Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AIR TRANSPORTATION SAFETY INVESTIGATION REPORT A19P0059

ENGINE POWER LOSS, FORCED LANDING INTO TREES

Lakes District Air Service Ltd.
Cessna 182E, C-FLVN
Smithers, British Columbia, 50 NM N
04 May 2019

Canada

ABOUT THIS INVESTIGATION REPORT

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Summary

On 04 May 2019, the Lakes District Air Service Ltd. Cessna 182E (registration C-FLVN, serial number 18253755) was conducting a fire surveillance flight under daytime visual flight rules. The flight was being conducted on behalf of the BC Wildfire Service in the vicinity of Smithers, British Columbia, with the pilot and 3 crew members on board. Approximately 3 hours into the flight, the pilot transmitted a Mayday before communication was lost. The 406 MHz emergency locator transmitter activated on impact and its signal was received by the Canadian Mission Control Centre. A helicopter search was conducted and the aircraft wreckage was located in a forested area approximately 50 nautical miles north of Smithers, 500 feet north of the Babine River, 5.6 nautical miles east of the Silver Hilton Steelhead Lodge airstrip. The aircraft had collided with trees and terrain. One crew member survived the crash and was transported to hospital by helicopter. The pilot and the other 2 crew members were fatally injured. The aircraft was destroyed; there was no post-impact fire.

1.0 FACTUAL INFORMATION

1.1 Background

On 30 April 2019, 4 days before the occurrence flight, the pilot and the 3 crew members arrived at Burns Lake, British Columbia (BC), to prepare for conducting fire surveillance flights on behalf of the BC Wildfire Service. The occurrence aircraft, C-FLVN, was already at the Burns Lake Airport (CYPZ), the main base of operations for the aircraft operator (Lakes District Air Service Ltd.).

On 01 May 2019, an imaging-sensor-equipped belly pod was installed on the aircraft (Figure 1), as per Supplemental Type Certificate (STC) SA4-662. On 02 and 03 May, flights were conducted to test and calibrate the scanning equipment to detect underground hot spots in areas of previous fire activity. During those flights, it was determined that the best scanning results were obtained when the aircraft flew at a height of between 3000 and 4000 feet above ground level (AGL) and a groundspeed between 80 and 90 knots. It was also determined that the scans were best performed early in the day, before solar heating of ground objects resulted in erroneous infrared signatures.

Figure 1. The occurrence aircraft on the morning of the accident with imaging sensor belly pod installed (Source: Precision Vector Aerial Inc., with TSB annotation)

1.2 History of the flight

At 0541[1] on 04 May 2019, the occurrence aircraft departed CYPZ with the pilot and 3 crew members on board. The purpose of the flight was to scan for hot spots in 3 areas[2] of

1 All times are Pacific Daylight Time (Coordinated Universal Time minus 7 hours).

2 Poor weather forecast near Dease Lake caused the scan at one location to be postponed, leaving 2 areas near Smithers, British Columbia.

previous fire activity. The aircraft was carrying full fuel, which allowed for a flight endurance of approximately 5.5 hours.

The aircraft's location throughout the flight was being monitored by the BC Wildfire Service's Northwest Fire Centre (NWFC) in Smithers, and by Lakes District Air Service Ltd. via tracking units installed in the aircraft. In addition to the electronic flight-following, radio check-ins between the pilot and the NWFC dispatchers occurred about every half hour.[3]

The aircraft flew from CYPZ to the first scanning site, approximately 50 nautical miles (NM) north-northwest, where it conducted scanning passes for 51 minutes while flying between 2500 and 3100 feet AGL.

The aircraft then continued 36 NM further north-northwest to the 2nd scanning site, 86 NM from CYPZ and about 48 NM north of Smithers. Radio check-ins confirmed normal operation, including a check-in at 0821, after more than an hour of scanning in the 2nd area. Shortly after that radio check-in, the aircraft's engine performance degraded. At 0832, the pilot advised the NWFC dispatchers that the aircraft would be landing at the Silver Hilton Steelhead Lodge airstrip,[4] which was located approximately 2.5 NM to the northwest (Figure 2, radio transmission 1).

At 0833, the pilot transmitted a Mayday call to the NWFC dispatchers indicating that the flight would be unable to reach the Silver Hilton Steelhead Lodge airstrip and stated that he would "land 5 miles west"[5] of the airstrip (Figure 2, radio transmission 2).

