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Fire Extinguishers: Halon is Worth the Cost

Forget consumer-grade stuff: A portable Halon extinguisher is the way to go, and products from H3R Aviation lead the market.

By Joseph E. (Jeb) Burnside

An in-flight fire is most pilots' greatest fear, surpassing even a mid-air collision. Although relatively rare, the unique combination of combustible materials and ignition sources available in the typical personal airplane means an in-flight fire must be dealt with quickly and decisively. Doing so usually means disabling systems to deprive the fire of its fuel or ignition sources and employing a fire extinguisher to smother it. A quick landing, even if off-airport, may be necessary.

There are lots of extinguishers on the market, products both designed for aviation use and those marketed as "all-purpose" units. How do they differ? And—most important—how do they work on the materials found in a typical aircraft fire? To find out, we gathered up current examples of aviation-specific and all-purpose extinguishers, lit a few fires and evaluated the results.

All the extinguishers we tested thwarted our efforts at arson. But we were surprised at how quickly we used up extinguishing agent, and the premium we had to pay for an extinguisher designed for the cockpit. We also discovered, however, that there are real differences between household, automotive and aviation-grade extinguishers.

The cloud was so large, in fact, we decided right then we didn't want to discharge a dry-chemical extinguisher in our airplane unless it was our last and only option.

Three things must exist for any fire to start: An ignition source, fuel (for the fire, not 100LL) and oxygen. These three items make the "fire triangle." Remove any one of them and the fire either doesn't start or is

CHECKLIST

- + Any extinguisher, even a dry-powder type, is better than nothing.
- + Halon-based units are superior for in-cockpit use, but no extinguisher is without toxicity risks.
- Dry-powder extinguishers can cause vision and breathing problems in the confines of a cockpit.
- Dry-powder extinguishers may result in corrosive by-products, ruining the avionics or airframe.

extinguished. Our cockpits feature an abundance of materials capable of sustaining a fire. Carpeting, insulation, upholstery and paper charts are present in almost every airplane.

Since fuel lines often run through our cabin—routed through the fuel selector, flowing via a capillary line to a fuel pressure gauge, running down an A-post from the wing tanks—there's another, much more combustible material nearby to get things burning. Our little experiment in pyromania demonstrated that when you combine even burn-tested fabric with some 100LL, an ignition source and the air flowing around and through an airborne airplane, you've got a problem.

EXTINGUISHER TYPES

There are two basic portable fire extinguisher types on the market these days: Halon and dry chemical. Of the two, dry chemical types are less expensive and far easier to find: We snagged two Kidde-brand units from our local Wal-Mart for under \$60. One was a typical residential unit, rated for use on wood/paper (type A), flammable liquids (type B) and electrical (type C) fires (see the sidebar on page 21 for an explanation of the different ratings). The other one was marketed for automobile use and rated for type B and C fires. The table (above right) summarizes the extinguishers we evaluated.

MANUFACTURER/ MODEL	AGENT	TYPE	DISCHARGE TIME	WEIGHT (LBS)	MOUNTING BRACKET	SIZE (Diameter x Height)	CLASS RATING	STREET PRICE
KIDDE/FX5 II	DRY POWDER (Sodium Bicarbonate)	DISPOSABLE	8 - 10 Sec.	2.85	NYLON, NECK ONLY	3.25 x 10.95	5-B:C	\$27
KIDDE/FX110E	DRY POWDER (Monoammonium Phosphate)	DISPOSABLE	8 - 12 Sec.	3.9	NYLON, WITH STRAP	3.25 x 13.75	1-A, 10-B:C	\$36
H3R AVIATION/RT-A600	BLENDED HALON	DISPOSABLE	10 - 12 Sec.	1.6	STEEL ROD, WITH STRAP	2.5 x 9.9	2-B:C	\$140
H3R AVIATION/A344	HALON 1211	RECHARGEABLE	10 Sec.	2.3	STAMPED STEEL, WITH STRAP	2.6 x 10.0	2-B:C	\$86
H3R AVIATION/RT-A1200	BLENDED HALON	DISPOSABLE	14 - 16 Sec.	3.3	STEEL ROD, WITH STRAP	3.0 x 11.3	5-B:C	\$260

We also obtained three Halon extinguishers from H3R Aviation, which manufactures a wide range of aviation-specific extinguisher products, including portable units and those large, wheeled bottles you might find on your FBO's ramp. Two of our H3R units use blended Halon, a combination of Halon 1211 and 1301; the third uses Halon 1211. According to the company, Halon 1211 is a liquid streaming agent while 1301 a gaseous flooding agent. Because of Halon's ability to react with a fire, it stops the ongoing chemical reaction without producing potentially damaging (i.e., corrosive) residues.

