



AVIATION INVESTIGATION REPORT A08C0124



FUEL STARVATION / FORCED LANDING

**MEADOW AIR LIMITED
CESSNA 337D, C-GYHW
BUFFALO NARROWS, SASKATCHEWAN, 14 nm NE
13 JUNE 2008**

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Aviation Investigation Report

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Summary

The Meadow Air Cessna 337D (C-GYHW, serial number 337-1111) was returning to Buffalo Narrows, Saskatchewan (SK), from Stony Rapids, SK, after having dropped-off a passenger. Approximately 14 miles northeast of the airport, the pilot declared an emergency due to a double engine power loss. The pilot completed a forced landing in a swampy area on the east shore of Churchill Lake, SK. The aircraft was substantially damaged. The pilot was transported to hospital in Île-à-la-Crosse, SK, and was subsequently released with minor injuries. The accident occurred at about 1140 central standard time.

Ce rapport est également disponible en français.

Other Factual Information

The aircraft was contracted to the Saskatchewan Government Ministry of Environment for forest fire detection purposes. The operator owned two other Cessna 337s (C-337s) and had operated the type for several years. On 12 June 2008, the day before the occurrence flight, the aircraft had been fully refueled and had completed a 0.9-hour training flight ¹. The aircraft was not refueled prior to departing for Stony Rapids on June 13, as it was believed that there was sufficient fuel remaining on board the aircraft to complete a round trip flight to Stony Rapids.

The pilot completed the two-hour flight to Stony Rapids without incident, and the aircraft was not refueled for the return flight to Buffalo Narrows. At approximately 1 hour and 30 minutes into the return flight from Stony Rapids, the front engine began losing power and, shortly afterwards, the rear engine lost power. The pilot switched both fuel selectors to the auxiliary fuel tank positions and turned on the auxiliary boost pumps; however, the engines would not restart or regain power. The pilot had not tried to use any fuel from the auxiliary tanks prior to the engine power loss because he believed there was sufficient fuel remaining in the main tanks to complete the flight. The total elapsed flight time since the aircraft was refueled and prior to the engines losing power was approximately 4.5 hours.

Records indicate that the pilot was certified and qualified for the flight in accordance with existing regulations. At the time of the occurrence, he had accumulated 1100 hours of total flying time. He was a new hire with Meadow Air Limited and had completed his initial company flight training the day before the occurrence. He had approximately 10 hours on the C-337 aircraft type, all of which was initial training. The occurrence flight was his first operational trip on the C-337 for Meadow Air Limited. At the time of the occurrence, the pilot had been on duty for five hours.

The weather for Buffalo Narrows at 1200 central standard time ² was as follows: wind 270° at four knots variable from 240° to 310°, visibility four statute miles in smoke, a few clouds at 3000 feet, scattered clouds at 10 000 feet above ground level (agl), ceiling overcast at 23 000 feet agl, temperature 21°C, and dew point 9°C.

Wreckage and Site Information

Examination of the aircraft wreckage at the accident site revealed no indication of any pre-accident anomalies. The nature of the damage to the aircraft's propellers indicated that the engines were not operating at the time of impact. The main fuel tanks were completely empty, and when selected on, the auxiliary fuel pumps were cavitating due to fuel starvation. Both auxiliary fuel tanks were full.

¹ During this flight, the occurrence pilot completed his C-337 proficiency training.

² All times are central standard time (Coordinated Universal Time minus six hours).

C- 337D Fuel System

The C-337D fuel system is comprised of two outboard main-wing fuel tanks and two inboard auxiliary (aux) fuel tanks. There are two engine-driven fuel pumps which supply fuel to their respective engines during normal operations. There are also two auxiliary fuel pumps which supply fuel to the engine-driven pumps for starting and emergency operations. The design of the system is such that the auxiliary pumps can only pump fuel from the main tanks. In the event that fuel is depleted from the main tanks, operation of the auxiliary pumps will not draw fuel from the auxiliary tanks.

