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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2009-022
Final

Fuel-related event 50 km south-west of Canberra 21 May 2009

Abstract

On 21 May 2009, the pilot of a Piper PA-31 Navajo, registered VH-WAL, was conducting a flight under the instrument flight rules from Albury, NSW to Canberra, ACT with one passenger on board. Approximately half way through the flight, the pilot became concerned about the quantity of fuel remaining and subsequently conducted a precautionary landing 50 km south-west of Canberra. There was no reported damage to the aircraft or injuries to the occupants.

The aircraft operator has advised the ATSB that, as a result of this occurrence, it has implemented a requirement for all of its pilots to use a documented fuel plan in all circumstances when flying from one location to another.

FACTUAL INFORMATION

History of the flight

On the afternoon of 21 May 2009, the aircraft operator required a maintenance engineer to be flown from Canberra, ACT to Albury, NSW in order to repair another company aircraft that had been grounded due to a technical problem. The operator's Beechcraft Be-76 Duchess (Duchess) would normally have been used, however the aircraft was unavailable to conduct the flight, so a Piper PA-31 Navajo (Navajo), registered VH-WAL, was used in its place.

The operator required the pilot to depart Canberra as soon as practicable, and the pilot used a computerised flight-planning program to plan and submit the flight plan, but did not use the associated fuel-planning section in the program to calculate the required fuel uplift. The pilot checked the aircraft's fuel records and gauges, and ascertained that the aircraft had 280 L of fuel on board for the 53-minute flight to Albury, which he considered to be more than sufficient, including reserves. The flight to Albury took less time than planned because of a 25 kt tailwind, therefore, the aircraft consumed less fuel during that flight. The pilot waited for about 1 hour at Albury for the maintenance action on the grounded aircraft to be completed.

Prior to departure from Albury for the return flight to Canberra, the pilot checked the remaining fuel on board the Navajo using the aircraft's fuel gauge and fuel calibration card, and determined that the aircraft had 160 L of fuel remaining. He performed a mental calculation to ascertain the fuel required for the flight, but stated that he inadvertently used the lower fuel-flow figures for the multi-engine Duchess aircraft that he normally flew, instead of the figures actually required for the Navajo.

At about 1440 Eastern Standard Time[1], the pilot departed Albury for the flight to Canberra with the engineer as a passenger. Approximately half way through the flight, the pilot became concerned about the indicated fuel quantity remaining. He re-evaluated the aircraft's endurance, and

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

assessed that the aircraft may not have sufficient fuel to reach Canberra or to return to Albury. The pilot assessed that the second half of the flight would mostly pass over inhospitable terrain, where a safe landing would not be possible. Instead of risking fuel exhaustion over inhospitable terrain, the pilot elected to conduct a precautionary landing on the Cooleman Plains in the Snowy Mountains. The aircraft was subsequently landed safely in a paddock about 50 km south-west of Canberra. There was no reported damage to the aircraft or injuries to the occupants.

Figure 1: Aircraft after precautionary landing

The pilot

The pilot was an experienced and current flight instructor, who was suitably qualified to fly and to instruct other pilots on the Navajo aircraft under the visual and instrument flight rules.

Most of the pilot's recent multi-engine flying was in a Duchess, in which flights were planned on the basis of consuming fuel at 80 L per hour (L/h) in flight. The pilot also occasionally flew the larger Navajo aircraft, in which flights were planned on the basis of consuming fuel at 144 L/h in the cruise and 227 L/h in the climb, and there was an allowance of 10 L or 20 L for taxi and takeoff, depending on the airport.[2]

The pilot reported that when instructing, he normally used standard company fuel plans for a limited number of flight profiles, which provided for conservative fuel management for those flights. His duties did not normally involve fuel-critical flights of varying duration.

The pilot's normal flight duties did, however, require an ability to operate an aircraft proficiently in many flight profiles; including those used when training students for abnormal or emergency flight situations, such as practice precautionary landings.

Flight planning

Fuel planning

Civil Aviation Regulation (1988) (CAR) 234(1) stated that an aircraft must not commence a flight unless the pilot has taken:

> ...reasonable steps to ensure that the aircraft carries sufficient fuel and oil to enable the proposed flight to be undertaken in safety.

The regulation also referred to matters that should be taken into account when planning the amount of fuel to be carried. A number of fuel planning and management options for application by pilots were highlighted in Civil Aviation Advisory Publication 234-1, which was issued in November 2006.

Weather

The weather forecast for Canberra that was valid at the time of departure from Albury, did not indicate any holding or diversion requirements for the pilot's planned arrival at Canberra.

Type of operation

The aircraft was operated by the flight school for private or airwork operations. Both the pilot and the passenger were employed by the operator and were at work at the time of the occurrence. The flight was conducted as a private operation.

The regulations for private flights required that sufficient fuel be carried for the flight. The regulations did not specify any requirement for formal fuel management procedures. In contrast, air transport operations were required to use rigorous fuel planning and management procedures.

