



FLYING LESSONS for December 27, 2018

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FLYING LESSONS uses recent mishap reports to consider what *might* have contributed to accidents, so you can make better decisions if you face similar circumstances. In almost all cases design characteristics of a specific airplane have little direct bearing on the possible causes of aircraft accidents—but knowing how your airplane's systems respond can make the difference as a scenario unfolds. So apply these *FLYING LESSONS* to the specific airplane you fly. Verify all technical information before applying it to your aircraft or operation, with manufacturers' data and recommendations taking precedence. **You are pilot in command and are ultimately responsible for the decisions you make.**

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This week's LESSONS:

From a [translated news report](#):

A Boeing 777-300...with 341 passengers and 16 crew was enroute at FL290 about 90nm southwest of Belo Horizonte, MG (Brazil) when the crew decided to divert to Belo Horizonte. Due to electrical problems the RAT (Ram Air Turbine) deployed. The crew performed an overweight emergency landing on Belo Horizonte's runway 16 at 01:43L (03:43Z) and became disabled on the runway due to all 12 main tyres having deflated.

Passengers reported there was a strong odor in the cabin, subsequently the captain announced there was a serious electrical fault prompting the diversion to Belo Horizonte.

Another passenger reported that suddenly all lights and the inflight entertainment system went out, only emergency lights remained. Shortly afterwards the aircraft began the descent towards Belo Horizonte, the crew announced that **they had lost all electrical systems** and were unable to dump fuel. The landing was hard, emergency services foamed the landing gear. About one hour after landing they were able to disembark via stairs. In the terminal it was being said, that **the aircraft had lost all navigation equipment, too**, the commander flew the aircraft with the assistance of ATC on the remaining radio for a safe landing. When the crew finally showed up in the terminal lounge, the crew was received with lots of applause, the captain took and answered a lot of questions.

The Aviation Herald learned that the electrical problems started with the failure of the right hand backup generator, as result both transfer and both converter **circuit breakers popped leaving all electrical busses unpowered** although left and right main generators as well as their generator controls, the APU and the left backup generator remained operative.

As [a] result almost all systems except a few connected to the standby busses lost power, only systems remaining powered are: stand by busses (powering one VHF radio) and emergency lighting, the left inboard and outboard and upper center displays as well as the left CDU remain also powered (according to FCOM via the batteries and/or RAT - with the RAT operating also the right hand - first officer's - displays are being powered).

The airline reported that it was not a failure of power generation but a failure of power *distribution*. The causes of that failure are now being investigated. After landing, when the crew shut the engines down, power returned, as result the cameras came back online and the crew could see that there was no fire on the landing gear or excessive heat on the brakes, hence the

crew queried the need for an emergency evacuation as suggested by emergency services. The captain wanted to avoid an emergency evacuation unless really necessary as the emergency evacuation could have resulted in injuries.

See <http://avherald.com/h?article=4c1cc3f6&opt=0>

More and more, light airplanes are designed with all-electric panels. It's becoming fairly common to modify legacy aircraft with all-electric panels also, eschewing perceived shortcomings of vacuum- or instrument air pressure-driven gyroscopic instruments. In general this can be a good idea—vacuum and especially instrument air pressure pumps are prone to failure. And when gyroscopic instruments fail in Instrument Meteorological Conditions (IMC)—especially attitude indicators—we pilots have [a very poor record](#) of maintaining control...and of surviving. If in fact pump failures are the most common cause of partial-panel conditions, then it makes sense that eliminating the need for the pump should reduce the chances of losing a primary attitude instrument.

See http://www.mastery-flight-training.com/faq_partial_panel_performan.pdf

Like the Brazilian 777, however, there is always the (admittedly remote) chance of total electrical failure. This could come in the form of a sudden buss failure, an alternator or regulator failure, or your first action in the event of an electrical fire or overheat: to turn off the battery master and alternator switches. Any of these events would plunge you into darkness, and in most cases cause you to lose virtually all of an all-electric panel.

Certainly you should have some backups. Most (but not all) certified panels require standby instrumentation. In most (but not all) cases these backups have emergency batteries that will run them, usually for about 30 minutes before these batteries also run out. Your airplane may have a dedicated alternate or standby electric buss that powers a portion of the panel. It may have a secondary source of electrical power such as a standby alternator...but that is not a requirement in all cases.

What this means is that you need a plan to deal with total electrical failure, or to handle the consequences of an electrical fire. This plan will have to be very specific to the airplane you're flying, because the type, operation and even physical location of equipment in an individual airplane will determine what you do after a total loss of electricity, what equipment you'll have available to get on the ground, and even the scanning techniques you must use to fly by reference to instruments.

For example, one of the airplanes I fly has a combined electric Primary Flight Display (PFD)/Multifunction Display. Naturally all navigation, communications and autopilot equipment are electrically powered. As backups the airplane has an electric backup attitude indicator (with a 30-minute emergency battery), a traditional pitot-static airspeed indicator and altimeter, and for directional control, that simple yet accuracy-challenged magnetic compass.