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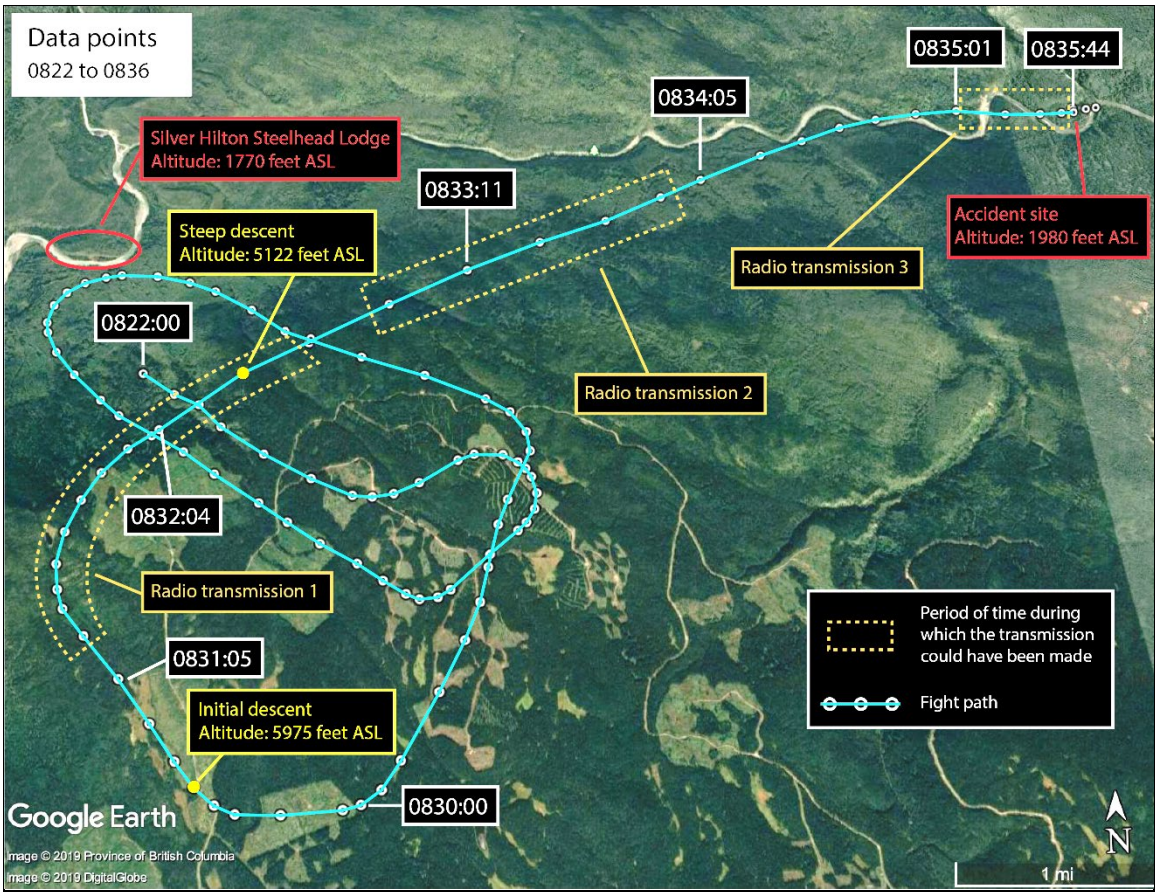
3 Radio communications were recorded but were not saved following the accident and were recorded over, leaving only the written communications log notes.

4 The Silver Hilton Steelhead Lodge airstrip is a private gravel and grass airstrip at a fishing camp on the Babine River. The airstrip, which measures about 1800 feet in length, is rough, and only about 1200 feet of it are useable. The pilot had not landed at Silver Hilton Steelhead Lodge before and, because the belly pod was installed, the aircraft was not approved to land on unpaved airstrips.

