AVIATION INVESTIGATION REPORT
A03O0156

ENGINE FAILURE AND FORCED LANDING ON WATER

MOONEY M20E C-GOEN

WASAGA BEACH, ONTARIO 5NM WSW

24 JUNE 2003

Aviation Investigation Report

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Summary

The Mooney M20E aircraft, registration C-GOEN, serial number 210044, with only the pilot on board, departed the Midland/Huronia Airport, Ontario, at 0715 eastern daylight time (EDT), on a visual flight rules (VFR) flight to Charleston, West Virginia. A few minutes after take off, the pilot transmitted a distress call to Toronto Buttonville flight service station (FSS), reporting that the engine had lost power and he was diverting to Collingwood airport for an emergency landing. Shortly afterwards he reported a total engine power loss and his intention to ditch the aircraft in Georgian Bay. At 0723 EDT he reported his position to Toronto Buttonville FSS as 7.5 statute miles (sm) from Collingwood at 3000 feet above sea level (asl) and indicated that the emergency locator transmitter (ELT) was armed. This was the last radio transmission from the aircraft. The aircraft struck the water shortly thereafter.

Two pilots flying in the vicinity heard the distress call. Both pilots volunteered to divert to the last position reported by C-GOEN, but their search for the aircraft was unsuccessful. The Rescue Coordination Centre (RCC) was notified and at 0912 EDT, located the aircraft submerged in 58 feet of water, five miles west-southwest of Wasaga Beach, Ontario. Divers were requested and brought to the site by helicopter. The divers entered the water at 0932 EDT and examined the aircraft but could not locate the pilot. Once search and rescue personnel departed the site, police divers took over the search for the pilot; his body was found at approximately 1930 EDT.

Ce rapport est également disponible en français.

Other Factual Information

Aviation Routine Weather Reports (METAR) were obtained from two separate locations. Wiarton, located approximately 52 nautical miles (nm) to the northwest of the occurrence site, was reporting wind from 190°T at 5 knots, visibility 12 sm, clear skies, temperature 17°C, and hazy conditions. Muskoka, located approximately 52 nm to the northeast of the occurrence site, was reporting no wind, visibility 10 sm, temperature 14°C, and hazy conditions.

The pilot was qualified for the flight and had a valid private pilot licence. He had obtained the aircraft in June 1998, and his pilot log books indicated C-GOEN was the only aircraft he had flown since that date. He had flown a total of 1247 hours of which 830 hours were on C-GOEN. In early 1998, he successfully completed the Transport Canada course on Human Factors in Pilot Decision-Making. The pilot's medical records indicated that he suffered from a chronic shortness of breath as a result of a low blood haemoglobin count , and occasionally required supplemental oxygen. This condition would have lowered his ability to sustain prolonged physical activities. Autopsy results indicated that the pilot had drowned.

Aircraft records indicate that the aircraft was maintained in accordance with current regulations. Aircraft documentation indicates that the last inspection and maintenance were performed on the aircraft in September 2002, before it was stored for the winter season. The aircraft's next flight was in April 2003 and since then it had been flown frequently. The only non-scheduled maintenance recorded as of September 2002 was the installation of a transducer and a pitch computer in April 2003.

When the aircraft was recovered, it was found that the integrity of the cabin structure had not been compromised by impact with the water. It was concluded that the ditching was performed in a manner that likely would have made this accident survivable.

Two aviator breathing oxygen bottles were found on board. One was strapped to the back of the right hand front seat with a mask connected to the bottle. The regulating valve was found in the open position and the pressure indicator was at zero pounds per square inch (psi). A second bottle was found on the floor in the rear of the cabin and its regulator valve was closed. The pressure indicator was at 2000 psi. A portable oxygen level indicator used to determine blood oxygen level was also found on board the aircraft.

A life vest was found, partially inflated, underwater beside the aircraft. Only one of the two available carbon dioxide gas cartridges for inflating the vest chambers had been activated. The plastic safety pin was still installed on the second cartridge, and the seal was not punctured. To fully inflate the two chambered vest, both of the cartridges need to be activated. The waistband was adjusted to form a 3½-inch diameter circle which would not fit a normal waistline.

It could not be determined whether the pilot was familiar with the procedures for donning the life vest. Identification markings on the vest indicated that it was manufactured in February 1997. The manufacturer recommends having the life vests tested and re-certified every two years but no test or certification dates were identified on the life vest.[1] During testing, the life vest was fully inflated by blowing on the two alternate inflating tubes; no leakage was evident.

The aircraft was transported to a local marina where the engine was examined externally for indications of catastrophic mechanical failures; none was observed. Based on the lack of external damage, the engine was prepared for a ground run. The engine was successfully started and remained at idle power until temperatures stabilized. When the throttle was increased from the idle position, the engine quit. The fuel system was then checked for water contamination, and the fuel lines from the electric fuel pump to the injectors were drained. Prior to re-attaching the lines, a fuel pressure check from the electric pump to the fuel servo was successfully carried out with no blockage apparent in the fuel lines. A second start was successful, but the engine again stopped when the throttle was advanced. Fuel pressure checks at the inlet to the fuel servo revealed pump pressure was available, but from the servo outlet to the fuel injectors pressure was minimal.

The fuel servo was removed for testing at an approved repair facility. The servo fuel screen was removed and a small amount of sediment was extracted onto a paper filter. The amount of sediment would not have affected the flow of fuel through the screen and consequently engine power. An external inspection of the servo revealed no obvious faults and the servo was installed on test equipment for further evaluation. Test fluid at 20 psi was introduced to the inlet side of the servo; this value is equal to the pressure supplied by the aircraft's engine-driven fuel pump. The servo outlet flow was measured at 25 pounds per hour at full throttle. This flow rate would only be sufficient to sustain idle engine power.

