Fire Extinguishers: Halon, Not Dry Chem

Halon and its newer alternatives are effective aircraft fire extinguishing agents. Things you bring with you in the cabin can make a fire much worse.

by Rick Durden

CHECKLIST

- Halon and Halon alternatives are effective and safe for use in aircraft.
- Halon alternatives are twice the weight of Halon but cost about the same.
- Dry chem extinguishers pose a crew risk and should not be used.

The idea of an inflight fire rightfully scares the bejabbers out of pilots. Uncontrolled combustion in a confined space is ugly enough—adding altitude and speed to the mix can make a fire lethal in short order. It's no wonder that pilots dealing with an inflight fire have jumped out of their aircraft even though they had no parachute.

While inflight fires are rare, we are of the opinion that every aircraft should have an effective fire extinguisher in the cabin where the pilot can reach it quickly and easily.

Our research and testing has led us to a two-fold conclusion as to what type of extinguisher you should carry in your aircraft: First, effective means an extinguisher that uses a "clean agent," either Halon or one of the Halon alternatives—if it is possible to extinguish the fire you're dealing with, they will do it and they won't hurt you or the aircraft in the process. Second, a dry chemical extinguisher—the most common type we see in aircraft—uses chemicals that have effects on the occupants and the aircraft that are so pernicious that we recommend against their use in aircraft. We'll tell you why we came to those conclusions.

THE FIRE QUADRILATERAL

For years we've been told about the fire triangle—with three essential elements for a fire: heat, fuel and oxygen—and that removing any one will put out a fire. That description is true, but incomplete. There is a fourth essential element: the chemical reaction that allows the other three to combust. Without the chemical reaction of the three other elements, heat, fuel and oxygen will happily coexist without starting to burn.

Fire extinguishers act to remove one or more of the fire quadrilateral—as we'll discuss below, extinguishers we consider appropriate for aircraft primarily interrupt the chemical reaction and don't remove the oxygen.

Despite interior fabrics made of materials that will self-extinguish or at least act to slow fire propagation, aircraft and their cabins have plenty

Clean agent H3R fire extinguishers: 5B:C-rated model C352TS using Halon 1211, left, and 2B:C-rated model B385TS using Halotron, a Halon alternative, in front of our test fire.

DRY CHEM? NOT IN AIRCRAFT

Dry chemical extinguishers have long been attractive because they are less than half the price of Halon and Halon alternative units. A visit to our local Home Depot store and a quick survey on the web found prices for 5B:C and larger dry chem extinguishers in the $35 to $70 range. However, the FAA specifically recommends against using them in aircraft in AC 20-42D. "In general, dry chemicals are not recommended for hand extinguishers for internal aircraft use, due to the potential for corrosion damage to electronic equipment, the possibility of visual obscuration if the agent were discharged into the flight deck area, and the cleanup problems from their use."

We agree with the FAA—there are serious downsides to dry chem extinguishers in aircraft. First, there's the blinding, choking chemical cloud. As we observed first-hand in our testing and the FAA stated in an earlier version of the AC, "Dry chemical extinguishing agents when discharged in crew compartments of confined areas may cause serious impairment to visibility. In addition, they may cause temporary breathing difficulty during and immediately after discharge."

Second, the agents used in dry chem extinguishers are highly corrosive. In our research for this article, we saw warnings indicating that the post-discharge cleanup from a dry chemical extinguisher can be so involved that it may preferable to scrap the airplane because the chemicals work their way into every nook and crevice of the avionics and aluminum structure.

of stuff that will burn nicely, thank you. Much of it is what we bring in, clothing, paper, pillows and baggage. This is a good spot to note that you should not wear synthetic materials, such as nylon, when flying—exposed to flame, they melt onto your skin, causing serious burns.

Aircraft fabrics that self-extinguish only do so when the fire source is removed. If there is an electrical or avgas-fed fire involved, the interior materials will burn. What's worse is that once they do burn, the fire-blocking chemicals with which they are treated cause them to give off gases that are toxic in small quantities—in addition to the usual toxic products of combustion, carbon monoxide and carbon dioxide that will do their best to kill you as the fire deprives the cabin of oxygen.

Bottom line, a fire in an aircraft cabin will kill you via the toxic gases it emits or the flames themselves. Unless you are on the ground and stopped when a fire breaks out, your survival may be dependent on having an effective fire extinguisher that you can reach right now.

We are aware of hangar-flying sessions in which pilots have said they wouldn't use a fire extinguisher in the cabin because the gases it expels are worse than the fire. That's absolutely untrue. While we don't recommend a dry chemical extinguisher, in an emergency using one is safer than letting a fire burn. Visibility will go to zero for some time and you'll be left with a large, corrosive mess.

Discharging Halon and Halon-alternative extinguishers pose little risk to occupants. The FAA put it bluntly in Advisory Circular AC 120-80, "The toxic effects of a typical aircraft seat fire, for example, far outweigh the potential toxic effects of discharging a Halon fire extinguisher."