5 The aircraft actually crashed 5.6 nautical miles east of the Silver Hilton Steelhead Lodge airstrip.

Figure 2. Flight path of the occurrence aircraft (dotted line) with associated events (Source: Google Earth, with TSB annotations)



At 0835, a final transmission from the pilot was received giving the position of the aircraft (latitude and longitude) and stating that the aircraft would be landing in the trees (Figure 2, radio transmission 3). Less than 1 minute later, the aircraft crashed into a forested area adjacent to the Babine River. The 406 MHz emergency locator transmitter (ELT) activated on impact and transmitted a signal, which was received by the Canadian Mission Control Centre (CMCC). The CMCC then relayed the information to the Joint Rescue Coordination Centre (JRCC) Victoria.

Shortly after the pilot's last radio transmission, the NWFC enacted its emergency response plan, which included dispatching 3 helicopters from Smithers to search for the occurrence aircraft.

The 1st helicopter arrived at the aircraft's last reported position at 1036 and, approximately 20 minutes later, located the accident site about 0.4 NM northeast of the last reported position. A survivor was spotted near the wreckage. A 2nd helicopter, carrying a local search and rescue team and a Royal Canadian Mounted Police member, arrived overhead the site at 1135 and was able to land nearby, reaching the survivor at 1202. A third helicopter was dispatched and staged at the Silver Hilton Steelhead Lodge to provide additional support if required.

At 1246, a search and rescue Cormorant helicopter arrived on scene. The survivor, who was seriously injured, was extricated using a hoist and taken to hospital.

1.3 Injuries to persons

Table 1. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft
Fatal	3	0	3
Serious	1	0	1
Minor	0	0	0
None	0	0	0
TOTAL	4	0	4

1.4 Damage to aircraft

The aircraft struck multiple treetops along a nearly 500-foot-long path eastbound before striking a large tree trunk and descending steeply, coming to rest nose-down at the base of a small berm. The aircraft was destroyed due to collision with trees and terrain (Figure 3).

Figure 3. The occurrence aircraft at the accident site, with the right wing atop a tree (Source: TSB)

1.5 Other damage

Not applicable.

1.6 Personnel information

Records indicate that the pilot was certified and qualified for the flight in accordance with existing regulations. The pilot had passed his last medical examination on 26 April 2019, 8 days before the accident. The pilot had retired in 2013 from a career as a corporate and airline pilot. At the time of the accident he had accumulated over 46 000 hours of flight time, of which 73 hours were on the occurrence aircraft. This was the second summer in which the pilot flew for Lakes District Air Service Ltd.

The pilot had completed recurrent training and a pilot competency check on the aircraft 4 days before the accident. Training at Lakes District Air Service Ltd. suggested that forced landings at times of the year when rivers have higher water levels and are flowing faster should be made into trees, not water.

The pilot owned 3 Piper PA-22 (Tri-Pacer) aircraft, which he flew recreationally, accumulating approximately 150 flight hours per year. All 3 aircraft were equipped with carbureted engines and carburetor heat systems.

1.7 Aircraft information

1.7.1 General information

The occurrence aircraft, a Cessna 182E manufactured in 1962, was a four-seat, high-wing monoplane of primarily aluminum construction. The aircraft was originally equipped with long-range fuel tanks (84 U.S. gallons, 78 U.S. gallons useable), a Continental O-470-R engine rated at 230 hp, and a carburetor air temperature system. The aircraft was imported to Canada in 1973.

In 2004, the Continental O-470-R engine was replaced with a Texas Skyways O-550F/TS engine, serial number 824089-R, driving a constant-speed 3-blade Hartzell PHC-C3YF-1RF propeller. Records indicate that the aircraft had been modified by at least 37 STCs, several of which were directly related to the installation of the Texas Skyways O-550F/TS engine. These changes included modifications to the carburetor, and replacement of the engine mount and propeller. The aircraft was equipped with wingtip extensions (STC SA93-136), which increased the aircraft's maximum gross take-off weight to 2950 pounds.

Lakes District Air Service Ltd. purchased the aircraft in 2008. The last 100-hour inspection was completed on 09 April 2019. The last journey log maintenance entry was the installation of the belly pod on 01 May 2019. There were no deferred defects.

The investigation determined that the aircraft was within weight and balance limits during the occurrence flight.

At the time of the accident, the aircraft had accumulated about 6548 hours total time and the engine had accumulated about 1736 hours since its last overhaul. The maximum allowable time between engine overhauls is 2500 hours.

