FUEL EXHAUSTION MANAGEMENT SAFETY ARTICLE

This report will consider the two main reasons why fuel stops getting to an engine during flight. **Fuel exhaustion** happens when there is no useable fuel remaining to supply the engine(s). **Fuel starvation** happens when the fuel supply to the engine(s) is interrupted, although there is adequate fuel on board.

CASE STUDY 1:

The aircraft took off on a private flight under visual flight rules (VFR) by day. After the take-off, when the aircraft was airborne approximately 20 feet above the runway, the pilot experienced an engine failure. The pilot executed a forced landing back onto the runway, but could not bring the aircraft to a stop before reaching the end of the runway. The aircraft rolled over the end of the runway onto ploughed land. The nose gear collapsed as it entered the soft soil and the aircraft sustained minor damage.

Figure 1: The position of the aircraft at the accident site.

CASE STUDY 2:

On 15 February 2006 the pilot collected the aircraft from the Aircraft Maintenance Organisation (AMO) at Wonderboom Aerodrome (FAWB) after undergoing a Mandatory Periodic Inspection (MPI) and it was released to service. After the aircraft was refuelled, it took off from FAWB on a private flight to Ermelo, where it was based. The aircraft then crashed on a farm in Evander, approximately 0.43 hours after taking off from FAWB. When overhead Evander, the engine had stopped due to fuel exhaustion and the pilot was forced to land on an uneven, open grass field on a farm. The aircraft possibly landed at a high speed. Upon landing it bounced, rolled and impacted with the ground nose-first in a left-wing low attitude before ground-looping and coming to a halt.

Figure 2: The position of the aircraft at the accident site.

CASE STUDY 3:

On 21 August 2007, at approximately 1540Z, the pilot, who was the sole occupant on board the aircraft, departed from Kimberley Aerodrome on a private flight in order to conduct some test circuits at the aerodrome. The pilot stated that after take-off, the aircraft climbed to approximately 800 feet AGL when the engine started to splutter and stopped. He turned the boost pump on to restart the aircraft and identified a possible area for a forced landing. He then selected the opposite fuel tank and again attempted to restart the engine with the fuel mixture at full rich, and then leaned the mixture in case of flooding, but the engine failed to restart.
The engine failure after take-off was caused by fuel starvation, due to fuel mismanagement.

Figure 3: The position of the aircraft at the accident site.

CASE STUDY 4:

On 29 August 2007, the pilot flew from Rand aerodrome (FAGM) on a training flight to the general flying area (GF), and then headed back to FAGM. While he was on final approach for runway 35, the engine stopped and he made a Mayday call to FAGM tower on frequency 118.7 MHz. The aeroplane was too far from the runway for a normal landing, and after unsuccessfully trying to restart the engine, the pilot executed a forced landing in an open field in Lambton. The aircraft collided with a rock before coming to a halt. The investigation found that the engine had stopped due to fuel starvation.

Figure 4: The position of the aircraft at the accident site.

Key messages:

Accurate fuel management starts with knowing exactly how much fuel is being carried at the commencement of a flight. This is easy to know if the aircraft tanks are full, or filled to tabs. If the tanks are not filled to a known setting, then a different approach is needed to determine an accurate quantity of usable fuel. Accurate fuel management also relies on a method of knowing how much fuel is being consumed. Many variables can influence the fuel flow, such as changed power settings, the use of non-standard fuel leaning techniques, or flying at different cruise levels to those planned. If they are not considered and appropriately managed, then the pilot's awareness of the remaining usable fuel may be diminished.

Keeping fuel supplied to the engines during flight relies on the pilot's knowledge of the aircraft's fuel supply system and being familiar and proficient in its use. Adhering to procedures, maintaining a record of the fuel selections during flight, and ensuring the appropriate tank selections are made before descending towards your destination will lessen the likelihood of fuel starvation, at what may be a critical stage of the flight. Pilots are therefore advised to comply with Part 91 of the regulations.

Conclusion:

Fuel exhaustion is more likely to occur on flights when there is a small flight fuel margin; that is, landing with just reserve fuel on board. In these circumstances, particular attention to detail in fuel management is warranted.

The chance of fuel exhaustion can be reduced by:

- using more than one source of information to obtain consistent results about the fuel on board before flight
- the use of a consistent procedure that is regularly checked to know the exact rate of fuel consumption
- monitoring the flight to ensure that sufficient fuel will remain on board in the event of unplanned delays.

Fuel starvation usually happens when the selected tank is run dry. In addition to the factors relevant to fuel exhaustion, the chance of starvation can be further reduced by:

- ensuring the pilot is fully familiar with the operation of the fuel system for both normal and abnormal operations
- adhering to pre-flight procedures and checks to ensure that the correct tank is selected before take-off and landing, using a fuel log during flight to provide a record of the fuel usage from each tank
- selecting the appropriate tank before descending to the destination and ensuring that the tank has adequate fuel for landing.