

Report on Decision XXVI/7

**Provided to the Parties to the Montreal
Protocol at the meeting of the 36th**

Open-ended Working Group

Paris, France – July 20, 2015

Halons Technical Options Committee (HTOC)

Co-Chair – Dr. Daniel P. Verdonik



T E A P

**OEWG 36
Paris July 2015**

Decision XXVI/7

- **Decision XXVI/7 requested the TEAP [Technology and Economic Assessment Panel], through its HTOC**
 - (a) To continue to liaise with the International Civil Aviation Organisation to facilitate the transition to halon alternatives, to approach the International Maritime Organisation to estimate the amount and purity of halon 1211 and 1301 available from the breaking of ships and to report information on global stocks of recovered halons to the parties in its 2015 Progress Report;
 - (b) To report on existing and emerging alternatives for halons, including information on their characteristics and their rate of adoption, in particular for aviation uses
- **Workgroup**
 - Dr. Daniel Verdonik, *HTOC co-Chair*
 - David Catchpole, *HTOC co-Chair*
 - Adam Chattaway, *HTOC Member*
 - Robert Wickham, *HTOC Member*
 - Thomas Cortina, *HTOC Consulting Expert*
 - Bella Maranion, *TEAP co-Chair (and former HTOC Member)*
- **Thanks to USEPA and its contractor ICF International for supporting analyses**

Halon 1211 Use

- Handheld extinguishers



- Aircraft Rescue & Fire Fighting



Halon 1301 Use

- Lavatory



- Engine/APU



- Cargo



New Design Aircraft – Regulatory Status

Requirement	Lavatory	Handheld Extinguisher	Engine / APU	Cargo
ICAO Date International Agreed Changes Date after which halons should not be used in completely new designs	2011 <u>Has Been Met</u> By using HFCs 227ea/236fa	2016 <u>Will not be met</u> Could Be Met By Using HFCs 227ea/236fa or HCFC Blend B. Industry choosing not to meet this date while awaiting regulatory approval of 2-BTP.	2014 <u>Will not be met</u> HFC-125 has been proven by US military. Industry impediments are space and weight concerns & the high GWP of HFC-125	NA
EU Cutoff Date EU Regulation Date after which halons cannot be used in completely new designs in EU	2011 <u>Should Be Met</u> By using HFCs 227ea/236fa	2014 <u>Could Be Met</u> By Using HFCs 227ea/236fa Industry impediments are space and weight concerns and the high GWP of the HFCs	2014 <u>Will not be met</u> HFC-125 has been proven by US military. Impediments to civil aviation air frame manufacturers are space and weight concerns & the high GWP of HFC-125	2018 <u>Will not be met</u> Halocarbons proven not to work. Industry estimates it will take until 2024 to develop a non-halocarbon alternative

