Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A03A0013

FUEL STARVATION / FORCED LANDING

COMPUTAPLANE LTD.

CESSNA 188B N6606Q

BADGER, NEWFOUNDLAND AND LABRADOR 19 NM WNW

04 FEBRUARY 2003

Canada

Aviation Investigation Report

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ComputaPlane Ltd.
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Summary

The single-engine Cessna 188B aircraft, N6606Q, serial number 18802951T, was being ferried from Canada to Africa and was en route from St John's, Newfoundland and Labrador, to Goose Bay. On the first leg of the trip, approximately 1 hour 30 minutes into the flight, the pilot attempted to transfer fuel from a modified fuel tank to the wing tanks. The engine stopped producing power, and the pilot then carried out a forced landing in a snow-covered frozen bog. The aircraft nosed over during the landing roll and came to rest in a nose-down attitude. The pilot was not injured.

An overflying aircraft received the MAYDAY call sent out by the pilot, proceeded to the given coordinates, located the occurrence aircraft, and reported one person standing outside the aircraft. Halifax Rescue Co-ordination Centre requested an AS350 helicopter, which was on a training flight, to proceed to the crash site for pickup. The helicopter arrived at the crash site approximately one hour after the accident, picked up the pilot, and transported him to Deer Lake.

Ce rapport est également disponible en français.

Other Factual Information

The pilot held a valid airline transport pilot licence and had approximately 2500 hours' flying time.

The accident occurred at approximately 1625 Newfoundland daylight time, 19 nautical miles west-northwest of Badger, Newfoundland and Labrador. The nearest weather reporting station, at Deer Lake airport, 40 miles west-northwest of the landing site, was reporting good weather conditions at the time of the occurrence with light westerly winds, visibility of 15 statute miles, ceiling 2400 feet, and a temperature of -2°C. The conditions at the accident site were similar.

This was the second attempt made to ferry this aircraft from Canada to its new owner, a company based in Kampala, Uganda. On 23 March 2002, an attempt to ferry the aircraft had failed after a different ferry pilot experienced problems while attempting to transfer fuel. The aircraft had safely returned to St. John's, where it remained in a hangar until the accident flight. The fuel transfer problem was not entered in the aircraft logbook, nor was it included on the list of snags (unserviceabilities) e-mailed by the pilot of the March 2002 flight to the ferry company. There was, however, verbal communication between these two parties about a fuel transfer problem.

The aircraft was being operated under Part 91 of the *Federal Aviation Regulations*, and as such would not be required to carry a flight/journey logbook or have the discrepancy recorded in a logbook. Federal Aviation Regulation (FAR) 91.7 states that the pilot in command of a civil aircraft is responsible for determining whether that aircraft is in a condition for safe flight. FAR 91.403(a) places the responsibility for maintaining the aircraft in an airworthy condition on the owner or operator of the aircraft. FAR 91.405(a) requires the owner or operator to ensure that discrepancies are repaired between required inspections and that maintenance personnel make appropriate entries in the maintenance records indicating that the aircraft has been approved for return to service.

The operator contracted with a local maintenance company to carry out specific maintenance tasks on the aircraft after the initial ferry flight: inspect the mixture control cable for proper operation and safety; replace the seal on the plexiglass window located on the top of the ferry tank (to facilitate the replacement of the seal, all the fuel was drained from the ferry tank and a large quantity of water was found in the drained fuel); replace the tail wheel tire; replace the magnetic compass; and perform periodic engine run-ups. The operator did not ask the maintenance company to troubleshoot the fuel transfer problem because they had dismissed this as being caused by improper operation of the fuel system. Consequently, the validity of the US flight authority and the Canadian validation of the US flight authority are suspect.

