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WORKING PAPER

ASSEMBLY — 38TH SESSION

TECHNICAL COMMISSION

Agenda Item 31: Aviation Safety — Emerging Issues

UPDATE ON THE DEVELOPMENT OF HALON ALTERNATIVES FOR AIRCRAFT FIRE EXTINGUISHING SYSTEMS

(Presented by the Council of ICAO)

EXECUTIVE SUMMARY

The production of halogenated hydrocarbons (halon), which have been the main fire extinguishing agent used in civil aircraft fire extinguishing systems, was banned in 1994 with the signing of the Montreal Protocol on Substances that Deplete the Ozone Layer. This was mainly due to its ozone depleting and global warming characteristics; nevertheless, halon is still widely used in civil aircraft fire extinguishing systems today. The 37th Session of the Assembly established timeframes for the replacement of halon in lavatories, engines, auxiliary power units (APUs) and handheld fire extinguishers. Subsequently, the Council adopted international Standards on 13 June 2011.

Between 2009 and 2012 a series of halon replacement coordinating meetings were held with regulators, international organizations and industry to discuss the status of halon replacement, reserves, contamination, and future activities related to halon replacement in cargo compartments. The last of these meetings took place in November 2012 and focused its work on the timeframes specified in the 37th Assembly Resolution on halon replacement and the viability of establishing a replacement date for halon in cargo fire suppression systems.

Action: The Assembly is invited to review this report and adopt the Resolution on halon replacement to supersede Resolution A37-9, as contained in the Appendix.

Strategic Objectives:	This working paper relates to the Safety and Environmental Protection and Sustainable Development of Air Transport Strategic Objectives.
Financial implications:	The activities referred to in this paper will be undertaken subject to the resources available in the 2014-2016 Regular Programme Budget and/or from extra budgetary contributions.
References:	Doc 7300, *Convention on International Civil Aviation* Doc 9958, *Assembly Resolutions in Force* (as of 8 October 2010) State letter AN 3/25.1-12/35 State letter AN 3/25.1-10/2

1. BACKGROUND

1.1 The 37th Session of the Assembly directed the Council to establish a mandate for the replacement of halon. Assembly Resolution A37-9 also directed the Council to report at the next ordinary session of the Assembly on the status of halon reserves, the progress made on the development of halon alternatives for cargo compartments and engines/auxiliary power units (APUs) fire extinguishing systems, and the status of halon alternatives for hand-held fire extinguishers.

1.2 Subsequently, in response to the resolution, the Council of ICAO adopted new Standards on 13 June 2011, for halon replacement in hand-held, lavatory, engine and APU fire extinguishers contained in Annex 6 — *Operation of Aircraft* and Annex 8 — *Airworthiness of Aircraft*.

1.3 The Standards mandate the use of an alternative agent to halon for:

a) lavatory fire extinguishing systems used in aircraft produced on or after 31 December 2011;

b) hand-held fire extinguishers used in aircraft produced on or after 31 December 2016; and

c) engines and APUs fire extinguishing systems used in aircraft for which application for type certification will be submitted on or after 31 December 2014.

1.4 Minimum performance standards (MPS) have been developed for all four affected aircraft systems by the International Aircraft Fire Protection Systems Working Group. This group was established by the United States Federal Aviation Administration (FAA) to explore the viability of halon alternatives. MPS describes the tests that shall be executed to demonstrate that the performance of a replacement agent provides the level of safety equivalent to a halon system.

2. DISCUSSION

2.1 Halon replacement agents

2.1.1 Two halon replacement coordinating meetings with regulators, international organizations, aircraft and fire suppression manufacturers were held in November 2011 and 2012. The meetings reviewed the status of potential halon alternatives, affirmed the agreed upon implementation dates and discussed the progress made in developing halon alternatives for cargo compartments.

2.1.2 Halon replacement agents for fire extinguishers in aircraft lavatories are presently available and several manufacturers have begun installation. The installation of halon replacement in the lavatory is considered to be a “drop-in” replacement.

2.1.3 Three alternatives are currently available for use in hand-held extinguishers. They have an average weight penalty of two times the current halon extinguishers and although all three alternatives have a global warming potential (GWP), there is no current international prohibition on their use in aviation.

2.1.4 There is a fourth promising halon replacement agent, 2BTP, which is reported to be neither a greenhouse gas nor an ozone depleting substance, and is considered a “drop-in” replacement.

The agent has passed MPS testing and is in the final stage of testing and approval, with commercialization for aviation expected sometime in 2014. In the event that a “drop-in” halon replacement agent is not available by 2016, the aircraft manufacturers have agreed to put into service the approved hand-held halon fire extinguishing agents in order to meet the 2016 deadline.

