Fire Protection Industry (ODS & SGG) Board

ARTICLE

Protection in the aviation industry

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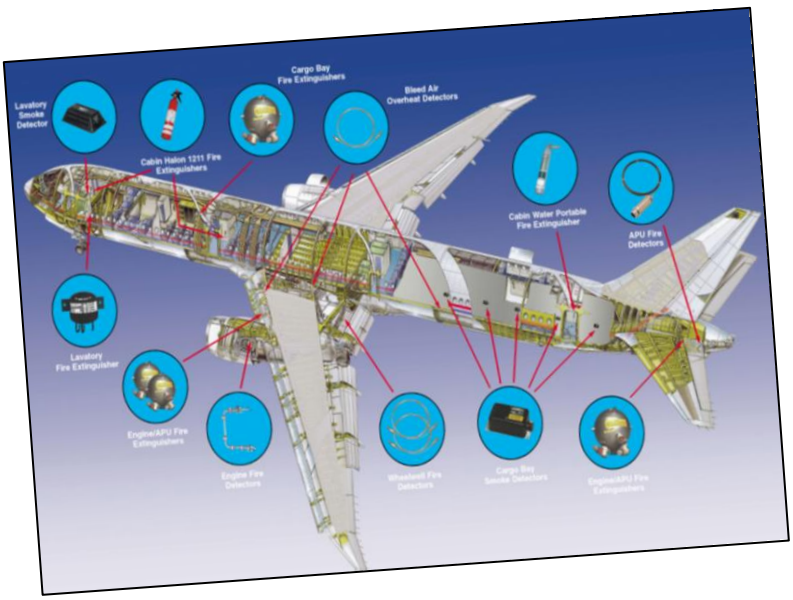
Fire is a major safety hazard for civil, commercial and military aircraft. In Australia the potential fire zones of modern multi-engine aircraft are protected by fixed fire protection systems. A fire zone is an area, or region, of an aircraft designed by the manufacturer to require fire detection and/or fire extinguishing equipment and a high degree of inherent fire resistance.

Fire safety in the aviation industry

The term “fixed” describes a permanently installed system in contrast to any type of portable fire extinguishing equipment, such as a hand-held extinguisher. A complete fire protection system on modern aircraft, and on many older aircraft, includes a fire detection system and a fire extinguishing system



Typical areas on aircraft that have a fixed fire detection and/or fire extinguisher are:

- Engines and auxiliary power unit (APU)
- Cargo and baggage compartments
- Lavatories on transport aircraft
- Electronic bays
- Wheel wells
- Bleed air ducts

Aviation applications of halon are among the most demanding uses of the extinguishing agent, and require their beneficial characteristics, especially dispersion and

suppression effectiveness, acceptable toxicity and highly efficient weight and space requirements. This is due to their unique ability to fight fires at the flame chemistry level. Other desirable characteristics that halon possess are avoidance of clean-up problems, minimal thermal decomposition products, suitability for use on live electrical equipment and effectiveness on hidden fires. Taking all of these characteristics into account it is no surprise that replacing halon for aviation use is proving technically difficult.

While alternative methods of gaseous fire suppression systems for ground-based situations have been implemented, aviation continues to depend on halon for the majority of its fire protection applications. This is despite over 20 years of research into halon replacements. The aviation industry relies on recycled agent to meet its needs, but this is a finite resource.

What makes halon so effective?

Halon is a liquefied, compressed gas that stops the spread of fire by chemically disrupting combustion. Halon 1211 (a liquid streaming agent) and Halon 1301 (a gaseous flooding agent) leave no residue and are remarkably safe for human exposure. Halon is most effective for flammable liquids and electrical fires and is electrically non-conductive. Halon works in several ways:

- Absorbing heat, i.e. making the fire work harder. All fire extinguishing agents absorb heat to some extent, and for many extinguishing agents this is actually the dominant fire extinguishing mechanism.
- Dilution – lowering of oxygen (and fuel vapour) concentration
- Radical (highly reactive molecules) removal by chemical scavenging – conversion of active radicals to stable species (hydrofluorocarbons (HFCs) and halons).
- Radical (highly reactive molecules) removal by catalytic chain processes, sometimes referred to as “chemically acting”. The agent needs to contain a bromine or iodine atom so it is generally limited to halons and CF3I. This is a very effective means of extinguishing and the main reason that halons are such effective agents.