Because the aircraft was being ferried a long distance, it had been equipped with a Federal Aviation Authority-approved, modified fuel system to increase its range. This system allowed fuel to be carried in a hopper tank normally used on this type of aircraft for aerial application of agricultural chemicals. When using this system, the pilot would use fuel from the two wing tanks until the wing tank fuel quantity indicators showed half full. He would then transfer fuel from the hopper (ferry) tank to replenish the wing tanks. Fuel from the ferry tank is drawn through a Wicks filter assembly by electric fuel pumps and is introduced into the main fuel system on the forward fuel line from the right wing tank. With both wing tanks interconnected by a common fuel reservoir, as fuel is transferred from the ferry tank, fuel quantity increases evenly in the left and right wing tanks. The Wicks filter assembly incorporates a clear glass bowl

and drain valve that serves as a means to determine if contamination is present in the filter assembly and as a means to carry out a fuel drain check on a pre-flight inspection. There were no specific instructions in the flight supplement regarding pre-flight inspection of the filter assembly.

About an hour into the flight, while level at 5500 feet and with the power set at 2400 rpm and 24 inches, the fuel flow was 15 gallons per hour (gph). Without any change in the outside temperature or the power setting, the fuel flow dropped to 13 gph and was oscillating plus or minus 1 gph. The pilot selected the auxiliary fuel pump on; the fuel flow increased to 18 gph and stabilized at 17 gph with the pump off.

Approximately one and one-half hours into the flight, the occurrence pilot attempted to transfer fuel from the ferry tank to the wing tanks, from which about 25 US gallons had been consumed. At the time, the aircraft was flying above a cloud layer at an altitude of 5500 feet and the outside air temperature was -16°C. After 30 minutes, no fuel appeared to have transferred, and the fuel gauges for the wing tanks were indicating one-half on the left and one-quarter on the right. The pilot observed a large bubble in the transparent fuel line linking the ferry tank to the fuel transfer pumps. He turned off the transfer pumps and twisted the fuel lines on the transfer pumps to check for a possible loose fitting. When he turned on the fuel transfer pumps again, the bubble was still there. He then noted that the fuel flow indication had dropped to zero and that the engine had stopped producing power, but the propeller was still windmilling. Before the engine stoppage, there were no indications of an impending problem (such as sputtering, rough running, or vibrations).

When the occurrence pilot arrived in St. John's to start the ferry flight, he checked the aircraft paperwork and logbooks and found them to be in order. There was no entry in the logbook concerning the fuel transfer problem on the previous flight. When he performed his pre-flight inspection, he found that the ferry tank was dry and clean, and fuel samples drained from the main fuel system were the correct colour and had no residues. No attempt was made to drain fuel from the Wicks filter for the ferry tank, possibly because the ferry tank was found to be dry and clean. The operating instructions for the ferry tank fuel system did not contain specific instructions to drain fuel from the Wicks filter during the pre-flight. The pilot checked the operation of the fuel transfer pumps during his pre-flight and observed that they were drawing current and vibrating; however, no fuel was transferred because the ferry tank was dry. Before refuelling the aircraft, the manager of the refuelling company advised the pilot to drain the remaining fuel out of the main tanks because it had been in the tanks for a long time. The pilot declined to do this because he had never experienced a problem with old fuel. He did, however, carry out a fuel drain check of the main tanks after they had been filled, and again the fuel was found to be the correct colour and had no contamination.

Conflicting reports exist as to whether the occurrence pilot was made aware of the fuel transfer problems experienced on the first ferry attempt or of the fact that water had been found in the ferry tank when it was drained to replace the seal on the plexiglass window. The fuel transfer problem had not been entered in the aircraft logbook, nor was it required to be entered by Part 91 of the FARs, under which the aircraft was operating, nor did the maintenance entry in the logbooks regarding the replacement of the seal mention that water was found in the tank when it was drained to facilitate this work. However, the maintenance company and Transport Canada airworthiness inspectors both suggested to the pilot that a test flight be carried out before the ferry flight, to check for proper operation of the fuel transfer system. A test flight was not conducted.

