Cabin Fire Battle Plan

Speed is life

BY **JAMES ALBRIGHT** james@code7700.com

A passenger leans into the cockpit and says, "Captain, there is smoke pouring from behind the lav. It's getting hard to see and breathe." As you turn to look, another voice shouts, "Fire!"

These words may be the most chilling you will ever hear in flight and they are your clarion call to battle. Dealing with a cabin fire is the worst kind of aerial combat you will ever face, and to prevail, you need a plan. Fire is a deadly adversary.

Pilots have faced this enemy from the dawn of aviation and a battle plan has evolved. Advisory Circular 120-80, Inflight Fires, is a good place to start, and don't forget to comb your aircraft manufacturer's manuals for mandatory procedures and recommended techniques. But you need more than the written materials; you need a memorized battle plan.

For too long the approach to such inflight emergencies was: Fight the fire; land if you have to. Then, an Air Canada DC-9 changed the way we think about cabin fires forever. In 1983, the captain

AIRCARE INTERNATIONAL

of Air Canada Flight 797 delayed the decision to land for 6 min. while his crew fought a lavatory fire. They were airborne for nearly 20 min. before he managed an emergency landing at Cincinnati/Northern Kentucky International Airport. After the exits were opened, introducing fresh air into the cabin, the aircraft burst into flames; 18 passengers and five crewmembers made it out, but 23 passengers perished.

Fifteen years later, the crew of Swissair Flight 111, en route from Boston to Geneva, detected what they thought was air-conditioning smoke and elected to return to Boston less than 4 min. after first detecting the odor. A minute later they opted for the closest airport, Halifax, adhering to the new inflight emergency philosophy: Point the airplane to a landable surface and fight the fire.

In the next 15 min., however, they declined direct routing to allow time to run checklists, prepare for the landing, and to allow for fuel dumping. Only after multiple aircraft systems began to fail did the crew declare an emergency and request an immediate landing. The MD-11 slammed into the Atlantic Ocean 6 min. later, nearly 21 min. after the crew first detected the odor, which turned out to have been caused by an electrical fire. All 243 people on board perished.

The statistics are clear: If you don't put a cabin fire out in 8 min. or less, it will probably become uncontrollable. If you have an uncontrollable cabin fire and don't land in 15 min. or less, you and all aboard may be doomed. Make no mistake about it: If you have a cabin fire you are in a battle against an enemy that has time on its side.

The key to surviving a cabin fire is speed: Point the airplane toward a landable surface, get it on the ground as soon as possible and fight the fire if you can. You should know how to fly your airplane's fastest possible approach and landing. Doing this requires practice and knowing exactly what to do without reference to checklists.

Land as Soon as Possible

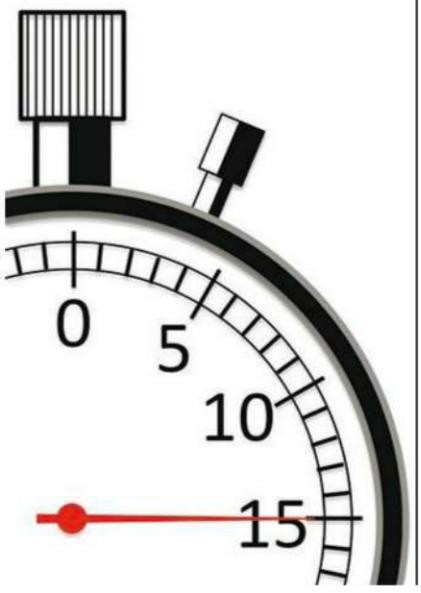
Studies have shown that a flight crew may have as few as 15 to 20 min. to get an aircraft on the ground if a fire progresses without intervention or becomes uncontrollable. If you cannot be absolutely sure the fire will be contained, your first focus needs to be landing the aircraft as soon as possible. To do that, you will need to do what you can from the cockpit to quickly reduce the source of smoke and fumes, point the nose to a landable surface, prepare yourself for an "IFR inside the cockpit" approach and landing, and do all of this very quickly and possibly without the benefit of a checklist.

Typical corporate and airline aircraft interiors can make detecting the exact origin of a fire difficult. What you may think is air-conditioning smoke may actually be an electrical fire. Smoke from behind an electrical panel door could be ventilation air from the engines. No matter the source, it may be prudent to have an immediate action plan on how to remove all possible threats while leaving the airplane still flyable and capable of shooting an instrument approach to a landing.

G450/G550 Cabin Fire Cockpit Flow (author's technique)

JAMES ALBRIGHT

Most aircraft manufacturers provide detailed checklists that are exhaustive in scope but too time-consuming to complete. Post-accident simulator tests following the Swissair 111 crash revealed most crews required 20 to 30 min. to complete the MD-11 Smoke/Fumes of Unknown Origin checklist. The fire became uncontrollable in half that time.



If your smoke and fumes checklist, or checklists, can't be completed in just a few minutes, you should devise an immediate action plan in a flight simulator to remove as many likely suspects as possible, while still leaving the airplane capable of navigating to a runway and shooting an ILS approach.

