



# Halon Replacement for Airplane Portable Fire Extinguishers - Progress Report

## International Aircraft Systems Fire Fire Protection Working Group

Köln, Germany  
May 10-11

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# Objective

**Provide a progress report on the implementation of BTP (2-bromo-3,3,3-trifluoropropene), American Pacific Halotron BrX, a new environmentally progressive Halon 1211 replacement agent for handheld fire extinguishers**

# Agenda

→ **Handheld Agent Comparison**

→ **Steps to Implementation**

→ **BTP Development Time Line**

→ **Current Progress**

→ **Future**

→ **Questions**

# Handheld Agent Comparison

Agent	UL 711 Rating	Agent Weight (#)	Ozone Depleting Potential (ODP)	Global Warming Potential (GWP) (100 year)
Halon 1211	5-B:C	2.5	6.9 <sup>1</sup>	1750 <sup>1</sup>
<b>Halotron BrX (BTP)</b>	<b>5-B:C</b>	<b>3.75</b>	<b>0.0028<sup>1,2</sup></b>	<b>0.26<sup>2,3</sup></b>
Halotron 1 (HCFC Blend B) <sup>4</sup>	5-B:C	5.5	0.01 <sup>1</sup>	79 <sup>1</sup>
FE-36 (HFC-236fa)	5-B:C	4.75	0	8060 <sup>1</sup>
FM-200 (HFC-227ea)	5-B:C	5.75	0	3350 <sup>1</sup>

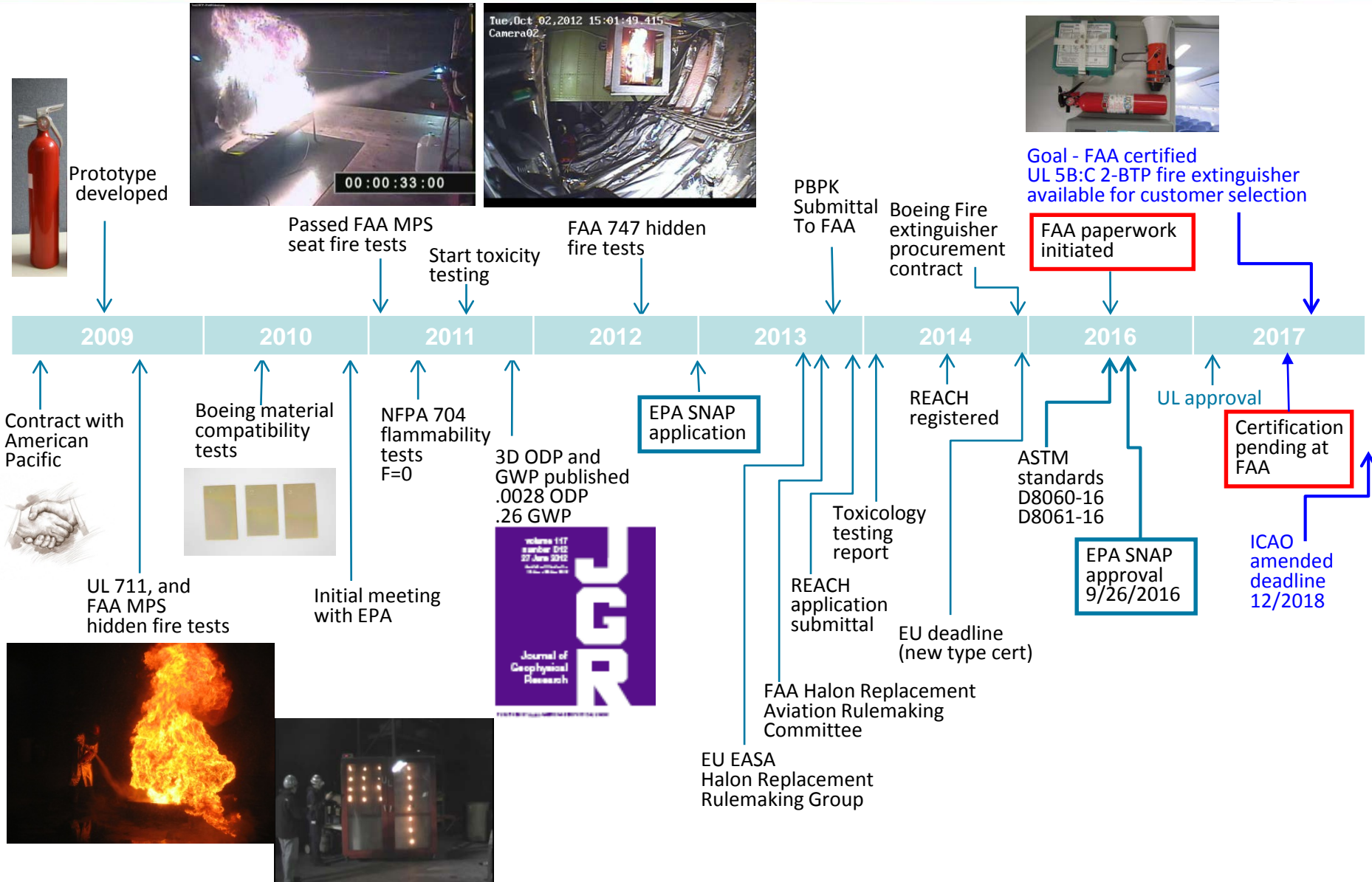
1. World Meteorological Organization Report No. 55 – “Scientific Assessment of Ozone Depletion: 2014.”  
<https://www.esrl.noaa.gov/csd/assessments/ozone/2014/chapters/2014OzoneAssessment.pdf>
2. Patten, K. O., V. G. Khamaganov, V. L. Orkin, S. L. Baughcum, and D. J. Wuebbles (2011), OH reaction rate constant, IR absorption spectrum, ozone depletion potentials and global warming potentials of 2-bromo-3,3,3-trifluoropropene, *J. Geophys. Res.*, 116, D24307, doi:[10.1029/2011JD016518](https://doi.org/10.1029/2011JD016518).
3. Patten, K. O., V. G. Khamaganov, V. L. Orkin, S. L. Baughcum, and D. J. Wuebbles (2012), Correction to “OH reaction rate constant, IR absorption spectrum, ozone depletion potentials and global warming potentials of 2-bromo-3,3,3-trifluoropropene”, *J. Geophys. Res.*, 117, D22301, doi:[10.1029/2012JD019051](https://doi.org/10.1029/2012JD019051).
4. HCFC -123 (primary constituent of Halotron 1) is currently regulated as a Class II substance in the U.S. under the Montreal Protocol and the Clean Air Act Amendments (CAA) of 1990. It is subject to US production phase-out in 2020, so supply will be limited to recycling unless HCFC-123 is removed from the Montreal Protocol and the Clean Air Act is amended.