Records indicate that the aircraft had an ongoing history of carburetor air box repairs and alternator-related maintenance.

1.7.2 Texas Skyways engine replacement

The Texas Skyways O-550F/TS engine is a 300-hp Continental IO-550-FT engine modified by Texas Skyways STC SE09131SC, primarily by removing the fuel injection system and installing a modified carburetor. Texas Skyways literature states, "The Texas Skyways modification derates the horsepower to 285HP at 2700 RPM by placing a red dot on the manifold pressure gauge."[6]

Installation of the Texas Skyways O-550F/TS engine into a Cessna 182E aircraft must be done in accordance with Texas Skyways STC SA09133SC. This STC includes a requirement to install a digital tachometer, an upgraded engine mount, and one of 3 approved propeller models.

The carburetor (Marvel Schebler model MA-4-5 MOD, part number 10-4893-1, serial number M3965204) was modified by the carburetor type certificate holder as part of the Texas Skyways engine STC. At the time of the accident, a temperature probe was not installed in the carburetor, and the aircraft was not equipped with a carburetor air temperature gauge. Neither the temperature probe nor the carburetor air temperature gauge was required to be installed.

1.8 Meteorological information

On the day of the accident, the graphic area forecast (GFA) issued for the area surrounding Smithers at 0431 and valid at 0500 for 12 hours, provided the following weather forecasts:

- Broken clouds 14000 feet with tops at 18000 feet above sea level (ASL)
- Scattered clouds 4000 feet with tops at 8000 feet ASL
- Visibility of more than 6 statute miles (SM), with localized areas of visibility of ½ SM, and freezing fog and cloud ceilings at 500 feet AGL

This forecast was available to the pilot before the flight's departure from CYPZ; the investigation could not determine if he accessed it, however.

The upper wind forecast for Smithers Airport valid from 0200 to 1100, at 6000 feet ASL, were westerly at 21 knots.

The nearest weather station to the accident site was Nilkitkwa, BC, about 14 NM east-southeast, situated at 3180 feet ASL and maintained by BC Wildfire Services. At 0800 and 0900 respectively, the Nilkitkwa weather station recorded surface temperatures of 6.5 °C and 6.7 °C with dew points of −0.7 °C and −1.0 °C. The surface temperatures at Smithers Airport, about 48 NM south at 1716 feet ASL, were 8.8 °C and 10.8 °C, with dew points of 1.6 °C and 0.8 °C. Surface winds at these 2 locations were predominantly from the north-northwest at less than 10 knots.

Two cameras recovered from the accident site contained photographs taken during the accident flight. A photo taken while the aircraft was scanning in the second area, about

6 Texas Skyways Inc., letter to Guardian Aerospace (23 February 2004).

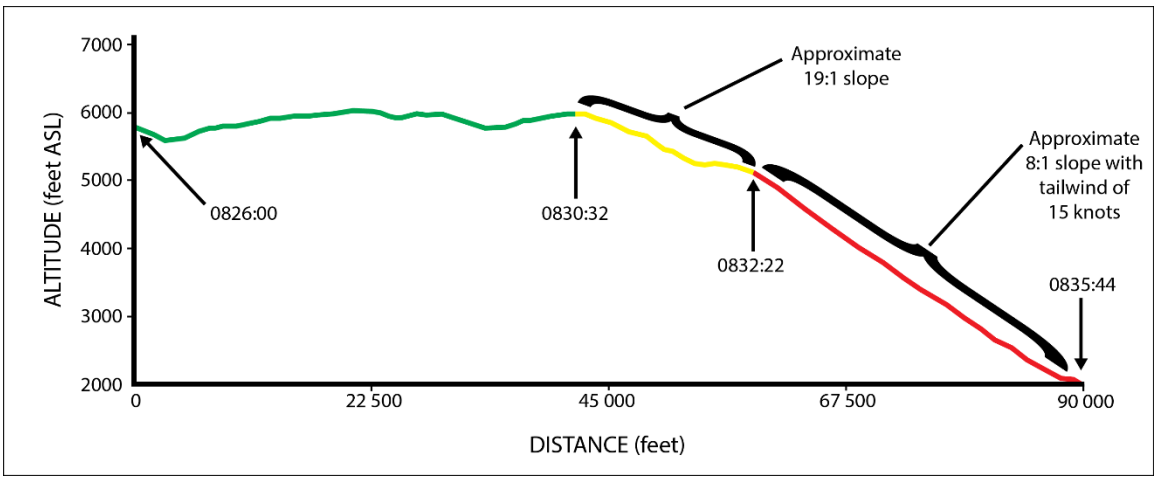
42 minutes before the accident, shows rain showers around the aircraft. A photo taken about 13 minutes before the accident shows the aircraft's outside air temperature (OAT) gauge reading 45 °F/7 °C. GPS (global positioning system) information indicates that the aircraft altitude at that time was about 5600 feet ASL.