Some aircraft, such as the Bombardier Challenger 605, will automatically shed all nonessential electrical loads when the air-driven generator is deployed. The crew can then focus on isolating bleed air systems.

Not all aircraft have easy, one-step solutions to combating a fire of unknown origin. But even very complicated procedures can be broken down into the required immediate actions. In a Gulfstream 450 or 550, for example, you can remove all electrical power from the airplane except the standby electrical system and still be able to communicate, navigate and land. You also can remove half of the engine bleed air without fear of depressurization. An immediate action flow can be completed in 30 sec.:

- ▶ Don pilot oxygen masks.
- ▶ Deploy passenger oxygen masks.
- ▶ Turn off all cabin and auxiliary master switches.
- ▶ Open the fuel crossflow valve and

FLIGHTSAFETY INTERNATIONAL

ensure main boost pumps are on.

▶ Close the bleed air isolation valve and turn off the left engine bleed switch.

▶ Activate the standby electrical system.

▶ Isolate the main AC buses, and turn off both engine-driven AC generators.

If the smoke continues you can open the left bleed switch and close the right bleed switch. Once the aircraft reaches a lower altitude, you can shut both bleed switches. This immediate action flow duplicates six pages of very-well-written checklist procedure into 30 sec. and gives you your best chance of starving a fire before it becomes uncontrollable.

While you are waiting for signs as to whether the fire is extinguished or becoming uncontrollable, you must focus on getting the airplane onto terra firma.

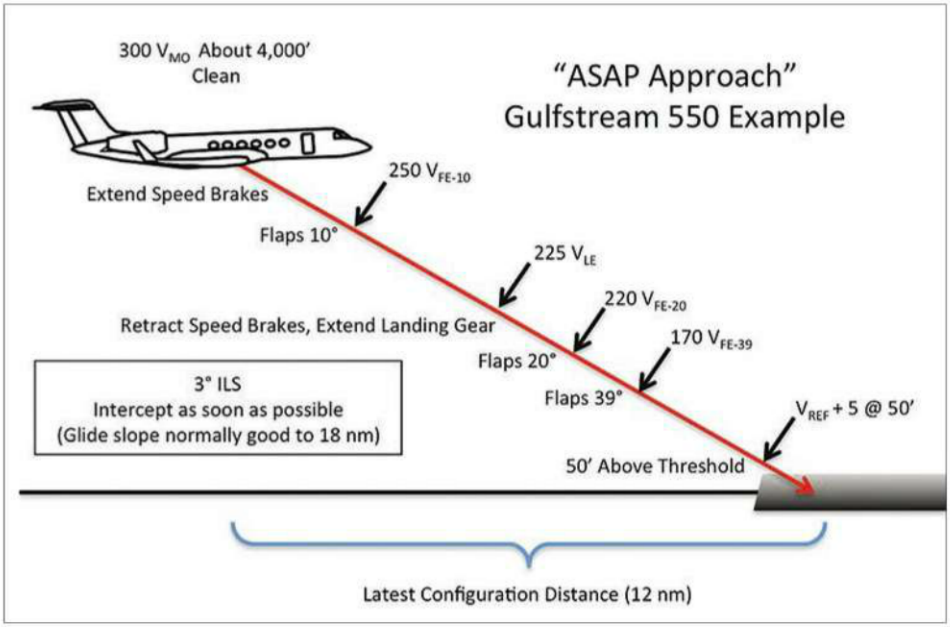
An oxygen mask and smoke goggles are a start, but having an Emergency Vision Assurance System (EVAS) can make the difference between attempting a risky "IFR inside the cockpit" landing and a relatively routine landing and successful evacuation. But using EVAS isn't intuitive. You need to practice deploying it under duress and shooting an approach to a landing. Training vendors, such as FlightSafety International, offer aircraft-specific EVAS training in realistic, stressful conditions.

While you are in the simulator learning how to run your manufacturer's smoke and fumes checklists more quickly, you also should explore the best techniques for getting the airplane from altitude to landing in minimum time. Flying at Vmo, chopping the throttles, throwing out the speed brakes and configuring as speed permits is the obvious procedure. But in what order do you configure and how late can you begin your deceleration? You should practice a few profiles in the simulator until you have the right answer. Much of this involves technique above and beyond the checklist. FlightSafety instructors are old hands at helping you develop your techniques.

In the Gulfstream 550, for example, you can aim for an ILS final at around 4,000 ft. on glideslope, flying clean and at the airplane's limiting speed. At 12 nm, no wind, you can bring the power levers to idle and extend the speed brakes. At 250 kt., you would extend the first notch of flaps. At 225 kt., you would retract the speed brakes and extend the landing gear. The remaining flap settings come at 220 and 170 kt. Simulator tests show this brings the airplane to 50 ft. above the runway at VREF+5, ready to land.

Your aircraft's configuration rules may be different and you might be able to get away with over-speeding the gear and flaps, but you won't know until you practice in the simulator. The G550, for example, is equipped with force limiters that stop flap extension if air loads are too high. Knowing the latest configuration distance can save you 5 or 10 min. should you configure too early, or having to circle at the last minute if you configure too late.