Halons and the Montreal Protocol

A number of scheduled extinguishing agents are classified as ozone depleting substances (ODS), i.e. when released into the atmosphere they will deplete the stratospheric ozone, and/or a synthetic greenhouse gas (SGG), i.e. when released into the atmosphere they will contribute to global warming.

Although halons are highly effective firefighting agents and explosion suppressants, they are extremely potent ODS as well as significant global warming gases. According to the Intergovernmental Panel on Climate Change (IPCC) fifth assessment report, halon 1301 has a global warming potential of 6,290 relative to CO2 while halon 1211 has a global warming potential of 1,750 relative to CO2.

As such, halons are defined as scheduled extinguishing agents under the Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 (the Act) and the Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 (the Regulations). The regulations stipulate certain obligations in how they are to be acquired, stored, used, handled, disposed of and maintained safely to minimise their impact on the environment. In essence, it is an offence to be in possession of halon unless it is contained in fire protection equipment installed in, or carried in, an aircraft. A Halon Special Permit (HSP) is available via Regulation 341 for other purposes, such as the storage of equipment spares. Applications should be made to the Fire Protection Industry (ODS &SGG) Board.

The Act and Regulations help ensure Australia meets legal obligations under the Montreal Protocol on Substances that deplete the ozone layer and the United Nations Framework Convention on Climate Change.

The Montreal Protocol sets binding progressive phase out obligations for developed and developing countries for all the major ozone depleting substances, including CFCs, halons and less damaging transitional chemicals such as hydrochlorofluorocarbons (HCFCs).

As one of the first countries to ratify the Montreal Protocol, Australia continues to be a leader in the phase out of ozone depleting substances. In many cases, Australia is well ahead of the Protocol requirements. Australia's approach has been based on a cooperative partnership between industry, community and all levels of government.

Under the Act, a scheduled extinguishing agent can only be discharged where the product containing the extinguishing agent is being used for its designed purpose, in other words in response to an actual fire. Discharge for testing or training purposes are not permitted unless the person meets the requirements in the Regulations, and has been granted a fire protection industry permit to do so by the Fire Protection Industry (ODS & SGG) Board (the Board).

It is very important that all aviation operators, facility managers, and owners understand the potential environmental impacts of scheduled extinguishing agents if released into the atmosphere. To learn more about the effects of scheduled extinguishing agents, please visit the Department of the Environment website http://www.environment.gov.au/protection/ozone

Aviation operators and staff should be diligent to ensure that an accidental discharge of fire protection systems and equipment is kept to an absolute minimum, in particular where the systems contain scheduled extinguishing agents.

Fire Protection industry (ODS & SGG) Board

The Board, appointed by the federal Minister for the Environment and Energy, administers the fire protection division of the regulations on behalf of the Australian Government, including matters which impact on fire protection in the aviation industry such as the use of halons. The Board exercises a range of powers and functions listed in sub regulation 311(2) in all states and territories in Australia, including to:

- receive applications and application fees for fire protection industry permits
- process applications within the 30 day time frame specified in the regulations
- issue fire industry permits in accordance with the regulations
- inspect premises as specified in the regulations.

The Board also undertakes other functions outside the regulations and:

- provides customer services support to members of the fire protection industry and the general public
- undertakes a program of communications and awareness activities aimed at encouraging compliance with the fire protection industry permits scheme.

The Board provides ongoing information to the fire protection industry and the general public on its activities and purpose.

Current status of aviation halon replacement options

All new installations of fire extinguishing systems for engines and cargo compartments use halon 1301, and all new installations of handheld extinguishers use halon 1211. With the exception of lavatory trash receptacles, there has been no retrofit of halon systems or portable extinguishers with available alternatives in the existing worldwide fleet of aircraft.
Key to the acceptance of one or more of the approved substitutes has been their ability to demonstrate their fire extinguishing performance equivalent to halon in specific applications. As such, substitutes for halon in civil aviation fire extinguishing systems are evaluated and approved according to the relevant Federal Aviation Administrative (FAA) Minimum Performance Standards (MPS). The following information in this article details the current status in each of the applications.
Lavatory trash receptacle

Research and testing has shown that there are suitable alternative gaseous fire suppression systems using FM – 200® / FE-227™ / HFC-227ea or HFC-236fa. Data from one lavatory extinguisher manufacturer shows that the vast majority of new production aircraft are now installed with non-halon systems. In addition, some airlines are replacing existing halon 1301 lavex systems with these halon-free alternative during scheduled maintenance operations.