The fuel tank selector controls are mounted overhead in tandem on the cockpit ceiling. The forward mounted selector controls fuel for the front engine and is marked with positions Left Main (normal operation), Fuel Off Front Engine, Right Main (cross feed operation), and Left Aux. The rear-mounted selector controls fuel for the rear engine and is marked with positions Right Main (normal operation), Fuel Off Rear Engine, Left Main (cross feed operation), and Right Aux ³.

Accessing fuel from the aircraft's auxiliary tanks is accomplished by first burning-off one hour's fuel from the main tanks and then switching to the auxiliary tanks. This method prevents return-line fuel from being vented overboard.

Information contained in the C-337's owner's manual indicated that cruise power fuel consumption would have been approximately 18 US gallons per hour (gph). The rate of fuel consumption for the previous day's training flight could have been as high as 25 gph. The main fuel system can carry 92 gallons of fuel and the auxiliary system can carry 36 gallons for a total fuel capacity of 128 gallons.

The investigation revealed several similar fuel management occurrences for this type of aircraft ⁴. As well, an article was found which refers to a high number of fuel management issues for this aircraft type ⁵.

C-337D Owner's Manual

The procedures in the C-337D owner's manual for "Engine Out During Flight" and "Engine Starts in Flight" require that fuel selectors are set to either of the main tanks for airborne restarts. The information contained in the C-337D owner's manual on selection of auxiliary fuel is listed only in the optional systems section and not in Section II (description and operating details). The owner's manual does not caution pilots to avoid running the main tanks dry.

³ An abbreviated C-337D fuel system diagram is contained in Appendix A.

⁴ Review of the United States National Transportation Safety Board database (16 similar occurrences) and consultation with Canadian operators

⁵ www.consultresearch.com/337fuel.htm (16/6/2008)
Internet address confirmed accessible as of report release date.

Meadow Air Limited Company Training Program

Meadow Air's C-337D ground school is based, among other things, on pilot self-study of the C-337D owner's manual. The company's C-337D exam contains questions that require knowledge of determining fuel consumption, but none relating to the procedure for accessing fuel in the auxiliary tanks.

Analysis

The pilot did not use any auxiliary tank fuel prior to completely exhausting the fuel in the main tanks. This procedure prevented a successful restart of either engine and is contrary to the procedures outlined in the C-337D owner's manual. The pilot's departure from the specified procedures and incorrect fuel estimate indicated that he did not fully understand the aircraft's fuel system.

The fuel selectors are located overhead on the cockpit ceiling, which requires that the pilot divert his attention from monitoring primary flight information when changing fuel selections. In a high-workload situation such as dealing with a dual-engine power loss, this cockpit configuration could complicate the management of the fuel system. The overhead location and tandem layout of the fuel selectors, along with the nomenclature of the system, which includes "aux" pumps that do not pump fuel from the "aux" tanks, can make operation of the C-337's fuel system confusing to pilots who are not totally familiar with its operation.

The higher rate of fuel consumption for the training flight as compared to cruise power fuel consumption contributed to the exhaustion of the fuel remaining in the main tanks.

Findings as to Causes and Contributing Factors

1. The pilot's estimates of the fuel remaining in the main tanks and the amount required to complete a round trip to Stony Rapids were inaccurate. Consequently, both engines stopped operating when the fuel in the aircraft's main tanks was depleted.
2. The pilot did not have a full understanding of the aircraft's fuel system and was unaware of the method and sequence for accessing the fuel in the aircraft's auxiliary (aux) fuel tanks. As a result, the pilot's operation of the fuel system rendered the fuel in the aux tanks unusable after the fuel in the main tanks was depleted and the engines could not be restarted.
3. The operator's training program for the C-337D did not establish or test the pilot's knowledge on how to operate the C-337D's fuel system.