2.1.5 Regarding halon replacement agents for engines and APUs, three agents have been successfully tested to the MPS. Although one of three alternatives has a significant GWP, the agents have very little to no ozone-depleting potential (ODP) and there is currently no international prohibition on their use for aviation. Research and development is progressing and one agent, HFC-125, is currently approved and used in some military aircraft, despite its weight and volume penalty. Another promising agent has been successfully tested to the MPS but could not extinguish a live-engine fire during testing. Additional research and development is in progress.

2.1.6 For halon replacement in cargo compartments, an integrated fire protection water mist/nitrogen system is the only alternative that passed the MPS. Although it is a promising concept, it requires significant development and acceptance. This approach uses an agent to knockdown the initial fire flames followed by the on-board inert gas generation system installed on aircraft to reduce fuel tank flammability, to control the fire.

2.1.7 The establishment of a timeframe for the replacement of halon in cargo compartment fire suppression systems remains a challenge. During the last ICAO International Halon Replacement Coordinating Meeting (IHRCM/3), the International Coordinating Council of Aerospace Industries Associations agreed to coordinate a collaborative approach involving all stakeholders in order to develop an industry recommendation for a halon replacement timeframe for cargo compartment. A working group has been established to submit a comprehensive recommendation with supporting documentation to ICAO by 31 December 2015 in order to introduce a recommendation at the next ordinary session of the Assembly in 2016.

2.2 Halon reserves

2.2.1 Until alternatives are available for all aircraft fire extinguishing systems, the aviation industry will continue to depend on halon reserves. In support of Resolution A37-9, the Secretary General issued a State letter requesting information on halon reserves accessible to the civil aviation industry within each State to support future operations.

2.2.2 Fifty three States replied to the State letter. Most States were unsure if their halon reserve would suffice for the aviation needs of their State, while others responded that their aviation industry relies on outside sources to provide the required halon.

2.2.3 The limited number of replies gives evidence that States do not know how much halon reserves are available to civil aviation. Although the United Nations Environment Programme (UNEP) has a process to estimate global halon reserves, the amount of halon available for civil aviation applications is unknown.

2.3 Contaminated halon

2.3.1 The global aviation supply of halon is now exclusively obtained from recovery, reclaiming and recycling. As time progresses from the end dates of production, halon is more difficult to recycle due to cross contamination. The cost to procure and recycle halon has also increased 100 per cent in the past five years.

2.3.2 A finding by a State civil aviation authority revealed that significant amounts of contaminated halon were released to the aviation industry for use in fire-fighting equipment. Based on this, the European Aviation Safety Agency (EASA) issued an emergency airworthiness directive and has subsequently issued four additional airworthiness directives to address contaminated halon in hand-held fire extinguishers. The FAA has also issued an airworthiness directive to address contaminated halon in hand-held fire extinguishers. To avoid any further occurrences with other Member States, the Secretary General issued a State letter urging States to ensure their aviation industry utilizes halon that has been recycled to an international or State-recognized performance standard.

2.3.3 Halon contamination is an issue and the quality of halon depends on the quality of the recycling process, as was emphasized in Resolution A37-9. In response, States have taken measures to minimize the probability that non-compliant/contaminated agents are installed on aircraft. EASA has initiated a rulemaking task responding to the need to protect against the use of contaminated halon in maintenance, production and air operator organisations. Transport Canada in cooperation with the FAA, the United Kingdom Civil Aviation Authority and EASA have accordingly undertaken a study to identify means to minimize the probability that non-compliant or contaminated agents are installed on aircraft. The project comprises two phases. The first is to document the processes currently in use in North America and Europe, and the second is to identify best practices, deficiencies and gaps, as well as develop proposed standardized quality protocols.

3. CONCLUSION

3.1 Halon alternatives are currently used in aircraft lavatories fire extinguishing systems and a “drop-in” halon replacement for hand-held fire extinguishers should be available in 2014. Research and development is progressing towards halon replacement for engine and APU fire extinguishing systems. A date has yet to be determined for halon replacement in cargo compartment fire extinguishing systems. The industry has agreed to provide a recommendation to ICAO on a timeframe for the replacement of halon in cargo compartment fire suppression systems in time for the Council to report at the next ordinary session of the Assembly in 2016, as set forth in the attached draft resolution.

3.2 Although progress is being made in the development of halon alternatives, the only source of halon replenishment of aircraft fire extinguishing systems comes from recycled halon and it will be necessary that halon reserves be monitored by States.