***BTP is the only agent with no environmental restrictions***

# Steps to Implementation

- ✓ Cup burner testing - 2002
- ✓ Initial toxicity tests (Ames, cardiotox...) - 2002
- ✓ 2-Dimensional Ozone Depleting Potential (ODP), Global Warming Potential (GWP), atmospheric lifetime - 2004
- ✓ Prototype extinguisher, near drop-in replacement for Boeing 1211 extinguisher - 2009
- ✓ Underwriters' Laboratory (UL) 711 5-B pan fire tests - 2009
- ✓ UL 711 cold temperature pan fire test - 2009
- ✓ Federal Aviation Administration (FAA) Minimum Performance Standard (MPS) AR-01/37 hidden fire tests - 2009
- ✓ 3-Dimensional model analysis of ODP and GWP - 2010
- ✓ FAA MPS AR-01/37 seat fire toxicity tests - 2011
- ✓ American Society for Testing and Materials (ASTM) flammability tests (per NFPA 704) - 2011
- ✓ Airplane material compatibility tests - 2011
- ✓ Synthesis of BTP for toxicology testing - 2011
- ✓ Publication of 3D ODP/GWP scientific paper - 2011
- ✓ Additional BTP physical properties testing – 2011
- ✓ Physiologically based pharmacokinetic (PBPK) testing and modeling –2013
- ✓ Toxicology testing – 2013
- ✓ Provide PBPK data to FAA for inclusion in Advisory Circular (AC) 20-42D & FAA/AR-08/3 – 2013
- ✓ US EPA Significant New Alternatives Policy (SNAP) application – 2013
- ✓ EU Registration, Evaluation, Authorization & Restriction of Chemicals (REACH) application - 2014
- ✓ European Chemicals Agency (ECHA) REACH registration - 2014
- ✓ US EPA Toxic Substances Control Act (TSCA) inventory listing - 2016
- ✓ US EPA SNAP approval – 2016
- ✓ ASTM standards D8060-16 and D8061-16 for BTP - 2016
- ✓ 3.25" diameter extinguisher for Boeing production/retrofit and completion of UL testing - 2016
- ✓ **UL approval/listing – 2017**
- **FAA certification – TBD**

