ARE YOU PREPARED FOR AN ELECTRICAL FIRE?

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It's 1998: A Swissair MD-11 crashes off the coast of Nova Scotia. Speculation is that crew disorientation due to smoke from an electrical fire began the chain of events that led to the accident. Investigation centers on the crew's actions while processing the electrical fire checklist.

Later that same year: An emergency Airworthiness Directive (AD) calls for disabling Bob Fields' inflatable door seals. The Federal Aviation Administration (FAA) is concerned about the possibility of electrical fires resulting from a malfunction of the door seal mechanism.

Mid-2000: A B58 takes off on a night IFR trip. The pilot reports an electrical fire shortly after takeoff. The Baron crashes into a lonely farm field, killing all on board.

Events such as these serve as reminders that we should periodically review the Electrical Smoke or Fire procedure for the airplanes we fly, really think about how we'd handle smoke in the cockpit, and practice using the checklist so we'll be ready in case we ever need it "for real." And yet, the vast majority of Raytheon/Beechcraft *Pilot's Operating Handbooks* (POHs) don't even include an Electrical Smoke or Fire checklist.

For those who fly airplanes that *do* have a printed procedure, and (perhaps more importantly) those who *do not*, let's discuss what you might do if you notice abnormally hot equipment or smoke in the cockpit.

Checklists: Some models have it, some don't

There's an amazing lack of consistency among Raytheon/Beech POHs. Procedures and checklists that appear in some versions of airplanes do not exist in others. Beech started publishing an Electrical Smoke or Fire checklist with the introduction of the V35B in 1972. To the best of my knowledge, however, they never put a similar procedure in earlier Model 35s or the Model 33 through the discontinuation of F33A production in 1994.

The A36TC, introduced in 1979, includes an electrical fire checklist that is also present in all B36TC POHs, but normally aspirated 36s and A36s did not get the procedure until the change to IO-550s and throttle-quadrant controls in 1984.

Barons, first introduced in 1961, have always had electrical smoke or fire checklists in all models. As I recall, so does the Duke. (I own a full set of Baron and 1966-and-later Bonanza POHs, but none for the Duke.)

Regardless of whether the particular airplane you fly includes such a checklist, or whether you're flying a Sport or Sierra or some other make and model of airplane, there are some basic considerations you should observe when contemplating an electrical fire.

What will burn!

When you think about it, there's not a lot on board an airplane that will burn. If aviation fuel, oil or perhaps hydraulic fluid isn't involved, it would take something *very hot* to ignite other on-board materials. It's most likely, then, that an electrical *fire* will actually be more of an electrical *overheat*. You won't see flames, and any smoke will be wispy, light-colored and thin. If

the electrical overheat is left unchecked, it may involve insulation and plastics, which if burned can produce a thicker, blacker and highly toxic smoke.

The best course of action, then, is to catch an electrical overheat *before* it can progress into a full-blown electrical *fire*. Run through the Electrical Smoke or Fire procedure at the first sign of eye irritation or wispy smoke, or if you notice that something "smells" or feels abnormally hot.

Single vs. twin, pressurized or not

The actions of fighting an electrical fire or overheat vary slightly depending on the makeup of the airplane you're flying. Electrical overheat considerations differ based on whether the airplane is a single or twin engine and, if a twin, whether it's pressurized or not.

Although I'll use the Bonanza and Baron as examples, the basic theory is valid for all makes of single vs. twin-engine airplanes. Remember that the manufacturer's POH is the final word in what's the "correct" thing to do in the event of electrical overheat or fire. If a checklist exists for the airplane you fly, by all means use it as your guide in isolating and extinguishing a fire.

The first step

The Baron and Bonanza electrical fire checklists call first for turning off the battery and alternator/generator switches. This will, of course, plunge you into darkness if you're flying at night or in "serious" instrument meteorological conditions (IMC) – so keep a flashlight handy when flying in other than "day visual" weather.

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Why turn off the power? Again, it takes a *lot* of heat to support a cabin fire. Usually, removing the source of ignition (the electrical system) will extinguish any avionics or related electrical fire.

What else happens when you turn off the battery and alternator/generator switches? Your avionics go away, of course. Along with communications and VOR navigation radios, you'll lose your Loran or GPS, which will have to reacquire chains or satellites (respectively) and recalculate their position to work after power returns. (Some newer models have batteries that will minimize the "down time" after electrical interruption. Check your POH supplement.)

