OAS-43A
(12/12)

Interagency Aviation Accident Prevention Bulletin

Subject: Aircraft Fuel Management

Area of Concern: Flight Safety

Distribution: All Aviation Operations

Discussion: From 2012-2022, 356 single pilot accidents occurred where pre-flight and/or in-flight fuel management errors led to significant aircraft damages and death.[1]

The Contributing factors that led to these incidents are as follows:

- Improper pre-flight planning – These events included not validating fuel levels during pre-flight inspection, improper validation (visual glance vs. using prescribed fuel stick), or a simple misjudgment of fuel required.
- Flight plan variance – These events could be identified when the pilot deviated from their initial flight plan, such as changing destination or adding stops but not fuel.
- In-flight management errors – These events included fuel burn errors, lack of in-flight monitoring, monitoring of inaccurate gauges, or not noticing indicators.

Fuel mismanagement is one of the primary causes of general aviation accidents in the United States. In 2017, the National Transportation Safety Board (NTSB) released Safety Alert SA-067, Flying on Empty which stated "on average more than 50 accidents per year occurred due to fuel management issues. Fuel exhaustion accounted for 56% of fuel-related accidents while fuel starvation was responsible for 35% of these accidents."

So, what is the difference between fuel exhaustion and fuel starvation? The NTSB defines them as the following:

Fuel *exhaustion* is running out of fuel whereas **fuel *starvation*** is having fuel onboard, but it doesn't reach the engine for reasons such as a blockage, improperly set fuel selector, or water contamination.

More than 66% of fuel management accidents occurred on flights when the intended destination airport was different than the departure airport. About 80% of all fuel management accidents occurred during the day in visual meteorological conditions; only 15% occurred at night.

Almost half of pilots involved in fuel management accidents hold either a commercial or air transport pilot certificate (48%). Pilots holding private, or sport pilot certificates make up 50%, and 2% of accidents involved student pilots.

Pilot complacency and overestimation of flying ability can play a role in fuel management accidents.[2]

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[1] Haney, J. (2023). Fuel Exhaustion in Single Pilot Operations. [Unpublished manuscript]. Aviation Safety, Embry-Riddle Aeronautical University.

[2] National Transportation Safety Board. (2017). *Flying on Empty: Prevent the Preventable with Careful Fuel Management.* https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-067.pdf

Within the timeframe mentioned above, the Department of the Interior has experienced a few mishaps attributed to fuel mismanagement. They are:

- Accident – Elko, NV. Aero Commander – Fuel exhaustion. June 2012. (Figure 1).
- Accident – Rock Springs, WY. Cessna T207 – Fuel starvation. November 2017. (Figure 2).
- Incident-With-Potential – McCarthy, AK. Cessna U206C – Fuel Starvation. June 2018 (Figure 3).

Figure 1 - Aero Commander

Figure 2 - Cessna T207

Figure 3 - Cessna U206C

Federal regulation [14 CFR Part 91.151] stipulates that no person may begin a flight in an airplane in day visual meteorological conditions, unless (after considering wind and forecast weather conditions) there is enough fuel to reach the intended destination, plus 30 minutes while at a normal cruising speed. NTSB research showed that at least 95% of the accidents occurred in "generally fair to good weather." Further, pilot complacency had a direct impact on fuel management mishaps; 95% of the accidents cited personnel issues compared to 5% citing fuel system malfunctions or failures.

Other areas that influence fuel exhaustion include:[3]

- Time of day – The expectation was night (dawn/dusk) conditions would increase likelihood; time of day (1441 mean) was not expected but a significant finding.
- Aircraft category (fixed-wing/rotor-wing) – 93% airplane, 6% helicopter, and 1% other.
- Pilot gender – 96% male, 2% female, and 2% unknown (Figure 4).
- Pilot age – The age group 50-69 accounted for 44% of accidents (Figure 5).

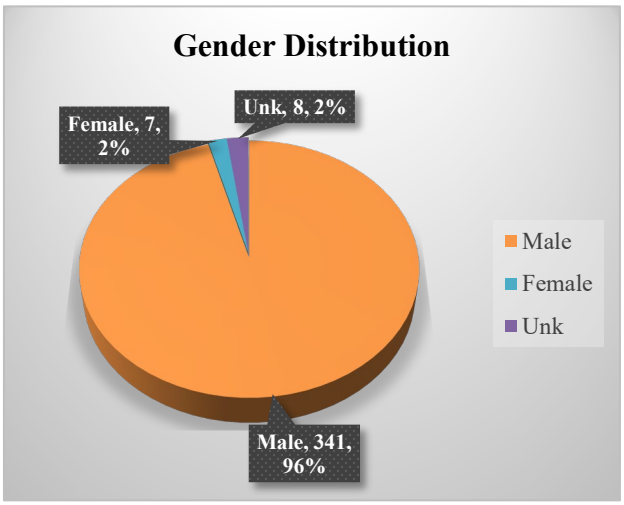

Figure 4 – Pilot Gender for Fuel Exhaustion Accidents (2012-2022)

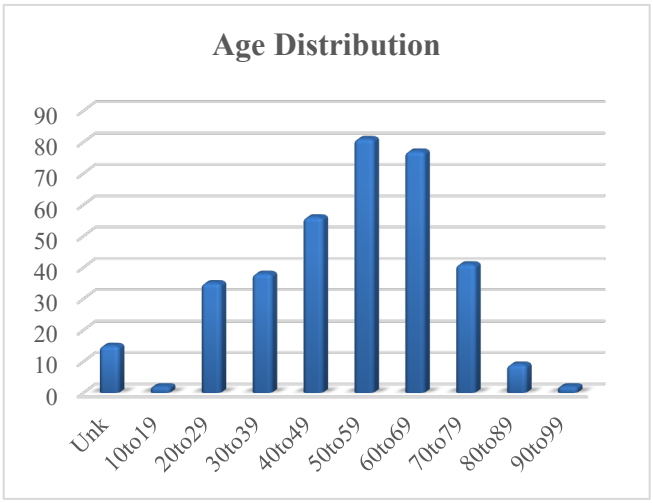

Figure 5 - Pilot Age for Fuel Exhaustion Accidents (2012-2022).

[3] Haney, J. (2023). Fuel Exhaustion in Single Pilot Operations. [Unpublished manuscript]. Aviation Safety, Embry-Riddle Aeronautical University.

What can you do to prevent misfuelling accidents? Here are a few tips from the NTSB:[4]

- Know how much fuel you have onboard at all times.
- During your preflight inspection, measure and/or visually confirm the fuel quantity in your tanks. Do not rely exclusively on fuel gauges.
- Know how much fuel you will need for a given flight.
- Make sure you have a fuel reserve for each flight.
- Know your engine's fuel burn rate and actively monitor the fuel burn rate for the entire time the engine is operating.
- Know your aircraft's fuel system and how it works.
- Review your aircraft's Pilot Operating Handbook and use the appropriate checklists.
- Don't stretch your available fuel supply. Stop and get gas!

/s/ Keith C. Raley	***/s/ Lori Clark***
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[4] National Transportation Safety Board. (2017). *Flying on Empty: Prevent the Preventable with Careful Fuel Management.* https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-067.pdf