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APPENDIX

DRAFT RESOLUTION FOR ADOPTION BY THE 38TH SESSION OF THE ASSEMBLY

Resolution 38/x: Halon replacement

Recognizing the importance of aircraft fire extinguishing systems to the safety of flight;

Recognizing that halogenated hydrocarbons (halon) have been the main fire extinguishing agent used in civil aircraft fire extinguishing systems for over fifty years;

Whereas halons ~~contribute to climate change and~~ are no longer being produced by international agreement because ~~they are ozone-depleting chemicals, and have been used as fire-extinguishing agents in commercial transport aircraft for 45 years;~~ their release contributes to ozone-depletion and climate change;

Recognizing that more needs to be done because the available halon supplies are ~~dwindling~~ decreasing and unsure and that the environmental community continues to be concerned that halon alternatives have not been developed for all fire extinguishing systems in civil aircraft;

Recognizing that the Minimum Performance Standard for each application of halon has been developed already by the International Aircraft Systems Fire Protection Working Group with participation by industry and regulatory authorities;

Recognizing that there are stringent aircraft-specific requirements for each application of halon that must be met before a replacement can be implemented;

Recognizing that the production ~~and import/export of halon~~ is prohibited by international agreement, ~~thus~~ halon is ~~mainly available by~~ now exclusively obtained from recovery, reclaiming and recycling ~~existing supplies. Thus~~ Therefore, recycling of halon gas needs to be rigorously controlled to prevent the possibility of contaminated halon being supplied to the civil aviation industry; and

Recognizing that any strategy must depend on alternatives that do not pose an unacceptable environmental or health risk as compared to the halons they are replacing; ~~and~~

~~*Recognizing* that while halon alternatives for lavatories are available, and that progress has been made in the development of halon alternatives in hand-held fire extinguishers, more work is needed in the development of halon alternatives for cargo compartment and engine/auxiliary power unit fire extinguishing systems, and that regular reviews are necessary to evaluate and understand the implication of potential halon alternatives on the industry and the environment~~:

The Assembly:

~~1. *Agrees* with the urgency of the need to continue developing and implementing halon alternatives for civil aviation;~~

~~2.~~1. *Urges* States and their aviation industries to intensify development and implementation of acceptable halon alternatives for fire extinguishing and suppression systems in cargo compartments and

engine/auxiliary power units, and to continue work towards improving halon alternatives for hand-held fire extinguishers;

~~3. *Directs* the Council to establish a mandate for the replacement of halon:~~

~~— in lavatory fire extinguishing systems used in aircraft produced after a specified date in the 2011 timeframe;~~

~~— in hand-held fire extinguishers used in aircraft produced after a specified date in the 2016 timeframe; and~~

~~— in engine and auxiliary power unit fire extinguishing systems used in aircraft for which application for type certification will be submitted after a specified date in the 2014 timeframe;~~

~~4. *Directs* the Council to conduct regular reviews of the status of potential halon alternatives to support the agreed upon implementation dates given the evolving situation regarding the suitability of potential halon alternative agents as they continue to be identified, tested, certified and implemented;~~

~~5.~~ 2 *Urges* States to ~~advise~~ determine and monitor their ~~aircraft manufacturers, approved maintenance organizations, air operators, chemical suppliers, and fire extinguishing companies to verify the~~ halon reserve and quality of halon ~~in their possession or provided by suppliers through effective testing or certification to an international or State recognized quality standard. States are also urged to require that the quality systems of air operators, approved maintenance organizations, and manufacturers provide a means for requesting from halon suppliers certification documentation attesting to the quality of halon to an established and recognized international standard~~;

~~6~~ 3. *Encourages* ICAO to continue collaboration with the International Aircraft Systems Fire Protection Working Group and the United Nations Environment Programme's ~~(UNEP)~~ Ozone Secretariat through its Technology and Economic Assessment Panel's Halons Technical Options Committee on the topic of halon alternatives for civil aviation;

~~7~~4. *Urges* States to inform ICAO regularly of their halon reserves and directs the Secretary General to report the results to the Council. ~~Further, the Council is directed to report on the status of halon reserves at the next ordinary session of the Assembly~~;

~~8. *Resolves*~~ 5. *Directs* that the Council shall report to the next ordinary session of the Assembly on ~~progress made developing halon alternatives~~ a timeframe for the replacement of halon in cargo ~~compartments and engine/auxiliary power unit fire extinguishing systems as well as the status of halon alternatives for hand-held fire extinguishers~~ compartment fire suppression systems; and

~~9~~ 6. *Declares* that this resolution supersedes Resolution ~~A36-12~~ A37-9.

— END —