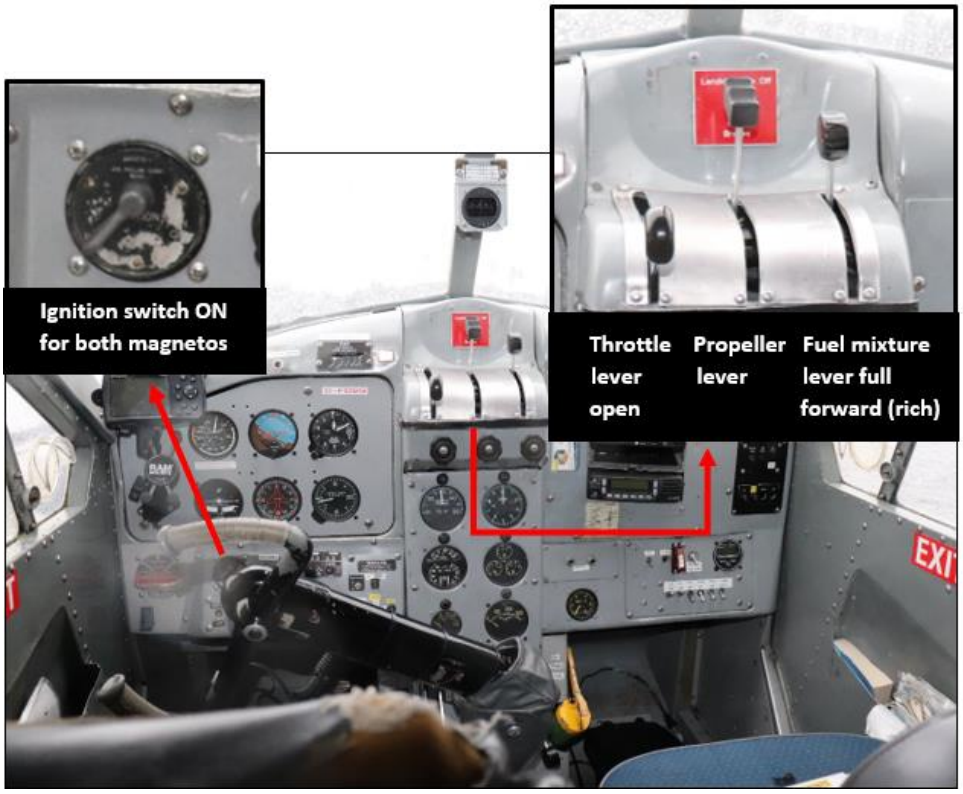
Aircraft examination

Approximately 45 minutes after the occurrence, the PRM examined the aircraft and found the battery master switch in the OFF position and the aircraft engine controls configured for a normal engine start, as outlined by the airplane flight manual (AFM):[5] the throttle lever was slightly open, the fuel mixture lever was in the full forward (rich) position,[6] and the ignition switch was in the ON position for both magnetos (Figure 2). The investigation could not determine the exact time at which the pilot configured the engine controls for start.

[5] Viking Air Ltd., Product Support Manual (PSM) 1-2-1, *DHC-2 Beaver Airplane Flight Manual* (2006), section 2.4.1: Normal Engine Start, p. 21.

[6] The aircraft engine (R-985-AN-14B) had carburetor model NA-R9B installed with a manual mixture control and 3 identified mixture lever settings: idle cut-off, full lean, and full rich.

Figure 2. Photo, taken 5 hours after the occurrence, showing the aircraft engine control positions as found by the person responsible for maintenance 45 minutes after the occurrence (Source: Royal Canadian Mounted Police, with TSB annotations)



During this examination, the PRM also observed the following:

- The control column and the handwheel were locked by the left-hand seat belt as outlined in the AFM.[7]
- The engine cover had been removed and was lying on the dock.
- A glove was resting inside the front of the engine cowling at the 6 o'clock position.

The PRM function tested the battery master switch and found that when the battery master switch was turned on, the master relay for that circuit would not connect the battery to the aircraft electrical system to supply electrical power. The following day, maintenance replaced the relay and then tested the aircraft electrical system, including the battery master switch and the battery, with satisfactory results.

[7] Viking Air Ltd., Product Support Manual (PSM) 1-2-1, *DHC-2 Beaver Airplane Flight Manual* (2006), section 1.11.4: Control Locks, p. 12.

Propeller safety

During the daily inspection of the occurrence aircraft, the pilot had to check the propeller for water damage, per the company standard operating procedures (SOPs),[8,9] but the procedure does not define the steps or the techniques used to complete the inspection.

The AFM for the aircraft describes 2 cases in which the manual rotation of the propeller is warranted:

- to ensure there is no hydraulic lock in the cylinders from excess oil;[10] and
- to clear excess fuel from the engine if over-primed.[11]

In both cases, the AFM indicates that all switches must be off and the mixture lever must be set to idle cut-off to prevent an unintentional start during propeller rotation. TC's *Flight Training Manual*[12] and *From the Ground Up*[13] also identify that the aircraft ignition (magneto) switches must be off during any inspection or hand movement of the propeller before starting the engine.