Halon, of course, is a chlorofluorocarbon banned in the U.S. and most other countries since January 1, 1994, as part of the Montreal Protocol on ozone depleting substances. Before it was banned, enough of the stuff had already been produced that new extinguishers can be sold and, as in-service units reach their life limits, their Halon can be recycled. As a result, it's likely fire extinguishers containing Halon will be around for some time. That's a bad thing if you're worried about the ozone layer, but a great thing if your cockpit catches fire while you're sitting in it.

We deferred to H3R Aviation in choosing which models to evaluate, but asked for extinguishers appropriate for a four-seat piston single, a

six-seat piston twin and a cabin-class turboprop, like a King Air.

The A344 unit is ideal for the piston single, especially since its stamped-steel mounting bracket is more robust and allows greater flexibility in choosing a location. The RT-A600, meanwhile, has a different bracket and weighs less, but also holds more extinguishing agent; it's the one we'd use in a twin, perhaps behind the front seats. We feel the largest of the three, the RT-A1200, is ideal for mounting, say, on a King Air's cockpit bulkhead.

INHALING HALON

One of the issues associated with Halon use, especially in the tight confines of a cockpit, is ensuring adequate ventilation. According to FAA Advisory Circular AC 120-80, In-Flight Fires, "NTSB investigations of in-flight fires indicate that crewmembers have been hesitant to use Halon extinguishers during flight because of mistaken ideas about adverse effects of Halon." The FAA notes, "The toxic effects of a typical aircraft seat fire, for example, far outweigh the potential toxic effects of discharging a Halon fire extinguisher."

Hopefully, discharging any extinguisher in a cockpit

puts out the fire. But, discharging some extinguishers can create a whole new set of problems. Again, the FAA (from AC 20-42C, Hand Held Fire Extinguishers for Use in Aircraft): "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." Our testing confirms these two cautions.

Another issue with dry chemical extinguishers is their often-corrosive residue. The agent usually used in



You'd be surprised how many pilots we know who've never tried to get to their extinguisher while simultaneously trying to fly the plane with their other hand. Make sure the device you buy can be mounted somewhere you can actually reach with your seat slid into position.

them is either sodium bicarbonate or monoammonium phosphate; the consumer-grade Kidde extinguishers we purchased used both. Of the two, monoammonium phosphate is much more corrosive. According to the National Fire Protection Association and quoted by H3R Aviation, "Any chemical powder can produce some degree of corrosion or other damage, but monoammonium phosphate is acidic and corrodes more readily than other dry chemicals...."

Despite NTSB and FAA statements indicating Halon extinguishers are

preferable to dry chemical units, the FAA is careful to note "human exposure to high levels of Halon vapors may result in dizziness, impaired coordination, and reduced mental sharpness."

Decomposed Halon by-products—those created when the compound is exposed to a fire—are more toxic than the Halon itself. The FAA's punchline: "[D]ecomposition products from the fire itself, especially carbon monoxide, smoke, heat, and oxygen depletion, create a greater hazard than the thermal decomposition products of Halon."

PUTTING OUT FIRES

The potential for toxicity or corrosion is rather academic until there's a fire and you need something—anything—with which to put it out. To see for ourselves how the two types of extinguishers stacked up, we started a fire. Not just any fire, though. Since we couldn't find anyone willing to donate their airplane for testing, we needed a Plan B. In hindsight, that was a good decision having little to do with proximity to real firefighting equipment, not to mention people trained to use it, and everything to do with using too much gasoline. And, since we value our relationships with the local airport's management, which generally takes a dim view of bright flames, we relocated our project off-airport.

We obtained some burn-tested synthetic

(i.e., not leather) upholstery material left over from an interior refurbishment project. We used some scrap lumber and plywood to fashion a frame, stapling the upholstery to both sides, then moved the whole rig outdoors. Being too cheap to drain any precious 100LL, we sprinkled—sparingly at first—some unleaded gasoline on the contraption, let it soak in for a few moments and grabbed the nearest Halon extinguisher. At the flick of a Bic, we were in business. We waited a couple of seconds for the flames to spread evenly along the frame, then pulled the extinguisher's trigger.

It's not an exaggeration to say the effect was immediate and satisfying: The flames went out—period—and left us contemplating a slightly darkened wooden frame and charred upholstery remnant. As noted, this was a Halon extinguisher, one grabbed at random from our selection of three.

We re-lit our contraption and—being already on the ground and, therefore, somewhat patient—waited a few more seconds than before. When we couldn't stand it any longer, we hit the Halon extinguisher's trigger again; two bursts. And, again, the results were impressive. Our little conflagration was out. The small Halon extinguisher we chose did its job, leaving nothing behind but smoldering upholstery. The bottle was near empty, though, after approximately eight seconds' use.

