CALLBACK

From NASA's Aviation Safety Reporting System

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The MisManagement Pageant: Preventable Fuel Management Errors

Safe flight operations involve an ongoing contest between proper procedures and a number of human factors that threaten to undermine them. This month's *CALLBACK* looks at recent fuel exhaustion and fuel starvation incidents in which human error was the primary cause. The reports also offer a lineup of constructive lessons regarding fuel planning, usage and system operation. If we keep the spotlight on the lessons learned, proper procedures will win the contest.

Contestant #1: *Mis*Calculation

Determining fuel remaining based on assumed fuel burned figures and on gauges that are assumed to be correct is a dangerous gamble. This Piper Navajo pilot learned that physical verification of the fuel onboard is the best way to prevent miscalculations.

■ *The aircraft started to run out of fuel on the midfield downwind position as a result of a fuel miscalculation that I had made. At the first indication of fuel exhaustion, I commenced a descending right turn to the runway and notified Tower of my situation. I was cleared to land and did so without incident. During the turnoff onto a taxiway, the right engine quit running….*

To the best of my knowledge, the origin of my fuel miscalculation was during a flight…on the previous day….

Based on [the flight time] *and the chart our company uses for fuel consumption on the Navajos, I calculated that I departed on this flight with 25 gallons of fuel which should have yielded 38 minutes of flight time.* [The flight was] *approximately 10-15 minutes. When making fuel calculations with this table, it is my personal habit to err on the side of caution, and I often make it a point to add several gallons to whatever number is given so that there is a bit of a "cushion." Although the numbers on paper indicated that the aircraft had 25 gallons of fuel, I was certain that there was a bit more. I was quite alarmed when both engines started to sputter on the midfield downwind leg.*

As a result of this incident, I made it a point to review the fuel logs for all flights made several days prior and have come to the conclusion that the error was made sometime during this period. In the end, the lesson learned here is that fuel gauges and fuel logs can be grossly inaccurate…. If you cannot physically see or touch fuel in the tanks, you cannot make assumptions.

Contestant #2 and #3: "*Mis*Identification" and "*Mis*Reading"

With two nearly identical aircraft on the field, refueling the correct plane becomes a concern. Unfortunately, by misreading a fuel sight gauge, this pilot "confirmed" a case of mistaken identity.

■ *I flew a new LSA (Light-Sport Aircraft) for display at* [an airshow]. *The sister ship to the one I was flying was already there. They are almost identical aircraft and both aircraft arrived with more than two hours of fuel remaining. Company plans required another pilot to take the aircraft I had flown (Aircraft #1)… and to leave the other aircraft (Aircraft #2) at the show with me. I placed a fuel order with the intention of fueling Aircraft #2, but they fueled Aircraft #1 instead…. I witnessed the refueling of Aircraft #1, but misidentified it as Aircraft #2.*

The following morning, I reset the EMS (Engine Monitoring System) fuel counter to "FULL." The location of the fuselage fuel filler does not allow for a visual inspection and the fuel sight tube, located behind the seats, is difficult to read (clear fuel in a clear tube). When full, the fuel level is out of sight. I looked at the top of the tube for confirmation and, anticipating a full fuel indication, I misread no visible fuel as an indication of a full tank. I did not inspect the lower portion of the tube that was probably reading a partial fuel situation.

…Nearing [my destination], *the engine gave signs of fuel exhaustion so I requested assistance from Approach who vectored me to an uneventful landing.*

After refueling… I departed and landed at my next stop where I spent the night thinking about what I had done wrong and how very lucky I was.

Both of the above incidents involved fuel exhaustion (depletion of all useable fuel onboard). The following reports deal with fuel starvation (useable fuel remains

in the tank/s but is prevented from reaching the engine). Causes of fuel starvation may include blocked fuel lines or filters, pump or valve failures and fuel contamination. Fuel starvation can also be caused by human error. In the following reports, misinterpretation of fuel selector positions led to unplanned landings.

Contestant #4: *Mis*Interpretation

Assumptions and misinterpretations are dangerous factors to mix with fuel planning and fuel tank selection. This pilot of an experimental aircraft had to react quickly when both of these factors combined to abruptly shorten the flight.