1.9 Aids to navigation and aircraft performance

The flight was conducted under visual flight rules and in daylight visual meteorological conditions. The aircraft was equipped with a Garmin Aera 795 GPS. Data from this GPS were recovered and are presented in Figure 4. The investigation determined that the Silver Hilton Steelhead Lodge airstrip was not in the GPS database, nor was it required to be according to company procedures or Transport Canada regulations.

The maximum glide chart in the 1966 Cessna 182J owner's manual[7] indicates a power-off glide ratio of about 10:1 with the propeller windmilling and the flaps retracted.

Figure 4. Occurrence aircraft altitude profile for the last 10 minutes of the flight (Source: TSB)



1.10 Communications

Not applicable.

1.11 Aerodrome information

Not applicable.

1.12 Flight recorders

The aircraft was not equipped with a flight data recorder or cockpit voice recorder, nor was it required to be by regulation.

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7 The 1962 Cessna 182E owner's manual does not include a maximum glide chart, but the 182E and 182J share similar performance specifications.

1.13 Wreckage and impact information

The wreckage was located about 500 feet north of the Babine River, about 5.6 NM east of the Silver Hilton Steelhead Lodge airstrip. At the time of the accident, the Babine River was in freshet and, as a result of the fast-flowing high water, almost no gravel bars or open shorelines were visible.

The propeller remained attached to the engine. All 3 blades were bent back equally but were otherwise undamaged, including leading edges and tips.

The gascolator contained 100LL avgas with no contamination present in the bowl or screen. The throttle control was fully in (full throttle), the mixture control was fully in (full rich mixture), and the propeller control was fully in (full fine pitch).

Both wing tank fuel caps were found secured. The fuel selector valve[8] was selected to "both," and no contamination was found in the fuel lines or the carburetor. The carburetor air box was crushed at impact and no determination could be made of its pre-impact condition. However, the carburetor heat control remained connected to the carburetor air box and was found in the fully-in (cold) position. At impact the control had been bent at 90 degrees immediately forward of the instrument panel, trapping the centre control wire in the "carb heat cold" position. Measurement of the flap screw jack showed that the flaps were fully extended at impact.

The aircraft wreckage was recovered from the accident site and examined by TSB investigators. The engine was sent to a certified overhaul facility for examination with TSB investigators in attendance.

The engine could not be run on a test stand, primarily because of extensive crushing damage to the oil pan, so the engine was torn down and inspected. No pre-impact mechanical defects were found that would explain a total or partial power loss. However, several anomalies were found.

The outer portion of the alternator drive belt (the portion that does not contact the pulley grooves) was excessively and abnormally worn, and a large amount of rubber dust had been deposited on the firewall and accessory section of the engine. Records show that the alternator had been replaced 6 times since the installation of the Texas Skyways O-550F/TS engine in 2004. The alternator mounting brackets, wiring, and drive belts had also been replaced or repaired numerous times during that period. The alternator installed at the time of the accident was a 70 A Plane Power alternator, installed via STC SA10682SC. The tension arm to the alternator was not a type specified in the STC nor was it a Cessna 182 part originally installed on the aircraft.

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8 The shaft between the fuel selector handle and the fuel selector valve had bent and fractured at impact, but the valve was found in the "both" position.

The teardown also showed premature wear on some internal carburetor components.

In accordance with Cessna Service Letter 63-11[9] and Service Kit SK 180-24,[10] the source for carburetor heat had been changed from the original shroud around the muffler, to a small shroud on the left exhaust manifold. As well, the exhaust cones inside the muffler had been removed.

1.14 Medical and pathological information

There was nothing to indicate that the pilot's performance was degraded by fatigue, medical or physiological factors.