# BTP Development Time Line



# BTP Current Progress

❑ **ICAO Halon handheld replacement date moved from 2016 to 2018.**

- ✓ **Supports BTP implementation delays.**
- ✓ **Align with EASA CS26 rule.**
- ✓ **Align Foreign Civil Aviation Authorities and Member States.**

**ICAO A39-WP/235:**


**[http://www.icao.int/Meetings/a39/Documents/WP/wp\\_235\\_rev1\\_en.pdf#search=portable%20extinguishers](http://www.icao.int/Meetings/a39/Documents/WP/wp_235_rev1_en.pdf#search=portable%20extinguishers)**

***BTP implementation before December 31, 2018***

# BTP Current Progress

❑ Underwriters Laboratories approved BTP fire extinguisher:

✓ UL listing of the Kidde Halotron BrX fire extinguisher:

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**GAOM.EX15347**  
Clean-agent Extinguishers [Page Bottom](#)

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**Clean-agent Extinguishers**

[See General Information for Clean-agent Extinguishers](#)

**KIDDE TECHNOLOGIES INC., DBA KIDDE AEROSPACE & DEFENSE** EX15347  
& FENWAL SAFETY SYSTEMS  
4200 AIRPORT DR  
WILSON, NC 27896 USA

**Stored-pressure-type Extinguishers**

Model	Nominal Agent Capacity, lb	Min Use Temp, °F	Rating	Marine Type
<b>FE36</b>				
PRO5-FE36	5.0	-40	5-B:C	Yes
<b>Halotron BrX</b>				
3.75#BrX	3.75 +	-40	5-B:C	No

+ FAA Approved in accordance with DOT/FAA/AR-01/37

➤ Awaiting UL qualification report

***UL 5-B:C Fire Extinguisher per AC20-42D***

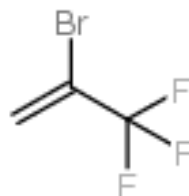


# BTP Current Progress

## ❑ New chemical registration

- ✓ BTP is US EPA SNAP approved.
- ✓ BTP is EU REACH registered.
- Boeing is evaluating BTP registration/notification requirements to support customer import obligations for new chemicals (varies by country).

CAS No.: 1514-82-5



***Seamless Halon replacement for our Customers***

# BTP Current Progress

## ❑ Awaiting FAA certification/approval:

➔ **FAA AC 20-42D, “Hand Fire Extinguishers for use in Aircraft” states: *“We accept hand fire extinguishers approved by: U.S - Underwriters Laboratories, Inc...or equivalent.”***

- **Boeing proposed compliance to AC20-42D based on UL approval, meeting SAE AS6271.**
- **The FAA required an issue paper (IP) to document approval of new fire extinguisher and compliance with toxicity requirements at airplane level.**
  - **Requires FAA review of FAA MPS seat fire data, UL/MPS data, and EPA data.**

***Late requirements documentation continues to delay  
Halon 1211 replacement***

# BTP Current Progress

## ❑ **FAA certification/approval:**

➔ **AC20-42D neat agent toxicity method of compliance shows Boeing flight decks are too small for Halon 1211 (or BTP) discharge, even using a stratification factor. Aircraft Certification Office requires IP for test data as well as toxicity.**

- **Halon 1211 has been safely used for decades.**
- **An IP is required since the AC doesn't provide acceptable methods.**
- **DOT/FAA/TC-14/50 stratification factors fell short of goal.**

***AC20-42D should be revised***

# Future

- ❑ **Boeing and the FAA are working together on Halon replacement lessons learned.**
  - **Project management, requirements management, and documentation of acceptance criteria form the basis of Boeing's lessons learned.**
  - **The goal is to improve cargo/propulsion Halon replacement projects, as well as future certification projects.**
- ❑ **Boeing BTP fire extinguisher airplane implementation pending FAA certification.**

***BTP fire extinguishers with GWP < 1 to replace Halon 1211 with 6.9 ODP and 1750 GWP***

# Questions?