Current Production Aircraft – Regulatory Status

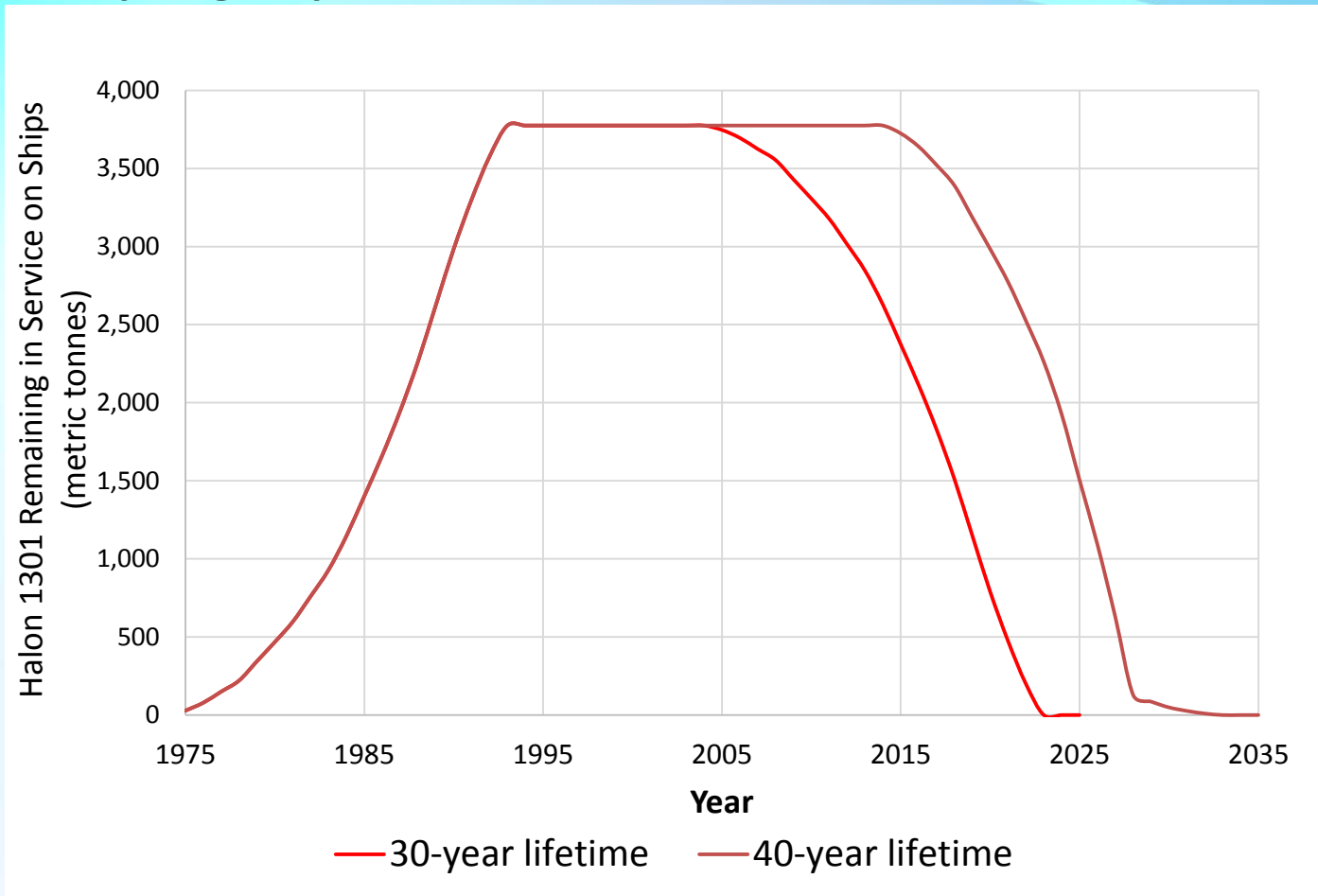
Requirement	Lavatory	Handheld Extinguisher	Engine / APU	Cargo
ICAO Date International Agreed Changes Date after which halons should not be used in the production of aircraft	2011 <u>Has Been Met</u> By using HFCs 227ea/236fa	2016 <u>Will not be met</u> Could Be Met By Using HFCs 227ea/236fa or HCFC Blend B. Industry choosing not to meet this date while awaiting regulatory approval of 2-BTP.	NA	NA
EU End Date EU Regulation Date after which halons cannot be used in the operation of aircraft - includes retrofit requirement	2020 <u>Should Be Met</u> By using HFCs 227ea/236fa	2025 <u>Could Be Met</u> By Using HFCs 227ea/236fa Industry impediments are space and weight concerns, and the high GWP of the HFCs.	2040 <u>Might be met</u> HFC-125 has been proven by US military. Long term development of halocarbon potential alternatives under way	2040 <u>Might be met</u> Industry estimates it will take 9 years to develop and implement non-halon system. Nitrogen/water mist system under development. New halocarbons yet to be evaluated

Status of Alternatives In Aviation

- **Aircraft Rescue and Fire Fighting (ARFF)**
 - Halon 1211 used in large portable extinguishers and Fire Trucks
 - HCFC-123 based Blend B has proven to be an effective alternative
- **From an ODP and GWP basis, the best option to meet ICAO dates for on board halon 1211 replacement is the approved HCFC-123 based Blend B if 2-BTP is not approved**
- **Lack of Progress in Implementing Alternatives**
 - Only the smallest use of halon 1301 has been replaced with alternatives
- **There is not going to be enough recycled halon 1301 for all uses**
 - All Civil Aircraft built today require halons in all but smallest use
 - Civil Aircraft have long lifetimes until scrapped 20 – 40+ years
 - Aircraft built this year need adequate replenishment supplies through at least 2035 - 2055 unless retrofit
 - 9 year cargo bay system development time (i.e., new design in 2024)