After the accident and before TSB investigators arrived at the accident site, the wind flipped the aircraft over onto its back. The wing tanks and the ferry tank were found to be empty during the on-site examination of the aircraft. Discolouration of the snow indicated that fuel had drained from the tanks after the aircraft flipped over, indicating that there had been fuel in the tanks when the accident occurred.

After the aircraft was removed from the accident site, components of the fuel system were removed and examined. The following observations were made:

1. The Wicks filter for the ferry tank contained a mixture of fuel and water (approximately 60 per cent water). The filter also had a large amount of corrosion residue.

2. The bowl on the airframe fuel strainer assembly contained only a small quantity of a fuel/water mixture, which was mostly water. The interior of the bowl was heavily corroded, and the fuel strainer screen was severely contaminated with solid particles.

3. The line between the engine firewall and the engine-driven fuel pump contained a small quantity of fuel. This line had been cross-threaded onto the fuel pump fitting, but there was no sign of fuel leakage.

4. The fuel servo injector screen contained a small quantity of water and small particles of solid contaminants.

5. The fuel flow divider screen was heavily contaminated with solid particles and had signs of water contamination.

6. The fuel injector nozzles were examined by holding them up to a light and looking through them. Light is clearly visible through clean nozzles, but no light was visible through the nozzles removed from cylinders 1, 3, and 5. About 20 per cent of the light that would normally be seen through a clean nozzle was viewed through the nozzles from cylinders 2 and 4; about 80 per cent of the light was viewed through the nozzle from cylinder 6.

The fuel line between the engine firewall and the engine-driven fuel pump was forwarded to the TSB Engineering Laboratory, where it was subjected to a suction test, a pressure test, and an internal examination. No discrepancies were found that would have prevented fuel from flowing through the fuel line. The engine-driven fuel pump was examined and tested in the TSB regional wreckage facility, and it operated normally.

Analysis

The entire aircraft fuel system was found to be heavily contaminated with water and solid particle contaminants. The water in the system probably led to internal corrosion, which resulted in the fuel screens becoming severely contaminated with solid particles.

The combination of solid particle contaminants and ice forming after exposure to the cold temperatures at altitude probably resulted in a partial blockage, causing the initial drop in fuel flow. Activating the auxiliary fuel pump increased the fuel pressure and temporarily cleared this blockage. However, the particle contamination and the ice eventually completely blocked the

flow of fuel to the engine, and the engine stopped. The fuel transfer failure could also be attributed to ice, with water freezing in the fuel line linking the ferry tank to the transfer pumps.

The water contamination could have been introduced into the system from rain leaking through the defective seal on the ferry tank plexiglass window before or during the previous ferry flight attempt, from water condensing in the fuel tanks while the aircraft was on the ground for nine months with partial fuel in the fuel tanks, or during previous fuelling of the aircraft.

The conclusion that the initial fuel transfer problem was attributable to incorrect operation of the transfer system was not based on any firm data. An adequate examination of the fuel system after the initial ferry flight attempt would probably have revealed discrepancies (such as an improperly operating fuel system or fuel contamination) that would have been corrected before the second ferry flight attempt.

The following TSB Engineering Laboratory report was completed and is available on request:

LP30/2003 Fuel Supply Hose Examination

Findings as to Causes and Contributing Factors

1. Water contamination in the fuel system led to internal corrosion and solid particle contamination of the fuel screens. The contamination and water/ice led to a complete blockage of fuel flow to the engine, and the engine stopped.

2. The operator dismissed the fuel transfer problem on the initial ferry flight attempt as being caused by improper operation of the fuel system. The operator did not ask the maintenance company, which was contracted only to carry out specific tasks, to do a thorough inspection of the ferry tank fuel system.

3. An adequate examination of the fuel system after the initial ferry flight attempt would probably have revealed discrepancies (such as an improperly operating fuel system or fuel contamination) that would have been corrected before the second ferry flight attempt.

This report concludes the TSB's investigation into this occurrence. Consequently, the Board authorized the release of this report on 22 October 2003.