■ *While climbing through 1,400 feet, there was a sudden engine stoppage. I had been talking to Approach for VFR Flight Following, but immediately switched to Tower, declared an emergency and landed safely….*

On takeoff, the fuel selector had been switched to a nearly empty fuel tank and a couple of minutes into the flight the fuel in that tank was depleted.

My high-wing experimental aircraft has four tanks. Each of the outboard tanks feeds (if transfer pumps are activated) into an inboard main tank and the main tanks are controlled with a fuel selector having "LEFT," "RIGHT," and "BOTH" positions. There are fuel sensors on each of the inboard main tanks. The fuel sensor on the right main tank had been intermittently malfunctioning during the last few flights, reading "0" when it was full and then starting to work when the fuel had drained to about half a tank. During preflight, I noted that one of the fuel tank sensors was reading "0." I assumed that this was the right tank and that this meant the tank was nearly full. In reality, however, the left tank was nearly empty (which the indicator correctly showed), and I had the fuel selector selecting the left tank. During preflight I checked the fuel level in the two outboard tanks, both of which were full, and therefore I "knew" that I had enough fuel for my flight. I typically check the fuel level by dipping my finger into the tank. Since the fuel level in the main tanks was below where I could feel, I did not check the main tanks by hand, and failed to check them with a dipstick.

This incident was due to…a chain of events including the intermittent operation of the fuel sensor, misinterpreting an empty indication as meaning the tank was full and misinterpreting the left tank indicator as the right tank. In addition, there was a failure on preflight to determine the actual fuel levels in the main tanks.

Lessons learned: 1) always positively identify the fuel level in each tank before flying and 2) repair or replace malfunctioning indicators. In addition, this incident could have been mitigated if I had either selected "BOTH" tanks for take-off (standard procedure) or moved the fuel selector to the "BOTH" position as soon as the engine stopped.

A Light-Sport pilot's misinterpretation of LEFT and RIGHT, ON and OFF, resulted in an engine-off landing.

■ *I departed as a student pilot on a solo cross-country operating under Sport Pilot regulations…. During the preflight, I observed that the fuel was unbalanced. I spoke with the flight school's manager* [who] *stated that this was a normal issue and that I should turn off the fuel valve to the tank with the lower quantity after I am no longer in a critical stage of flight. During the enroute portion of the flight, I shut off the left fuel valve to allow the fuel to equalize as instructed.*

When I was getting ready to descend to pattern altitude, I intended to turn the left fuel valve back to the "ON" position, but I inadvertently shut off the valve which was in the "ON" position. Again my intention was to turn both valves to the "ON" position, but I made the mistake of turning both of the fuel valves to "OFF." I made my approach radio call and descended to pattern altitude. The aircraft continued to run as normal. Then shortly after entering the 45-degree entry to downwind Runway 34, the engine died due to fuel starvation. I performed the Engine Restart procedures. I checked to assure that both fuel valves were in the same direction, not realizing that both fuel valves were in the wrong position. The engine failed to restart…. I decided to land the airplane. I… announced that I was "engine-out," made a "Mayday" call… and made a safe landing….

I determined that I had misinterpreted the fuel valve positions and turned both to the "OFF" rather than the "ON" position as intended….

Additional information and training on fuel management issues can be found on the following web sites:

NASA ASRS (Database Report Set – Fuel Management Issues)

http://asrs.arc.nasa.gov/docs/rpsts/fuel.pdf

Aircraft Owners and Pilots Association (AOPA) Air Safety Foundation

http://www.aopa.org/asf/hotspot/fuel_check.html
http://www.aopa.org/asf/publications/sa16.pdf

Federal Aviation Administration (FAA)

https://www.faasafety.gov/files/gslac/library/documents/2009/Oct/37519/Flying Lessons October 1, 2009.pdf

ASRS Alerts Issued in January 2011	
Subject of Alert	**No. of Alerts**
Aircraft or aircraft equipment	2
ATC equipment or procedures	2
Airport facility or procedure	6
TOTAL	**10**

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January 2011 Report Intake	
Air Carrier/Air Taxi Pilots	2855
General Aviation Pilots	799
Controllers	533
Cabin/Mechanics/Military/Other	554
TOTAL	**4741**