Handheld extinguishers

As of 2003, three halon alternatives, FM – 200® / FE-227™ /HFC-227ea, HFC-236fa and hydrochlorofluorocarbons (HCFC) Blend B, have successfully completed all of the required handheld UL standards and MPS tests and extinguishers are commercially available. However all of these units have adverse volume and weight characteristics compared to existing halon 1211 extinguishers, and to date, none have been qualified for airline use.

There is one other potential agent: a low GWP agent (3, 3, 3-trifluoro-2-bromo-prop-1-ene or 2-BTP) that has the potential of lower space and weight impact compared to other alternatives. The agent manufacturer is in the process of obtaining US regulatory approval, and if successful this agent could be commercialised in the next few years to meet aviation needs for a handheld extinguisher replacement.

Engine and auxiliary power unit (APU) compartment

The situation with engine and APU compartments is slightly complicated by the fact that the US FAA are revising the Engine/APU MPS. Nevertheless three potential replacement agents, HFC-125, FIC-13I1, and FK-5-1-12 were tested based against a previous version of the MPS and equivalent concentrations were determined, yet none have been commercialised. As with the hand held extinguisher application the replacement agents all suffered at least one drawback compared with halon, (increased weight, or toxicity, or decreased performance at low temperatures).

Testing of other extinguishing agents, including one solid aerosol, continues.

More recently the civil aviation industry has come to the conclusion that it needs to take a different approach to finding a halon 1301 replacement for engine and APUs. Instead of separate efforts, they are going to pool their resources to develop a single agent/approach and have formed the Engine/APU Halon Alternatives Research Consortium (IC) to accomplish this. This activity is in its early stages.

Cargo compartments

Protecting the cargo compartment is the most challenging application and to date there have been no cases of halon 1301 replacement with an alternative extinguishing agent. MPS testing of halocarbon agents has shown that they are not technically or economically feasible due to the space and weight requirements of maintaining the high concentrations of these agents that is necessary to meet the MPS. A combination of water mist and nitrogen has been tested to and met the requirements of the current MPS. Commercial development of a water mist/nitrogen cargo fire suppression system is in the

early stages. In a recent development the International Coordinating Council of Aerospace Industries Associations (ICCAIA) has formed the Cargo Compartment Halon Replacement Working Group (CCHRWG) to begin to coordinate a single industry effort to find an alternative to halon 1301 in cargo bays.

The Fire Protection industry Board recommendations on aviation fire safety

Replacing halon in aviation applications is an extremely challenging undertaking. The existing legislation and continuing reduction in the availability of recycled halon is forcing the aviation industry to rethink its approach.

However, for gaseous fire suppression systems to operate effectively on aircrafts, it is recommended that:

- Owners and facility managers, only have licensed technicians working on gaseous fire suppression systems that hold the appropriate Extinguishing Agent Handling Licence (EAHL) when installing, decommissioning, servicing or handling scheduled extinguishing agents.
- Licensed Aircraft Maintenance Engineers (LAMEs) and Aircraft Maintenance Engineers (AMEs) handling scheduled extinguishing agents complete the unit CPPFES2043A - *Prevent ozone depleting substance and synthetic greenhouse gas emissions* or an equivalent assessment to achieve competency.
- A Halon Special Permit (HSP) is required when possessing halon.
- Ongoing maintenance of systems will greatly improve the efficiency and longevity of the system.

The Board has also published an aviation industry factsheet and an Ozone Depleting Substances and Synthetic Greenhouse Gases (ODS & SGG) Good Practice Guide. Technicians servicing or working on gaseous fire suppression systems containing scheduled extinguishing agents in the aviation industry are encouraged to download a copy of the Good Practice Guide and the factsheet from www.fpib.com.au/ozone.

The guide and factsheet provide additional information on your obligations under the Regulations and further details on the issues discussed in this article.

Finally, if you would like further information in relation to this article or wish to contact the Board, please contact Julia Nicolas, Communication and Compliance Coordinator at julia.nicolas@fpib.com.au or (03) 8892 3131.