



Every Trip Has a Story

BY MARK LACAGNINA

Resetting a circuit breaker without knowing why it opened can be deadly.

Circuit Breakers — In. Most general aviation pilots react to that ubiquitous preflight checklist item by hunting down any open circuit breakers (CBs) and dutifully pushing them back in. Similarly, there is the old saw about a CB that trips in flight: Reset it once; if it trips again, leave it alone.

These are dangerous habits, according to the U.S. National Transportation Safety Board (NTSB), which has pointed to a recent in-flight fire and fatal crash in calling for education and training of general aviation pilots and maintenance personnel on the hazards of resetting CBs without knowing why they tripped. The crash also exemplifies the potential consequences of not following required

procedures when maintenance is deferred and of operating an aircraft with a known discrepancy, according to the board's final report on the accident.¹

The accident occurred the morning of July 10, 2007, and involved a Cessna 310R — one of nine airplanes operated by the National Association for Stock Car Auto Racing (NASCAR). The company used the light piston twin primarily to transport equipment and documents but occasionally allowed its medical officer to conduct personal flights in the airplane with a company pilot aboard as a safety pilot.

The medical officer, 53, held a commercial pilot certificate and had 276 flight

hours, including 26 hours in the 310. He was the pilot-in-command (PIC) of the accident flight. The safety pilot, 56, held an airline transport pilot certificate with several type ratings and had 10,580 flight hours, including 67 hours in the 310. Both pilots had completed 310 proficiency training at a commercial flight-training facility in January 2007.

Smoke in the Cockpit

The airplane departed from Daytona Beach, Florida, at 0822 local time for a flight to Lakeland, about 80 nm (148 km) southwest. Shortly after the 310 reached its cruise altitude, 6,000 ft, the safety pilot declared an emergency and told air traffic control (ATC) that there



was smoke in the cockpit and that they were diverting to Sanford International Airport.

ATC radio contact and radar contact with the airplane were lost when it was about 8 nm (15 km) northwest of the airport and descending rapidly. Witnesses saw the 310 trailing smoke as it made a steep turn to the west shortly before striking trees and crashing in a residential area. The pilots and three people on the ground were killed, and four people on the ground were seriously injured. The airplane and two houses were destroyed by the impact and postcrash fire.

Examination of the wreckage revealed signs of an in-flight fire. Thermal damage and soot deposits were found on components that came to rest outside the area of the postcrash fire. The cabin door, for example, was found relatively intact about 60 ft (18 m) from the main wreckage. “The undamaged latching pins and the location and existence of the observed trailing soot deposit are consistent with the pilots having opened the cabin door to vent smoke during an in-flight fire,” the report said.

Most of the recovered electrical system components and wiring were severely damaged or destroyed. However, markings on some wiring indicated that it had polyvinyl chloride (PVC) insulation, which produces toxic hydrogen chloride gas when heated. “PVC-insulated wiring has not been used as a general-purpose wire in new airplane designs by Cessna and other manufacturers since the early 1970s,” the report said. “However, the FAA [U.S. Federal Aviation Administration] permitted the continued use of PVC-insulated wiring in airplanes in which it was already being installed, including Cessna 310s, which Cessna

had been manufacturing since 1953.”

‘Don’t Turn It On’

Investigators also found a maintenance discrepancy report that had been filed by another company pilot who flew the 310 the day before the

accident. The discrepancy report said that the pilot smelled electrical components burning shortly after the weather radar display “went blank” during cruise flight and that the odor ceased after he turned off the unit and pulled its 5-ampere CB. The pilot left one copy of the discrepancy report in the maintenance binder, which he placed on the airplane’s throttle quadrant, and gave the other copy to the director of maintenance.

The accident report said that an in-flight fire could have occurred during the previous day’s flight if the pilot had not pulled the CB: “Pulling the circuit breaker for the weather radar stopped a symptom — the burning smell — of the problem by removing electrical power from the circuit. However, it did not correct the underlying problem.”

NASCAR’s aviation department did not have documented guidance for scheduling and tracking airplane maintenance, or for communicating the maintenance status of its airplanes to maintenance technicians and pilots. “Further, NASCAR had no system through which any individual, including the director of maintenance, could remove an airplane from the flight schedule because of airworthiness concerns,” the report said.²

The weather radar maintenance discrepancy report was discussed by the aviation director, chief pilot and director of maintenance, who agreed that the 310 could be flown the next day. “According to the chief pilot, the director of maintenance told him: ‘It will be okay. Just tell [the safety pilot] not to turn it on,’” the report said.

Not Airworthy

The reported maintenance discrepancy was not investigated before the accident flight, no corrective maintenance was performed, and none of the required actions for continued operation of the 310 were taken. “Without examining the weather radar system and then either removing the airplane from service or placarding the airplane and collaring the circuit breaker, as well as making a maintenance records entry, it was not permissible to fly the airplane under federal regulations,” the report said. A CB is “collared” with a tie wrap or similar device to prevent it from being reset.

Collaring a CB with a tie wrap helps to prevent a defective electrical component from being reactivated.