Fire extinguishers are rated for the type of fire they are designed to fight, per the National Fire Protection Association (NFPA). Class A fires are ordinary combustible materials such as wood, cloth, paper and plastic. Class B fires are flammable liquids, oil, grease, paint and flammable gases. Class C fires are from energized electrical equipment—the extinguishing agent should be non-conductive. Class D fires are combustible metals such as magnesium, titanium and lithium.

For aircraft fires, the NFPA recommends—and all the sources we researched agree—the fire extinguisher should be capable of handling Class B and C fires. The letter rating is shown on the extinguisher

Fire extinguishers for Class A and B fires also display a numeric rating in front of the letter rating—the higher the number, the more effective the extinguisher for a particular fire. The number rating is a statement of how big a fire, in square feet, the unit should be able to extinguish.

For a two- or six-place general aviation airplane, we recommend at least a 5B:C extinguisher.

HALON

The most effective extinguishing agent for Class A, B and C fires, bar none, is Halon—which the FAA describes as one of the class of halocarbon chemicals. It, and newer Halon alternatives, are considered clean agents because they pose little risk to humans in the area when discharged. The clean agents stop the chemical reaction necessary for a fire.

Unfortunately, Halon is a chlorofluorocarbon that does tremendous damage to the ozone in our atmosphere, and its manufacture has been illegal since 1994. Enough was made that, through recycling of Halon from extinguishers that have not been used during their 12-year service life, there is still an adequate, but shrinking supply. Halonalternatives do not have the adverse effect on the atmosphere, have a low carbon footprint and are legal to manufacture.

We spoke with Chris Dieter, senior vice president of H3R Aviation, the major player in the aviation fire extinguisher world, who told us that there has been a great deal

The H3R Halotron 2B:C extinguisher knocking down flames on our test rig, above right. The throw pillow on the seat was protected from the extinguishing agent by the seat back and kept burning after the Halotron agent was exhausted. A dry chem extinguisher was used to put out the remainder of the fire—note the cloud of chemical, not something we'd want in the cockpit, below right.

of research into finding a Halon replacement—and Halon is gradually becoming harder to get. The most common of the Halon alternatives is Halotron. Currently, a fire extinguisher using Halon weighs half that of the same-rated extinguisher using a Halon alternative. However, according to Dieter, that may be changing in the near future as more effective clean extinguishing agents are being developed.

Weight is the only difference when it comes to Halon and Halon alternative extinguishers—the same rated extinguishers are priced about the same. For a 2B:C Halon or Halotron, we saw prices between $100 and $120. For a 5B:C extinguisher, street prices ranged from $165 to $220.

TESTING

In 2008, before the FAA recommended against using dry chem extinguishers, *Aviation Consumer* tested Halon and dry chem fire extinguishers on a rig designed to simulate aircraft cabin materials. Both types extinguished the fire. This time we decided to go one better by constructing a wood structure about the size of an aircraft seat, stapling burn-tested interior materials provided to us by Centennial Aircraft Interiors as well as fabrics aircraft occupants would wear. We put a throw pillow of the sort we see routinely carried in airplanes on the seat. The pillow proved to be a big deal.

We then tried to light the self-extinguishing fabric—oriented vertically. It would smoke and melt when the flame was applied, but the fire went out when the flame was removed. We stayed out of the smoke emitted.

Next we sprinkled a quarter-cup of mogas on the various fabrics and the pillow. When we applied flame (using an fireplace igniter), the rig lit and became an inferno within 20 seconds.

We used a 2B:C Halotron extinguisher per the instructions—start eight feet from the fire, aim at the base and use a sweeping motion. We used short bursts (figure on about 10 seconds of extinguishing material) and knocked the fire down completely on the side of the rig facing us. However, the pillow was shielded by the seat back and was burning intensely. We moved around to spray it, but we ran out of agent.

Using a 1AB:C dry chemical extinguisher, we were able to put out almost all of the remaining fire—a bit of fabric continued to smolder. Stepping on it a few times solved the problem.

We came to three conclusions: we disagree with recommendations that a 2B:C extinguisher is large enough for a two- to four-place airplanes—we recommend a 5B:C extinguisher. Second, after seeing (and breathing some of) the cloud generated by a small dry chem extinguisher, if we ever have to use an extinguisher in anger in the cabin of an aircraft, we want it to be a clean agent rather than dry chem. Finally, that throw pillow you use behind your back can be a menace.

MAINTENANCE

Modern fire extinguishers are remarkably resilient—but they are not set-and-forget devices. They should be visually inspected every 30 days. At six years the extinguisher should be emptied, inspected and recharged by a fire extinguisher repair facility. Every 12 years the extinguisher must be hydrostatically tested.

RECOMMENDATIONS

We'll put it bluntly, if you don't have a fire extinguisher in your airplane, buy a Halon alternative clean agent unit—or Halon, if weight is an issue—5B:C extinguisher and mount it where you can reach it easily. If you have a dry chem extinguisher in your airplane, follow a two-step approach: first, take it home and put it in your kitchen where it can be easily reached; second, follow the recommendation in the previous sentence before further flight.