Finding as to Risk

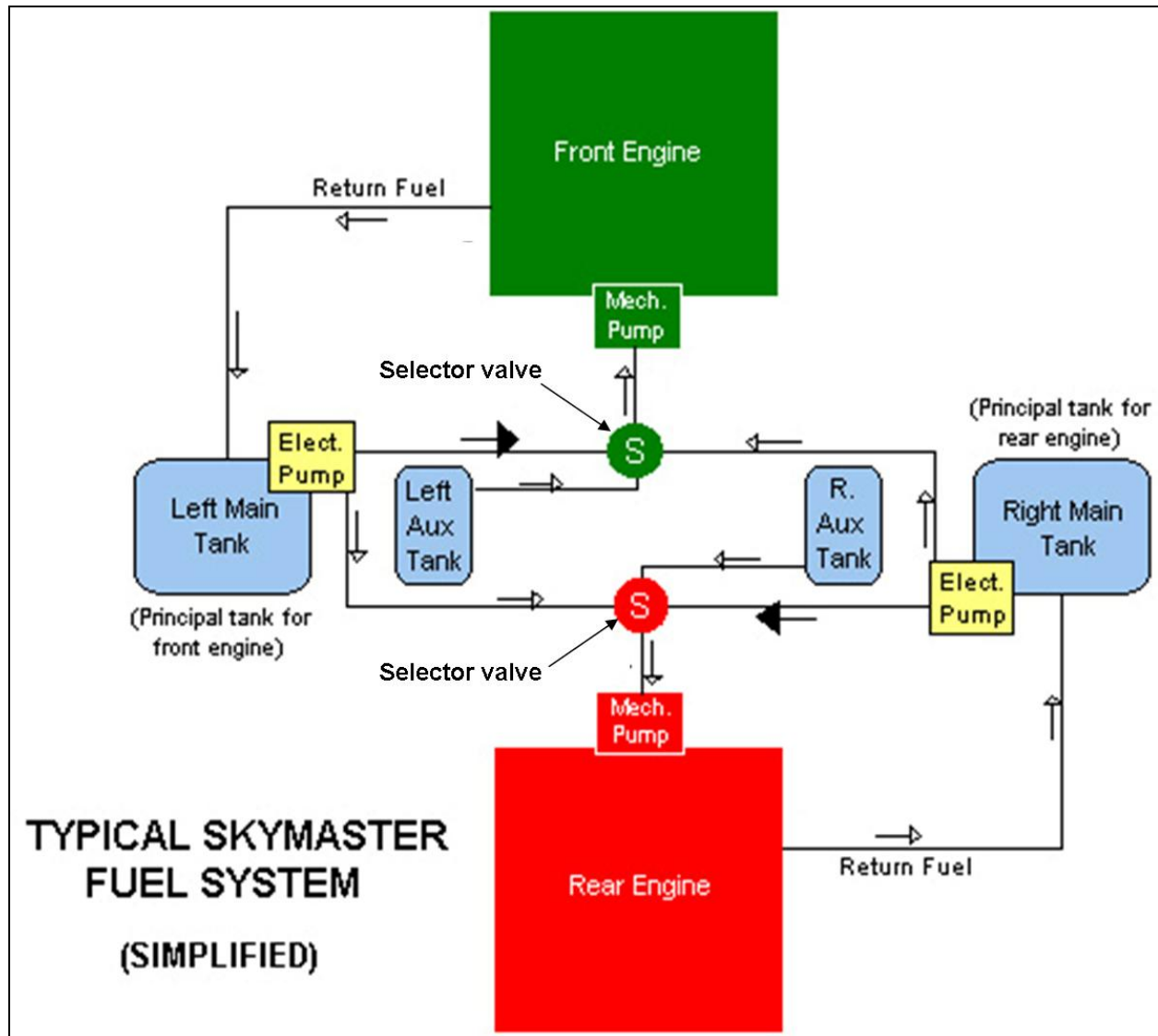
1. The design and nomenclature of the C-337D fuel system complicates its operation during periods of high cockpit workload, thus increasing the risk of confusion.

Safety Action Taken

The operator has added questions to the C-337D training exam which test for knowledge of the operation of the fuel selectors, fuel management, and the auxiliary boost pumps.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 30 December 2008.

Appendix A – Fuel Schematic (simplified)



Source: www.consultresearch.com/337fuel.htm

Internet address confirmed accessible as of report release date.