Additionally, I have an iPad and a portable moving-map GPS receiver, and a handheld communications radio.

With all these backups it seems I've got plenty of capability if the primary panel instruments go black. In fact I do...but it is still limited, and more importantly, ***it is very different from what I'm used to working with***. Making the transition from full-capability and possibly automated flight to hand-flown partial panel flight with this mish-mash of alternate indications.

Consider this scenario: You've just departed into IMC. You're a conservative pilot; you adhered to your personal limitation to take off only if the ceiling and visibility are above circling minimums for your departure airport, and now you're climbing in dark but smooth, warm clouds. As you pass through 1500 feet Above Ground Level (AGL), the panel suddenly goes dark.

Everything is gone except the backups: a yellow light is flashing rapidly on your standby attitude indicator, advising you to push a button to transfer it to battery power (it will transfer automatically if you delay or forget). The backup altimeter and airspeed indicator are fine,

although its hard to see them without any cockpit lights. Your yoke-mounted iPad continues to work unhindered; the cockpit isn't quite dark enough to trigger the iPad's automatic dimming for night flight so its bright display attracts your eyes and makes it even harder to see the darkened backups.

These backup instruments are mounted somewhere out of the way—perhaps left of the now-dark PFD, or below it, or in the center of the panel, or in the worst cases way over on the far right side of the panel (because apparently the panel designers thought the primaries couldn't possibly fail, or they were not instrument pilots who had ever tried to fly partial panel in such a configuration). The yoke-mounted iPad is your only navigational information; your directional data comes from this same tablet software or the old-school and error-ridden magnetic compass mounted high on the center panel or even way up in the windscreen, unlighted and bouncing around in the dim light.

If you're like most pilots your handheld radio is in your flight bag, if you have one at all. So you are completely "lost comm" unless you can fish it out, turn it on (the batteries *are* fresh, aren't they?), tune it (what frequency were you on again?) and (if you're equipped) you plug it into your headset and into an externally mounted antenna (because the range is extremely limited using the handheld's internal or screw-on antenna).

Of course you have no autopilot while you do all this work in the transition. In some fairly recent airplane designs the trim system is entirely electric, with no means of manually adjustment. If this describes your airplane, you'll have to manually fight the trim if you make any changes in airspeed and/or airplane configuration...which you will have to do repeatedly to get the airplane back on the ground.

This all screams for creating a written, airplane-specific checklist for making the transition—and regular practice in this severely degraded state of control and navigation. There's nothing about it that is intuitive or easy. You *can* be ready to handle it, but ***you won't be ready...unless you're ready.***

Simply having backup instrumentation does not mean you'll be able to control the airplane and navigate to a successful landing if the rest of the panel goes dark. It's highly unlikely...but it *can* happen. Certainly the 777 crew didn't expect it. But the pilots were ready to respond.

Don't be too proud (or too complacent) of this technological [panel] you've constructed. Like any other avionics, as the panels of all-electric and glass cockpit aircraft ages we will probably see more instances of total electrical failure. Any electrical fire will cause you to immediately lead the panel to the dark side. Like any other potential emergency, we need to develop and practice procedures applicable to our specific airplanes *now*, so we're ready to respond if the panel blanks out in flight...possibly at night and/or in IMC.



See <https://www.youtube.com/watch?v=h0E9P1qHHkE>

Questions? Ideas? Opinions? Send them to mastery.flight.training@cox.net



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See <https://www.pilotworkshop.com/botched-go-around?ad=turner-go-around-botch>

Debrief: Readers write about recent *FLYING LESSONS*:

With the holiday and all, I'll defer reader Debrief items until next week.

Questions? Comments? Suggestions? Let us know, at mastery.flight.training@cox.net

"I really enjoy reading these and get a lot out of them for both general aviation and work flying."

- Reader and *FLYING LESSONS* financial supporter Stephen Freedman

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More on Ice

For the last couple of weeks *FLYING LESSONS* and reader DebrieFs have explored decisions concerning flight in icing conditions. While most pilots seem to focus on the issue of *legality* concerning flight in possible icing, I've tried to emphasize the safety and therefore wisdom of doing so. This week the folks at Bold Method have addressed another question: "[Is Flying Through Wet Snow Considered 'Known Icing'?](#)"...which is as much about assuring a survivable outcome than it is an exploration about whether or not it is an FAA-enforceable offense to do so. It's worth the quick read.

See <https://www.boldmethod.com/learn-to-fly/weather/is-flying-through-snow-known-icing-conditions/>

Happy New Year to all my readers and *FLYING LESSONS* supporters around the world.

Share safer skies. [Forward *FLYING LESSONS* to a friend](#)



Pursue *Mastery of Flight*.

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