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Both pilots had access to information that would have alerted them to the unresolved maintenance discrepancy and the hazard that it presented, the report said. The safety pilot had been told about the weather radar discrepancy during a telephone call from the chief pilot and during a conversation with a maintenance technician. “On both occasions, the [safety pilot] dismissed the issue as unimportant,” the report said. The safety pilot’s reaction likely was based on the perception that the weather radar system would not be needed because visual meteorological conditions prevailed along the planned route.

Apparently, no one told the PIC about the maintenance discrepancy; but the write-up by the pilot who had flown the airplane the previous day was available for review. “The maintenance discrepancy binder was prominently placed on the throttle quadrant and

would have been easy to review during the preflight inspection or before the airplane departed,” the report said.

Routine Reset

The 310 had been flown without further event for about an hour after the pilot pulled the weather radar CB the previous day. The next day, the airplane had been aloft about 10 minutes when the safety pilot declared an emergency, and it crashed two minutes later. Examination of the wreckage indicated that the in-flight fire likely began in the left cockpit sidewall, which houses a dense collection of electrical wiring for various components as well as fuel lines for gauges in the instrument panel.

“The most likely reason for the rapid onset of the problem is that one of the pilots reset the radar circuit breaker, thus reinitiating the development of the

problem encountered on the previous flight,” the report said.

A firm conclusion could not be made, but it is likely that the CB was reset by the PIC. The CB panel was near the PIC’s left leg and would have been difficult for the safety pilot to reach.

“General aviation pilots often reset circuit breakers during preflight preparations unless the circuit breakers are placarded or collared to show that the associated system is to remain unpowered,” the report said, noting that the 310’s “Before Starting Engines” checklist included the item: “Circuit Breakers — In.”

The report also cited potentially hazardous guidance in the pilot’s operating handbook for the 310 — and in many other general aviation aircraft handbooks — that a tripped CB can be reset *once* after allowing it to cool for a specific period. “The rationale behind this one-time reset practice is that if



the circuit breaker tripped because of anything other than a transient or nuisance event and if the triggering condition was still present, the circuit breaker would trip again shortly after being reset,” the report said.

Spreading the Word

NTSB’s warnings about resetting CBs echoed those in the final report by the Transportation Safety Board of Canada (TSB) on the 1998 crash near Peggy’s Cove, Nova Scotia. The TSB report said that resetting even a low-ampere CB can be dangerous, especially if the initiating event is electrical arcing.³ “A tripped CB should not be reset before any associated fault is located and eliminated,” the report said.

The Peggy’s Cove accident and others involving in-flight fires prompted the FAA in 2004 to issue Advisory Circular (AC) 120-80, *In-Flight Fires*. The AC says that even if there is no hidden fire that causes a CB to trip, “the resetting of a tripped circuit breaker can overheat wiring, ultimately leading to failure and arcing.”

Noting that some aircraft electrical components are critical to safe flight and must remain powered, AC 120-80 provides the following guidance about resetting tripped CBs:

Crewmembers may create a potentially hazardous situation if they reset a CB without knowing what caused it to trip. A tripped CB should not be reset in flight unless doing so is consistent with explicit procedures specified in the approved operating manual used by the flight crew or unless, in the judgment of the captain, resetting a CB is necessary for the safe completion of the flight.

In its report on the 310 accident, NTSB said that most air carriers operating under U.S. Federal Aviation Regulations Part 121 have used information from the AC to revise their manuals and checklists to specify CBs that are essential and may be reset. “Moreover, aircraft operated under Part 121 commonly have indicators, such as circuit breaker markings or coloring, or segregated placement of specific circuit breakers in the cockpit, showing which circuit breakers are critical,” the report said.

However, many corporate/business aircraft operators and private pilots operating under the general flight rules of Part 91 have not changed their operating procedures. “One reason might be that individuals operating airplanes under Part 91 are less likely to have a formal system for addressing AC guidance,” the report said. “As a result, many general aviation pilots, mechanics and operators may not have reviewed AC 120-80. Even if [they] have reviewed the AC, the guidance contained in manuals provided by general aviation airplane manufacturers often directly conflicts with the guidance contained in AC 120-80.”

Based on the findings of the 310 accident investigation, NTSB called on the FAA to inform general aviation aircraft operators, pilots and maintenance technicians about the guidance provided by the AC and to require that the information be included in initial and recurrent training. “If general aviation pilots, maintenance personnel and operators had a more thorough understanding of the potential hazards of a reset circuit breaker — as outlined in AC 120-80 — they would be less likely to reset a tripped circuit breaker without knowing what caused that circuit breaker to trip,” the report said.

NTSB also recommended that the FAA require general aviation aircraft manufacturers and aftermarket-equipment suppliers to either improve or create guidance “regarding which circuit breakers pilots should and should not attempt to reset before or during flight.” ➔

Notes

1. NTSB Aircraft Accident Summary Report NTSB/AAR-09/01/SUM, *In-Flight Fire, Emergency Descent and Crash in a Residential Area; Cessna 310R, N501N; Sanford, Florida; July 10, 2007.*
2. The report said that NASCAR made many changes after the accident to improve its maintenance policies and procedures.
3. TSB Accident Investigation Report A98H0003, *In-Flight Fire Leading to Collision with Water: Swissair Transport Limited; McDonnell Douglas MD-11, HB-IWF; Peggy’s Cove, Nova Scotia, 5 nm SW, 2 September 1998.*

NTSB investigators found signs of an in-flight fire.