1.15 Fire

There was no post-impact fire.

1.16 Survival aspects

The investigation determined that the aircraft initially contacted the trees in a wings-level attitude with full flaps deployed and at a relatively slow speed. However, as the aircraft descended into the trees, the right wing struck a large tree, which resulted in a steep descent into the ground at the base of a berm. The impact of the aircraft with the base of the berm prevented the aircraft from sliding forward, increasing the deceleration forces.

The pilot, seated in the front left seat, and the crew member, seated in the front right seat, were both wearing a lap belt and shoulder harness at the time of the accident. Rear-seat shoulder harnesses were not installed, nor were they required to be, but both rear-seat occupants were wearing their available lap belts. The crew member in the rear left seat survived the accident and was able to exit the aircraft by himself after the aircraft came to a stop. The pilot and the other 2 crew members were fatally injured on impact.

1.17 Tests and research

1.17.1 TSB laboratory reports

The TSB completed the following laboratory report in support of this investigation:

- LP100/2019 Engine Instrument Six-pack Examination

1.18 Organizational and management information

Lakes District Air Service Ltd. is an operator in north-central BC that started in 1976. It is authorized to conduct aerial work and air taxi operations under Subpart 702 and

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9 Cessna Aircraft Company, Service Letter 63-11 (22 February 1963).

10 Cessna Aircraft Company, Service Kit SK 180-24, Modification of Carburetor & Cabin Heat System (revised 27 May 1963).

Subpart 703 of the *Canadian Aviation Regulations* (CARs), respectively. The accident flight was conducted under Subpart 702.

1.19 Additional information

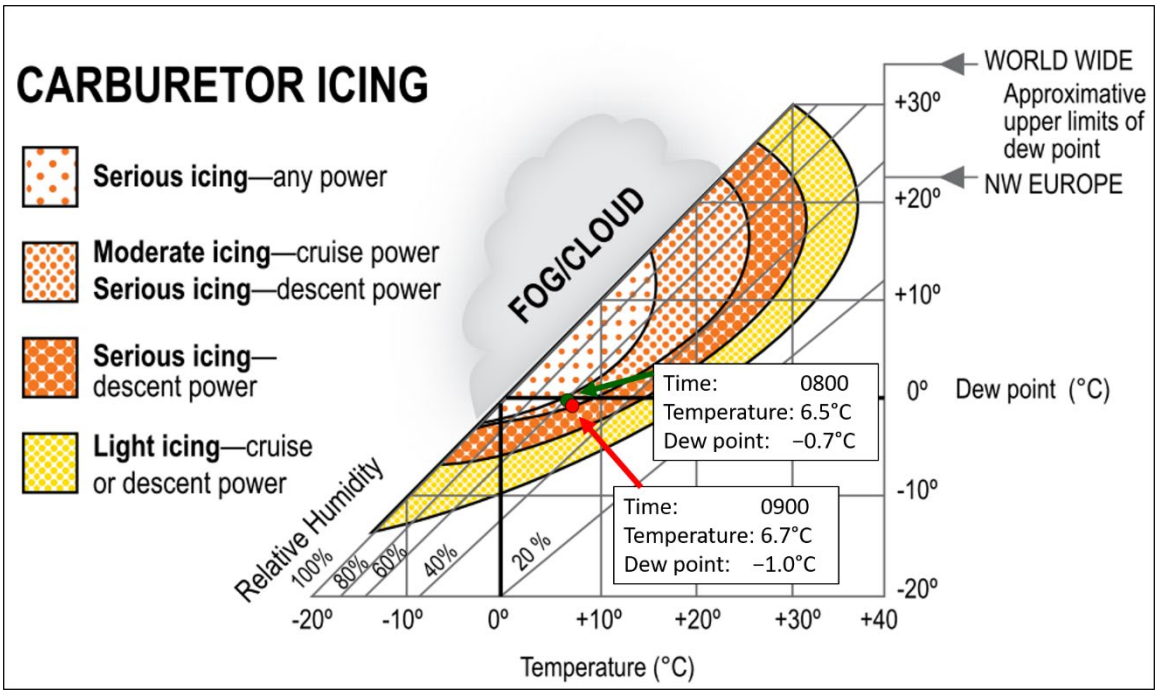
1.19.1 Carburetor icing

Carburetor icing is a phenomenon where water vapour in the air freezes and adheres to internal surfaces of the carburetor. This occurs because the temperature of air entering the carburetor is reduced by the effect of fuel vaporization and by the decrease in air pressure caused by the Venturi effect. If the air temperature in the carburetor drops below freezing, ice may form on internal surfaces of the carburetor, including the throttle valve.