Hand propping, the procedure wherein an aircraft engine is intentionally started by rotating the propeller by hand, is the only time the engine controls are set to the start position while the propeller is manually rotated. The *FAA Airplane Flying Handbook*[14] warns that "a spinning propeller can be lethal should it strike someone"[15] and that hand propping should be the last option to start an aircraft. The handbook also says that "[i]t is critical that the procedure never be attempted alone."[16] In the case of a floatplane, TC's *Flight Training Manual*[17] adds that the propeller must be rotated from behind with the person standing and bracing on the right-hand float. The company SOPs and the aircraft AFM do not have a hand-propping procedure for the occurrence aircraft.

In this occurrence, the pilot was standing on a plank in front of the aircraft when the propeller was manually rotated with the engine controls configured for start, but the video resolution from the closed-circuit television camera was insufficient to enable the investigation to determine whether the

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[8] Pacific Coastal Airlines, *Standard Operating Procedures—Dehavilland Beaver,* Amendment 3 (14 April 2016), section 3: Normal Operating Procedures (Straight Floats), p. 30.

[9] Wilderness Seaplanes began as the seaplane division of Pacific Coastal Airlines until it became a separate entity in 2016. (Source: Wilderness Seaplanes, https://www.wildernessseaplanes.com/aboutus-info.php [last accessed on 25 March 2021].) Wilderness Seaplanes is still owned by Pacific Coastal Airlines and it still uses Pacific Coastal Airline's de Havilland Beaver standard operating procedures.

[10] Viking Air Ltd., PSM 1-2-1, *DHC-2 Beaver Airplane Flight Manual* (2006), section 2.3: Before Starting Engine, p. 19.

[11] Ibid., section 2.4.2: Failure in Starting, p. 21.

[12] Transport Canada, TP 1102E, *Flight Training Manual,* 4th edition (revised August 2004), Chapter 3: Inspection: p. 19.

[13] S. A. F. MacDonald and Isabel L. Peppler, *From the Ground Up* (Aviation Publishers Co., Millennium Edition [2000]), p. 81.

[14] Federal Aviation Administration (FAA), FAA-H-8083-3B, *Airplane Flying Handbook* (2016), p. 2-13, at https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/airplane_handbook/media/04_afh_ch2.pdf (last accessed 30 March 2021).

[15] Ibid.

[16] Ibid.

[17] Transport Canada, TP 1102E, *Flight Training Manual,* 4th edition (revised August 2004), Exercise 26: Floatplanes, Starting the Engine, p. 183.

propeller rotation was intentional (oil scavenging, inspection, or hand propping) or unintentional (pilot bracing due to a loss of footing or falling).

Aircraft ground operations on water

Ground operations at a water aerodrome expose flight and ground crews to the risk of drowning. This risk can be mitigated with the implementation of physical defences. TC's *Flight Training Manual*[18] notes that the surface on the aircraft floats is typically wet and suggests that "floatplane pilots should wear shoes or boots that afford a good grip." In addition, the *Canada Occupational Health and Safety Regulations*[19] state that "if there is a risk of injury due to slipping in a work place, the employer must ensure that slip-resistant footwear is worn."

The company does not have a policy on footwear, and the investigation could not determine if the pilot slipped during his pre-flight duties in this occurrence.

Wearing a personal floatation device (PFD) will increase the probability of survival in water by keeping a person afloat.[20] The *Canada Occupational Health and Safety Regulations*[21] require an employer to provide a PFD for every person exposed to the risk of drowning in the workplace unless a fall-protection system is in place.

The company had supplied CAW5 with 1 PFD for employees to use during dock operations. The pilot was not wearing the PFD, nor was he required to wear it by company policy or regulations.

Due to the propeller strike and the pilot's resultant injuries, it could not be determined whether the outcome of the occurrence would have been altered had the pilot been wearing a PFD.

Safety actions taken

In response to this occurrence, Wilderness Seaplanes Ltd. now requires all staff at CAW5 to wear a PFD while working on the dock and to complete propeller safety training.

Safety message

If an aircraft propeller is manually rotated, operators and crews need to be aware that inadvertent engine ignition can occur, potentially causing fatal injuries. Flight and ground crews are reminded to exercise extreme caution while working in close proximity to aircraft propellers.

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[18] Ibid., Exercise 26: Floatplanes, General Considerations, p. 183.

[19] Employment and Social Development Canada, SOR/86-304, *Canada Occupational Health and Safety Regulations* (last amended on 01 January 2021), Part XII: Protection Equipment and Other Preventive Measures, subsection 12.11(3).

[20] Canadian Red Cross, *The Floatation Report — Lifejackets/Personal Floatation Devices and Boating Fatalities in Canada: 20 Years of Research* (2016), PFD Effectiveness, p. 69, at https://www.redcross.ca/crc/documents/What-We-Do/Swimming-Water-Safety/2016_Flotation_Report_E_May30.pdf (last accessed 31 March 2021).

[21] Employment and Social Development Canada, SOR/86-304, *Canada Occupational Health and Safety Regulations* (last amended on 01 January 2021), Part XII: Protection Equipment and Other Preventive Measures, subsection 12.15(1).

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 16 June 2021. It was officially released on 25 June 2021.

Visit the Transportation Safety Board of Canada's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

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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