Since that piece of upholstery was ready for the scrap heap, we turned the rig around, exposed the other one, and dumped on more gasoline. Maybe too much. We readied a dry chemical extinguisher, flicked our Bic again and stood back. This time, we had a fire. Putting it out required a few more bursts from the dry-chemical extinguisher than with a Halon unit. But it did go out.

The big difference was the white cloud that remained post fire. We had to wait for it to clear before we



Don't rest easy because the fabrics in your aircraft passed the FAA burn test. If there's any gasoline involved, they will burn. Enthusiastically. The good news is that—if you can aim at the base of the fire—a small extinguisher will probably do the job. Given how close your hands may be to the heat in the confines of the cockpit, you may also want a set of Nomex (fireproof) gloves next to your extinguisher.

THE ABCS OF FIRE EXTINGUISHERS

Before buying an extinguisher for use in aircraft, make sure it is rated for Class B and C fires. The following classes are defined by the National Fire Protection Association (NFPA):

Class A: Ordinary combustible materials like wood, cloth, paper, rubber and plastic. For these fires, the quenching and cooling effects of water—or solutions containing water—are considered primary.

Class B: Flammable liquids, oil, grease, oil-based paints, lacquers and flammable gases for which extinguishing agents with a blanketing effect are essential.

Class C: Energized electrical equipment, where the non-conductivity of the extinguishing agent is important.

Class D: Combustible metals (i.e., magnesium, titanium, zirconium, sodium, lithium and potassium) requiring non-reactive dry powders.

Additionally, a numeric rating is used with the identifying letters for extinguishers labeled for Class A and Class B fires. The higher the number, the greater is the extinguisher's relative effectiveness on a given size fire.

Effectiveness depends on the agent, the extinguisher's capacity, discharge rates and other features, but the numerical rating for Class B extinguishers indicate the approximate number of square feet of fire it can extinguish. Numeric ratings are not used for extinguishers labeled for Class C or D fires. Extinguishers effective on more than one class of fire have multiple "numeral-letter" and "letter" classifications and ratings; for example, 5 B:C.



could test again. Once the cloud cleared, we sprinkled a little more gasoline on the rig, lit it and put it out again, eventually using up the dry-chemical unit after 10 or so total seconds' use. This time, we had an even larger cloud of powder, which also covered everything nearby: the test rig and its upholstery, spare extinguishers, grass, pavement and an *Aviation Consumer* editor.

The cloud was so large, in fact, we decided right then we didn't want to discharge a dry-chemical extinguisher in our airplane unless it was our last and only option. Put aside the long-term corrosion dangers to the aircraft resulting from the cloud of powder: We genuinely would have been IFR in the cockpit, unable to see the panel clearly. In our view, that's going to be an unnecessary distraction in the immediate aftermath of fighting a cockpit fire. Too, we wouldn't want to breathe that stuff—opening a window would have been mandatory.

RECOMMENDATIONS

No way, no how are we going aloft without a fire extinguisher. A dry-chemical unit, while inexpensive, easy to find and effective, leaves too much to be desired. Among the issues strongly arguing in favor of a

Halon extinguisher, in our opinion, are potential corrosion along with the respiratory and vision-limiting effects a dry-chemical extinguisher produces.

Balancing the need to put out a cockpit fire that might destroy the airplane anyway—and you along with it—against the risk of corrosion rendering it and your avionics unairworthy at some later date is a valid question. But it's one thing to consider what those corrosive effects might be and how they'd manifest themselves against the possible outcome of not having an extinguisher at all. For not too much more money, you can get the "real deal" in a portable extinguisher designed for aircraft use. We think that's money well-spent.

As for which brand to get or where to buy it, our research among the usual suspects of general aviation vendors reveals they all stocked some combination of the same units marketed by H3R Aviation. Although we're surprised no other manufacturer apparently markets Halon units to general aviation, the H3R Aviation products are top-notch. Each came with a steel mounting bracket suitable to the task. No doubt other manufacturers produce portable Halon units sized to work well in

cockpits but don't market them to GA. There's no FAA fire-extinguisher approval process relevant to Part 91 operators; the important thing is making sure an appropriate one is available when you need it.

Solid maintenance by well-trained technicians, enforcing a no-smoking policy, replacing worn or dated wiring and avoiding too many portable devices—along with their power cords—will help minimize the likelihood of an in-flight fire.

On the really bad day you have one, however, you'll want to reach for a Halon extinguisher while aiming for the nearest runway.

When he isn't torching aircraft parts in the name of research, Jeb Burnside is the editor of our sister publication Aviation Safety.

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