Use of partial power increases the likelihood of ice buildup on the throttle valve and decreases the exhaust system heat available for the anti-ice system. Use of richer mixtures increases the cooling effect of fuel vaporization. As ice forms, this increases the Venturi cooling effect due to narrowing of the carburetor throat and this narrowing reduces power output. If significant ice is allowed to develop within the carburetor and full heat is applied to melt it, the resultant water flow through the engine causes the engine to run rough and to lose further power and may even cause the engine to quit. Unchecked, the ice can quickly lead to a complete engine failure. To overcome carburetor icing, aircraft manufacturers provide a system to heat the incoming air and prevent ice accumulation.

To help determine whether atmospheric conditions are likely to produce carburetor ice, charts that compare outside ambient temperature and dew point have been produced (Figure 5).

Figure 5. Carburetor icing potential based on ground-level weather conditions at Nilkitkwa, BC (Source: Transport Canada, TP 14371, Transport Canada Aeronautical Information Manual [TC AIM], AIR – Airmanship [10 October 2019], section 2.3, with TSB annotations)



The chart indicates that, based on the temperature and dew point at the weather station 14 NM from the accident site at the time of the occurrence, the conditions were conducive to serious carburetor icing even at cruise power. Although the dew point at the aircraft's location is not known, nearby rain showers indicate humidity at least as high as that at the weather station. When a dewpoint is not precisely known, the presence of precipitation should indicate to pilots that atmospheric conditions are high in relative humidity.[11] Furthermore, the likelihood of accumulating carburetor ice increases as both relative humidity increases and air temperature decreases towards 0°.[12]

Ice that forms in a carburetor during flight rarely remains after a crash, making carburetor ice difficult to identify as a cause of power loss. Nonetheless, accidents and incidents involving carburetor icing are prevalent in aviation, and engine power loss due to carburetor ice has been indicated in 2 recent U.S. accidents involving Cessna 182 aircraft equipped with Texas Skyways O-550 engines, one in 2014[13] and another in 2018.[14]

1.20 Useful or effective investigation technique

Not applicable.

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11 UK Aeronautical Information Service, Aeronautical Information Circular (AIC) P 077/2009: Induction system icing on piston engines as fitted to aeroplanes, helicopters and airships (10 Sept 2009), at http://www.nats-uk.ead-it.com/aip/current/misc/AIC/EG_Circ_2009_P_077_en.pdf (last accessed on 12 May 2020).

12 Federal Aviation Administration (FAA) A20-113, Pilot precautions and procedures to be taken in preventing aircraft reciprocating engine induction system and fuel system icing problems (22 October 1981) at https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_20-113.pdf (last accessed on 12 May 2020).

13 National Transportation Safety Board Aviation Accident Final Report of accident number WPR14LA208, at https://app.ntsb.gov/pdfgenerator/ReportGeneratorFile.ashx?EventID=20140524X94635&AKey=1&RType=Final&IType=LA (last accessed 10 May 2020).

14 National Transportation Safety Board Aviation Accident Preliminary Report of accident number CEN19FA008, at https://app.ntsb.gov/pdfgenerator/ReportGeneratorFile.ashx?EventID=20181016X94909&AKey=1&RType=HTML&IType=FA (last accessed 10 May 2020).

2.0 ANALYSIS

2.1 Introduction

The pilot was medically fit and qualified for the flight. The aircraft had sufficient fuel for the intended flight. No performance issues had been reported for almost 3 hours of the flight. No pre-impact mechanical defects were found that would explain a total or partial power loss. As a result, this analysis will focus on the effects of carburetor icing.

2.2 Carburetor icing

The engine teardown did not reveal any mechanical cause for an engine power loss.

There have been 2 recent accidents in the U.S. indicating carburetor icing on similar aircraft with the same engine modification, signalling that these aircraft may be susceptible to the accumulation of carburetor ice.