open access website, <http://www.world-ships.com/>

Still attempting to purchase access to lifetime data to refine estimates

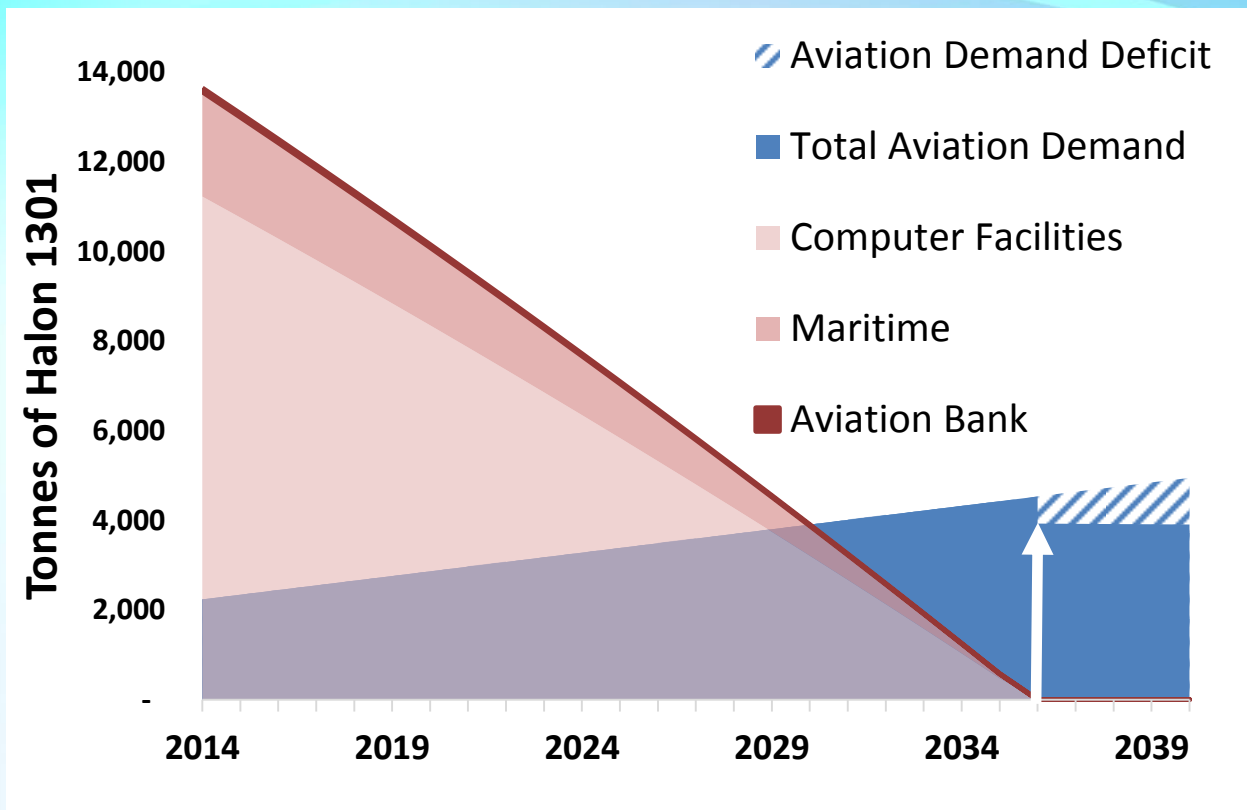


- **Halon From Shipbreaking will last only 8 – 18 more years and it is not dedicated to civil aviation**

Global Halon 1301 for Civil Aviation Use

- Not all halon 1301 in global bank will be available to civil aviation
 - 41,000 – 43,000 t in global bank (SAP data and HTOC model)
 - Subtract what is not available to civil aviation
 - 17,000 t reserved for future use in ground-based fire protection systems in Japan
 - About 4,600 t reserved by the U.S. military for use in existing critical weapons systems
 - About 1,500 t of halon 1301 in oil facilities on the North Slope of Alaska and other places around the world
 - About 2,200 t already installed on civil aircraft rising to 6,000 t by 2050
- Leaves 14,000 – 17,000 t (33% - 40%) for civil aviation if every other gram of halon 1301 becomes dedicated to civil aviation
- Global and Civil Aviation emission rates will play an important role in how long civil aviation can be supported
 - HTOC ~3% and SAP data ~4% of bank / year
 - Anecdotal information places civil aviation closer to 5% / year

High Annual Aviation Emission Rate; ~14,000 t



Low Annual Aviation Emission Rate; ~17,000 t runs out in 2045

Not enough halon 1301 in global bank to support civil aviation over 20 - 40 year life of aircraft

Takeaway Messages

1. Globally, there are adequate supplies of halon 1211 at this point
 - On an ODP/GWP basis the best option to meet ICAO dates for on board halon 1211 replacement is HCFC-123 based Blend B if 2-BTP is not approved
2. Industry is producing aircraft that will not have access to recycled halon 1301 over their lifetimes
3. Therefore, we find it nearly indisputable that Civil Aviation will need production of new halon 1301 in the future
 - Average age of some civil aircraft when scrapped is more than 40 yrs
 - There is a lack of progress in implementing halon alternatives in Civil Aviation