You should practice these "speed runs" while wearing an oxygen mask, smoke goggles and using EVAS, if you have it. Irrespective of EVAS, you should assume you will be in a cockpit filled with smoke. We can all operate the speed brakes, extend the landing gear and operate the flaps by feel alone. But can you tune an ILS frequency and program your flight director without sight of the switches and



From altitude to landing in minimum time.

screens? If you have a choice, find an ILS with a long runway, tune the ILS immediately and plan on capturing the ILS as soon as possible. If your autopilot is working, use it. At that point, even if you do lose sight of everything inside, the aircraft will end up on the runway and all you have to do is brake to a stop. You might break something when autolanding an airplane without auto-land capability, but you are more likely to safely evacuate a broken airplane than a crashed one.

Inflight Firefighting

Over the years we've come to realize that if you don't snuff a cabin fire out in the first few minutes, it will become uncontrollable.

If you have an extra crewmember or if you are far enough from landing that you can spare a pilot, fight the fire. Any able-bodied passenger would be a good second choice. You need to fight the fire aggressively. Training companies such as Aircare International can prepare you for the fight. Just as a flight simulator ensures you react proactively and correctly to an engine fire, an Aircare FACTS cabin simulator can put you in the stressful situation in a safe environment to help you learn to deal with chaos should someone in back ever yell "Fire!" for real.

The first step in fighting any fire is to ensure the firefighter is safe. Know where any protective gear is and how to use it. Personal breathing devices are of little use if they are buried behind hundreds of pounds of baggage, especially if one of those bags is the source of the fire.

There are several areas in the cabin that are more likely than others to be the source of a fire:

- The galley — most notably a convection oven, a microwave oven and trash bins.
- Other trash bins, such as in the lavatory.
- Any baggage compartments.
- Electrical equipment racks.
- Air-conditioning ducts.

You should look for the exact location of the fire before applying any extinguishing agent, if possible. Discharging the extinguisher into the lavatory without first gaining access to the trash bin, for example, would not put out a fire in the bin. Look for smoke and use the back of your hand to feel for hot spots on panels and doors. The back of your hand is more sensitive to heat than your palms or your fingertips and using the back of the hand minimizes the risk of immobilizing your hands in case of burns.

Personal electronic devices (PEDs) scattered throughout the cabin, in carry-on luggage or in stowed baggage, can be a source of a particularly difficult fire to extinguish. While a halon fire extinguisher can temporarily reduce the flames and smoke from a lithium battery fire, it will not end a thermal runaway. The offending battery must be cooled by dousing with water and ice. Moving the PED to an oven can contain the fire but will not help with smoke. Commercially available PED fire bags may help with the smoke temporarily. No matter how a lithium battery thermal runaway is treated, it cannot be assumed to be permanently extinguished. The airplane must be landed as soon as possible.

Venting the smoke off the airplane can extend your firefighting time and possibly save lives as a result, but the process is less than intuitive. Turning off all air-conditioning packs, if they are the source of the smoke, might be the right answer. But that action will probably also slam any outflow valves closed, trapping the smoke inside the cabin. Even with a good air-conditioning pack you need to consider pressurization actions carefully. Raising the cabin altitude to increase airflow is usually a good bet. Many modern corporate aircraft completely exchange cabin air in 2 min. or less. Larger aircraft can take 5 min. or more. Increasing cabin altitude can speed the exchange of air.

If the Day Ever Comes

The more you practice getting the airplane on the ground as soon as possible, the better prepared you will be to combat fire in flight. But remember that for any battle no plan survives the enemy. You will need to be creative and flexible when dealing with a cabin fire. There are other things you can do to stack the odds in your favor.

Declare an emergency and let ATC know what you are doing; let them adjust to your needs. You can ask them for a vector to the nearest runway, about the weather and approach availability. And then let them know you want a single frequency, preferably the tower's frequency, because changing frequencies may become impossible. If your aircraft has a radio that is available down to the last bit of electrons on the aircraft, use it (VHF No. 1 on a Gulfstream 550).

Get the ILS tuned and the autopilot in control as soon as possible. Once the autopilot has the ILS beam in its electronic grasp, you can have it land the airplane even if you don't have an auto-land system. If you lose sight of the instruments, let the autopilot do its thing and once you feel runway below you, apply the brakes.

If you have a chance, discuss post-landing duties with the other pilot and other available crewmembers. Decide which exit is best, where to funnel passengers — upwind on the grass is best — and who will secure the aircraft. Let tower know where you plan on sending passengers so fire rescue doesn't run anyone over.

If that day does come and all goes well, you will have a war story to tell and a planeload of passengers wanting to buy you a beer. But long before that day, you will need to think the process through, devise your own immediate action flow and practice in the simulator.

Remember those two critical numbers: If you don't extinguish the fire in 8 min. or less you probably won't, and if the fire becomes uncontrollable, you need to get the airplane on the ground in 15 min. or less to be able to successfully evacuate all on board. **B&CA**