2 For example, operation at a larger airport could be expected to involve extended taxi distances.

Additional information

Human performance

For experienced pilots, many of the tasks associated with operating an aircraft become highly automatic. Through training and experience, they develop a range of skills that enable them to carry out many flying tasks as a matter of routine. While this skill development is almost always very beneficial to flight safety, it can at times lead to error. For example, when changed circumstances require a modification to a strongly habitual routine, it is possible that the habitual routine will 'capture' the actions of the pilot. This type of human performance error has been termed 'habit capture'.[3]

Similar occurrences

Fuel management issues are not new in aviation, and have been a continuing safety concern for aviation authorities worldwide for many years. A sample of fuel management-related ATSB investigation and research reports includes:[4]

- Occurrence investigation report 199804432, which described a light twin–engine aircraft that ditched into the sea as a result of fuel exhaustion[5].
- Occurrence investigation report AO-2007-017, which described a fuel starvation[6] event involving a twin-engine turboprop aircraft.
- The December 2002 research paper, *'Australian Aviation Accidents Involving Fuel Exhaustion and Starvation.'*
- The June 2005 research report B2005/0085, *'Power loss related accidents involving twin-engine aircraft.'*

3 Reason, J. *Human error.* (Cambridge University Press, 1990).

4 Available at www.atsb.gov.au

5 Fuel exhaustion - the state in which all of the aircraft's useable fuel has been consumed.

6 Fuel starvation - the state in which all of the aircraft's useable fuel has not been consumed, but that fuel is not available to at least one engine.

Inadequate pre-flight preparation was established as a primary contributing factor in the majority of the reported fuel exhaustion occurrences.

ANALYSIS

Fuel management

The use by the pilot of only a mental calculation during his fuel planning for the flights, rather than using a documented method as a primary calculation method or as a cross check to the mental calculation, increased the risk of an error in that planning. The application by the pilot of the Duchess fuel planning data to the operation of the Navajo was consistent with a habit capture error, and resulted in the aircraft having insufficient fuel to complete the flight to Canberra.

The safety benefit of cross-checking

The nature of the pilot's typical operations normally required different fuel planning considerations, compared with the occurrence flight. Instructional flights are often commenced with more fuel on board to accommodate their unpredictable nature due to variations in the length of the flight and average fuel consumption brought about by differences in the progress of students. Instructional flights are therefore rarely fuel critical. However, a flight from one point to another may be planned and operated based on more predictable fuel requirements, allowing for the minimum required fuel to be safely planned.

The frequency and familiarity of the pilot's involvement in instructional flights, may have reduced the pilot's awareness of the different risks associated with flights between two locations; flights which he conducted much less frequently.

Although the pilot was satisfied that the aircraft had more than sufficient fuel on board for each leg, the use of a documented fuel plan in addition to the 'mental check', would have reduced the chance of the pilot missing the inconsistency in his fuel management calculations.

Decision to land

The pilot's decision to land once he was no longer confident of reaching his destination or returning to the departure aerodrome, was appropriate given the circumstances. Analysis of the standard fuel consumption data indicated that the return

flight might have just reached Canberra Airport in nil wind conditions. However, the aircraft would have probably exhausted its fuel supply before reaching Canberra Airport in the existing 25 kt headwind. Had the pilot continued the flight, a safe landing was unlikely due to the mountainous terrain along the remaining track to Canberra.

The pilot's familiarity with the procedures for a precautionary landing, based on his normal instructional flying, increased the probability of a successful landing in challenging circumstances.

FINDINGS

From the evidence available, the following findings are made with respect to the fuel-related event that occurred about 50 km south-west of Canberra on 21 May 2009 and involved Piper PA-31 Navajo, registration VH-WAL, and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The pilot did not use a formal planning method to assess his fuel requirements, which increased the risk of any fuel planning errors remaining undetected.
- The pilot used fuel flow figures for a Be-76 Duchess when calculating the fuel required for a flight in a PA-31 Navajo, leading to an insufficient quantity of fuel for the planned flight.

Other key findings

- The aircraft was landed without damage in challenging circumstances.

SAFETY ACTION

Any safety issues identified during the conduct of an investigation are listed in the Findings and Safety Actions sections of the report. However, whereas an investigation may not identify any particular safety issues, relevant organisation(s) may proactively initiate safety action in order to further reduce their safety risk.

All of the relevant organisations identified during this investigation were given a draft report and invited to provide submissions. Although no safety issues were identified during this investigation, the following proactive safety action was submitted by those organisations.

Aircraft operator

Fuel planning methods

In response to this occurrence, the aircraft operator advised the Australian Transport Safety Bureau that a company requirement has been implemented for all pilots to use a documented fuel plan in all circumstances when flying from one location to another.

SOURCES AND SUBMISSIONS

Sources of Information

The sources of information for this investigation included the:

- pilot of VH-WAL
- aircraft operator
- Civil Aviation Safety Authority (CASA)
- Airservices Australia.

References

- Reason, J. *Human error.* (Cambridge University Press, 1990).

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the aircraft operator, the pilot, Airservices Australia and CASA. No submissions were received.