Disassembly of the fuel servo metering unit revealed murky water globules between the diaphragms and plates and minor corrosion on the face of the plates. The diaphragms were visually checked and appeared to be serviceable. The water globules were cleaned from the surfaces and the diaphragm springs were checked for freedom of movement. The servo was re-assembled and re-attached to the test equipment. The same amount of inlet pressure was applied, resulting in an outlet fuel flow rate of 75 pounds per hour at full throttle. Inlet pressure was reduced to zero and reapplied, resulting in an outlet fuel flow rate of 125 pounds per hour. According to the manufacturer specifications, this is an acceptable flow rate to produce full engine power.

The fuel servo manufacturer recommends overhaul at engine overhaul intervals or every 10 years, whichever occurs first. The engine on the aircraft was last overhauled in March 1996. No documentation was available to determine whether the fuel servo was overhauled at that time.

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[1] Canadian Aviation Regulation 625 - Aircraft Equipment and Maintenance - Appendix C, states the following: Survival and emergency equipment shall be overhauled at the intervals recommended by the manufacturer.

The fuel tanks were checked for water contamination, and water was found in the tanks. The water was clear, not murky as found in the servo. The fuel system is "tight" from the tanks to the servo, and the only entry for water contamination would be from the tank supply. It can be concluded that this water was a result of the aircraft having been submerged for some time.

The aircraft was equipped with an automatic, fixed emergency locator transmitter (ELT) located in the rear of the cabin. During the Mayday transmission, the pilot stated the ELT switch was selected to the armed position. In this position, the ELT is automatically activated when it is subjected to sufficient impact forces. The ELT can be accessed through the aft luggage door, located on the right side of the fuselage, aft of the rear cabin window. The door, which can only be opened from outside the aircraft, was found in the open position. The ELT switch was found in the ON position. In this position, the automatic activation feature is by-passed and the emergency signal on 121.5 megahertz (MHz) frequency is immediately transmitted. There were no reports of a signal being received during the search for the aircraft. The ELT was removed from the aircraft for examination at an approved avionics repair shop.

A label on the exterior case of the ELT identified the most recent repair shop. Typed on the label was the next ELT certification due date, September 2003, and the battery replacement date, August 2003. During testing, the battery voltage output was measured at 12.4 volts. The acceptable voltage for certification is 14.4 volts; however, considering that the ELT was submerged with the aircraft in cold water for a period of approximately one and one half days before recovery, a voltage lower than optimum was anticipated. The cover was removed to expose the internal circuitry and substantial corrosion was found on the circuit boards. The switch was tested and found to be serviceable. This test also confirmed that battery power was still available. The ELT transmitter output was checked on a very high frequency (VHF) radio but no signal output from the ELT was received. It was determined that the transmitter was unserviceable.

The normal water temperature for Georgian Bay in the early summer is 10-13°C. Research has shown that an individual fully immersed in water at this temperature for a period of one to two hours will reach the stage of hypothermia where unconsciousness will occur. Treading water or swimming will cause body temperature to decrease at a faster rate than if a person remains immobile or is partially out of the water. Survival time for an individual is dependent on physical condition and the amount of exertion while in the water.

Analysis

A review of the weather reports from two different stations in proximity to the occurrence showed that weather was not a factor in this occurrence.

The aircraft remained afloat for an undetermined amount of time. It appears that, at some time, the pilot attempted to don his life vest, but, for undetermined reasons, it was not donned correctly and the inflation procedure was not completed. The ELT had been switched manually to the ON position, which means that the pilot had to have exited the aircraft, opened the rear luggage door from the outside to access the ELT, and manually selected the ELT on. Turning the ELT on should have ensured the transmission of the emergency signal; however, no emergency signal was transmitted due to the faulty transmitter.
While search and rescue personnel were able to locate the aircraft from the information the pilot had provided during the distress call, the unserviceability of the ELT likely prolonged the search.

The fuel servo metering unit was contaminated with water and over time had become somewhat corroded. During climb out from the departure airfield, it is likely the contaminants in the fuel servo either reached sufficient mass or migrated within the metering unit, such that outlet fuel pressure to the fuel injectors was restricted. As a consequence, the servo could only supply sufficient fuel pressure to the injectors to sustain idle engine power.

The pilot's medical condition and his not wearing a life vest likely contributed to his inability to survive in the water. To remain afloat the pilot would have to tread water, thereby expending vital body heat at a fast rate. The unconscious stage of hypothermia would have been encountered sooner than for a person in good physical condition and wearing a life vest.

Findings as to Causes and Contributing Factors

1. Examination of the fuel servo revealed water contamination and corrosion in the fuel metering unit of the servo, resulting in reduced outlet fuel pressure to the fuel injectors. The engine quit as a result of the reduced fuel pressure, and the aircraft descended into the water.

2. The emergency locator transmitter (ELT) did not transmit an emergency signal after it was selected to the ON position. The absence of a signal from the transmitter likely increased the time required by search and rescue personnel to locate the aircraft.

3. The procedures to inflate and don the life vest were not followed by the pilot after the ditching. The water temperature and the additional physical exertion from treading water without support of the life vest increased the rate of body temperature loss, which probably expedited the onset of hypothermia.

Other Findings

1. It was determined that the life vest was serviceable.

2. The pilot's chances for survival in the water may have been affected by his medical condition.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 18 May 2004.

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