The temperature and humidity in the area where the flight took place were conducive to serious carburetor icing at any engine power setting. In addition, the mission required the aircraft to be operated at low groundspeeds, which necessitated a partial-power setting that made the occurrence engine even more susceptible to the formation of carburetor ice. The combination of the aircraft operating at a partial power setting and in atmospheric conditions conducive to carburetor icing likely resulted in ice forming in the carburetor.

The GPS (global positioning system) data shows that when the aircraft's performance started degrading, the aircraft started a shallow descent (about 19:1 glide ratio) that lasted for almost 2 minutes, consistent with partial engine power. This was followed by a steeper descent (about 8:1 glide ratio) that lasted for over 3 minutes, consistent with a complete engine power loss. The ice that likely formed in the carburetor would have initially reduced the engine's ability to produce enough power to maintain altitude and eventually led to a complete loss of power.

The carburetor heat control was found in the fully-in (cold) position. The pilot owned 3 carbureted aircraft and would have been familiar with the operation of carburetor heat systems, so it was unlikely that he would not have applied it in these circumstances. The investigation also considered other scenarios. Carburetor heat may have been selected on at some time before the crash but was likely returned to the cold position before impact. It is also possible, though less likely, that the carburetor heat control was returned to fully-in (cold) position when the carburetor air box was crushed at impact. If carburetor ice had indeed accumulated, it could not be determined why it would not have been removed or reduced by the carburetor heat system.

The aircraft was not equipped with a carburetor air temperature indication system, nor was it required to be. However, when installed, these systems can indicate to pilots when conditions exist that are conducive to carburetor ice formation before ice begins to accumulate. If aircraft equipped with carburetors are not equipped with a carburetor temperature indication system, there is an increased risk that pilots will not be aware that

they are in conditions in which carburetor ice accumulation is possible and consequently will not take the appropriate remedial actions in time.

2.3 Forced landing

Following the initial engine problems, the pilot indicated an intention to land at Silver Hilton Steelhead Lodge airstrip; however, the aircraft tracked away from the airstrip, and the pilot reported that he would land west of it, when in fact the aircraft crashed east of it. The airstrip was not in the aircraft's GPS database, and, as a result, it is likely that the pilot was unable to locate it in sufficient time to conduct a safe landing before the engine failed.

The Babine River was in freshet and no gravel bars or open shorelines were visible. In such circumstances, pilot training at Lakes District Air Service Ltd. suggested forced landings should be made into trees, not water. These factors may have contributed to the pilot's decision to make a forced landing into trees rather than to ditch in the river.

3.0 FINDINGS

3.1 Findings as to causes and contributing factors

These are conditions, acts or safety deficiencies that were found to have caused or contributed to this occurrence.

1. The combination of the aircraft operating at a partial power setting and in atmospheric conditions conducive to carburetor icing likely resulted in ice forming in the carburetor.

2. The ice that likely formed in the carburetor would have initially reduced the engine's ability to produce enough power to maintain altitude and eventually led to a complete loss of power.

3. Following the initial engine problems, the pilot indicated an intention to land at Silver Hilton Steelhead Lodge airstrip; however, the airstrip was not in the aircraft's global positioning system database, and, as a result, it is likely that the pilot was unable to locate it in sufficient time to conduct a safe landing before the engine failed.

3.2 Findings as to risk

These are conditions, unsafe acts or safety deficiencies that were found not to be a factor in this occurrence but could have adverse consequences in future occurrences.

1. If aircraft equipped with carburetors are not equipped with a carburetor temperature indication system, there is an increased risk that pilots will not be aware that they are in conditions in which carburetor ice accumulation is possible and consequently will not take the appropriate remedial actions in time.

3.3 Other findings

These items could enhance safety, resolve an issue of controversy, or provide a data point for future safety studies.

1. The tension arm to the alternator was not a type specified in the supplemental type certificate nor was it a Cessna 182 part originally installed on the aircraft.

4.0 SAFETY ACTION

4.1 Safety action taken

4.1.1 Northwest Fire Centre

The Northwest Fire Centre (NWFC) has changed its standard operating procedures to include saving the audio recordings of dispatch activities following an incident or accident. Recordings are normally saved for 24 hours before being overwritten.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 20 May 2020. It was officially released on 08 June 2020.