Also, if your airplane has an electrically driven slaved heading indicator (as part of an HSI and/or slaved ADF), slaving will blank out. After you restore power, you may have a "nav flag" and an inaccurate HSI and ADF for up to several minutes, especially if you've strayed from your heading while the power was off.

Any other equipment hard-wired into the airplane's electrical system that takes time to "spool up" after engine start will likely require the same start-up time after reintroducing electricity.

Electrical anti- and de-icing devices will be shut down for the time your master switch is off, so your autopilot is history. Stall and gear warning horns are inoperative. All your electrically powered engine monitoring equipment will be "out" until power returns. You'll disappear from the radar scope (except as a possible primary target) as your transponder no longer replies, and the controller's frantic calls will go unanswered until you have a powered-up radio.

In today's era of aero-paranoia, the Air Force may scramble fighters to see what you're up to. Do you care? Not really – you're trying to survive in a potentially toxic and lethal cockpit.

Pressing on

Continuing the checklist, you're going to limit the flow of air to the most likely overheated equipment and to ventilate the cabin to remove any contamination that's already in the air. In Bonanzas, pull the Firewall Air Shutoff valve. In pressurized airplanes, pull *both* Firewall Shutoff Valves.

In both cases, you're cutting off air flow from the engine compartment(s) into the cabin; you're also eliminating possible engine-compartment fire contamination in case you misdiagnosed the source of your overheat or smoke. Then open up the pilot-side window and/or pop open the forward door to suck out the smoke.

Be ready for cabin depressurization (and rapid fogging of moisture in the air that you may mistake for additional smoke) if you're flying a Duke or P-Baron up high. Also be aware of all the implications of having the forward door noisily open in flight.

Isolate affected equipment

To get a better idea of where the problem may lie, check the circuit breakers. Chances are, if something got hot enough to prompt use of the Electrical Smoke or Fire checklist, it also tripped a circuit breaker. If you find a breaker popped, or a breaker-type toggle switch mysteriously "off" when you thought it should be "on," don't reset it once you've started the Electrical Smoke or Fire procedure.

Now that you've removed electrical energy that sustains the fire, prevented fanning of any remaining flames and eliminated smoke from the cabin, you need to figure out what was burning. Here's where I personally differ with most presentations of the electrical fire/overheat scenario.

Most primary texts and instructors will tell you to individually turn off every piece of electrically powered equipment. Then turn on the battery and alternator switches. Next you'll turn things on one-by-one until something begins to overheat again. Lastly, they'll have you turn everything else on once you've found "the" errant piece of equipment.

I differ in that I'm not certain I'd find one single radio or device that's overheating. A fire that started in one place may have spread to another. And I'd like to avoid restarting a fire if I could possibly avoid it. That's why my technique is to turn off everything individually, turn on the battery and alternator/generator(s), and then power up *ONLY the minimum equipment required to get me on the ground.* This is consistent with the POH checklist, which calls for "Essential Electrical Equipment – ON" (italics mine).

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I'd start with a single comm and nav radio, followed by what few lights I might need to see what I'm doing without a flashlight. I'd turn on extra nav/comms *only if I absolutely needed them for an approach and landing at the nearest practical airport.* Transponders are optional in emergencies (air intercepts of nonsquawking airplanes notwithstanding) and on-board fires certainly qualify. So I'd leave the transponder off unless Air Traffic Control absolutely insisted, and even then I'd try to talk them out of it if they have a primary return.

Do you *need* an autopilot to descend and land? If you do, you shouldn't be flying in the first place – so don't tempt fire by turning it back on. Do you have to have your GPS or Loran to find an airport? You shouldn't, but if you're lost, certainly go ahead and restore power. You probably don't *have* to have a Stormscope or radar or TCAS, or any of the other nice-to-have extras, so

don't turn them on. In fact, if you can communicate and navigate (or get vectors from ATC as your source of navigation information) with hand-held units, there's no reason to turn the avionics back on at all.

The goal is to minimize risk by turning on only those items you absolutely need to land safely. Let an avionics technician troubleshoot the problem on the ground, where you're not risking your life. Use your best judgment and your knowledge of the systems installed in the particular airplane you fly.

Fire extinguishers

Small cabin fires can be put out with fire extinguishers. Remember, though, that Halon and some other styles of fire extinguishers work on the basis of *displacing* the oxygen that's required for the fire to burn.

If you use one of these extinguishers in an enclosed cabin, you may asphyxiate yourself – so use them sparingly and avoid inhaling the discharge. CO2, and other types of extinguishers also have a reputation for entering and destroying avionics. But in my opinion that's a low priority when facing a cabin fire.

Practice, practice, practice

You already have access to the best Cockpit Procedures Trainer (CPT) for your make and model of airplane – the airplane itself. Budget some time to simply sit in your airplane and run through the Electrical Smoke or Fire procedure. Physically perform the steps. Move the switches and controls like you'd have to do "for real" in an electrical emergency.

Decide beforehand what you'll power back up, *and what you won't*, if you notice electrical smoke. Do the all-important "memory steps." Pull out the checklist to verify you've missed nothing and to complete the procedure. Get in the habit of regularly practicing actual manipulation of the controls in your "CPT" for this and all other emergency procedures.

Next, practice making the transition from normal cruise to the emergency regime. If you have the opportunity to attend type-specific, simulator-based training, great! This is one area where simulator training is at its best. You can also learn a lot from nontype-specific simulators, if you can't attend a FlightSafety or a SIMCOM.

Practice this transition in your airplane. I highly suggest you obtain the services of an instructor or safety pilot who is expert in the ways of your specific model of airplane. Make sure you're either VFR where transponders and two-way communication aren't required, or coordinate the exercise with controllers beforehand, because you'll go "no radio" for at least a short time.

Begin the exercise from what you'd consider to be a "normal" cruise – power set, mixture leaned, navigating by ground reference, VOR, Loran or GPS (whatever is normal for you), and autopilot on, if so equipped. View-limiting device ("hood") on, dial in some place to navigate to, and head there.

Arrange before the flight for your instructor/safety pilot to say without warning, "I smell smoke" or some similar signal at some point in the flight. When you "detect" an electrical fire, run the checklist – including actually shutting off the battery and alternator/generator switches. Transition to hand-flying by partial panel, with whatever equipment you've got, in whatever light is available. Concentrate on partial-panel hand-flying while navigating en route and simultaneously running the electrical smoke or fire checklist.

Way too much work, you say? You're right – but it's what you'd have to do "for real" perhaps with the added stress of watery, itching eyes and coughing from the acrid smoke.

Helpful hint: If you've got someone on board with you, have them read the checklist steps to you.

If your passenger is familiar with the location and function of switches in the cockpit – and is sitting where he or she can reach them – put him or her in charge of running the Electrical Smoke or Fire checklist while you're flying the airplane. Consider training your frequent-flyer passengers for just this and similar emergencies beforehand. Manage your cockpit; make use of anything you've got to ease the load.

Any procedure, published or not, is only as good as your ability to run it under the stress of real-world conditions. Take some time to review and truly *think through* the Electrical Smoke or Fire and similar checklists, and what equipment you'd try to power back up and why. Contrive ways to review the physical motions of the procedure, as well as to practice the scenario as it would actually occur.

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Raytheon/Beech A36
Electrical Smoke or Fire Checklist
Action to be taken must consider existing conditions and equipment installed:

- Battery & Alternator Switches – OFF

WARNING: Electrically driven flight/engine instruments and stall warning horn will become inoperative.

- Firewall Air Control Knob – PULL (If smoke or fire is present in the engine compartment)
- All Electrical Switches – OFF
- Battery and Alternator Switches – ON
- Essential Electrical Equipment – ON (one at a time to isolate defective equipment)

NOTE: Ensure fire is out and will not be aggravated by draft. The cabin can be ventilated by pushing the firewall air control knob full forward, by opening the forward sidewall ventilation outlets and by opening the overhead fresh air outlets. The pilot's storm window can be opened if required.
Beechcraft A36 POH S/N E-1946, E-2104, E-2111 and after, revised October 1990

Raytheon/Beech 58P
Electrical Smoke or Fire Checklist
Action to be taken must consider existing conditions and equipment installed:

- Battery & Alternator Switches – OFF

WARNING: Electrically driven flight/engine instruments, pressurization dump and stall warning speaker will become inoperative.

If necessary, cabin pressurization may be dumped manually with the Emergency Door Seal Deflate Switch when electrical power is off.

- Oxygen – AS REQUIRED

- All Electrical Switches – OFF
- Battery & Alternator Switches – ON
- Essential Electrical Equipment – ON (Isolate defective equipment)

NOTE: Ensure fire is out and will not be aggravated by draft. Turn off CABIN HEAT switch and push in the CABIN PRESS AIR SHUTOFF controls. To evacuate smoke, the cabin pressure and door seal pressure should be dumped, if required.

Beechcraft 58P POH S/N TJ-436, TJ-444 and after, issued December 1983

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