TEAP RESPONSE TO DECISION XXIX/8
FUTURE AVAILABILITY OF HALONS
Decision XXIX/8

- Decision XXIX/8 on the future availability of halons and their alternatives, requested the Technology and Economic Assessment Panel (TEAP), through its Halons Technical Options Committee (HTOC) to:
  - Continue to liaise with the International Civil Aviation Organization (ICAO)
  - Explore the possibility of forming a joint working group with ICAO to develop and carry out a study to determine the current and projected future quantities of halons installed in civil aviation, uses and releases and any potential courses of action that civil aviation could take to reduce those uses and releases;
  - Submit a report on the work of the joint working group before the 30th Meeting of the Parties and the 40th ICAO Assembly for consideration and potential further action;

- TEAP / HTOC authors of the report:
  - Dan Verdonik, HTOC co-Chair, Adam Chattaway, HTOC co-Chair
  - Tom Cortina, HTOC Consulting Expert, Bella Maranion, TEAP co-Chair (and former HTOC Member)
At a March 2018 face-to-face meeting, ICAO formed an informal working group to provide information on:
- current and projected future quantities of halon installed in civil aviation
- associated uses and releases of halon from those systems
- potential courses of action to minimize unnecessary halon emissions

The informal working group consists of representatives from:
- airframe manufacturers Boeing, Airbus and Bombardier
- civil aviation fire protection cylinder manufacturers Meggitt and United Technologies
- civil aviation non-governmental organizations the International Air Transport Association (IATA) and the International Coordinating Council of Aerospace Industry Associations (ICC AIA)
- the ICAO secretariat, and the authors of this report

Prepared a survey that ICAO sent out officially as an ICAO State letter

It was anticipated that the survey would provide a more accurate estimate of annual halon 1301 emissions from civil aviation
Questionnaire Development

• Questionnaire designed to be short and simple
  – contact information and confirmation they perform halon 1301 servicing of civil aviation bottles
  – two questions to determine the amount of halon needed to be replaced in the bottles they received for servicing (i.e., the amount that was discharged / emitted from the bottles during aircraft operations)
  – four additional questions to get a sense of the halon 1301 market and availability

• Informal working group members from servicing companies thought it likely that most, if not all, companies would track or log:
  – the amount of halon recovered from the bottles they received (this would incur a cost to the company to get recycled/reclaimed), and
  – the amount of recycled/reclaimed halon put back into the same bottles (that would be charged to the customer of the bottle)

• National servicing companies’ contact information provided to States
Questionnaire Results

• 53 surveys were returned, 33 confirmed servicing aviation halon bottles
  – Only 21 provided data
  – Only 10 provided data on the questions intended to determine emissions

• The difference between the amount recovered versus the amount filled i.e., the amount emitted:
  – Ranged from 4% to 50%, Averaged 14%
  – Data set too limited to determine a more accurate emission rate
  – Provided additional anecdotal information that civil aviation emissions could be substantially higher than the 2-3% annual average overall emission rate used by the HTOC
  – Other anecdotal information available to the HTOC supports a higher annual emission rate
The Working Group recognized that a number of major service companies did not respond
- Some only provided data from one facility and not company wide
- Additional companies were identified in the survey

ICAO is following up with these companies to try to get additional data
Global Halon 1301 Availability

- HTOC estimate of halon 1301 is 37,750 metric tonnes at end of 2018
- However not all of this is considered to be available for civil aviation

<table>
<thead>
<tr>
<th>Application</th>
<th>Amount (Metric Tonnes)</th>
<th>Available to Civil Aviation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial (Japan)</td>
<td>16,250</td>
<td>No</td>
</tr>
<tr>
<td>Military</td>
<td>4,500</td>
<td>No</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>1,500</td>
<td>No</td>
</tr>
<tr>
<td>Nuclear</td>
<td>200</td>
<td>No</td>
</tr>
<tr>
<td>Aviation</td>
<td>2,800</td>
<td>No</td>
</tr>
<tr>
<td>Marine</td>
<td>1,500</td>
<td>Yes</td>
</tr>
<tr>
<td>Computer rooms etc</td>
<td>11,000</td>
<td>Yes</td>
</tr>
<tr>
<td>Potentially Available</td>
<td></td>
<td>12,500</td>
</tr>
</tbody>
</table>

This leaves about 12,500 metric tonnes of halon 1301 that could become available to support civil aviation and all other enduring uses.
Modeling Use, Emissions and Run-out Date

- Two assumed amounts of available halon (12,500 +/- 10% in metric tonnes) and four emissions scenarios - a total of eight total scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Total Available Worldwide Supply</th>
<th>Annual Emission Rate (Aviation)</th>
<th>Annual Emission Rate (non-Aviation)</th>
<th>Global Overall Emission Rate</th>
<th>Year Available Supply Runs Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11,500</td>
<td>2.3 – 2.8%</td>
<td>0.1 – 3%</td>
<td>1.6%</td>
<td>2048</td>
</tr>
<tr>
<td>2</td>
<td>11,500</td>
<td>7.6%</td>
<td>0.1 – 3%</td>
<td>1.9%</td>
<td>2038</td>
</tr>
<tr>
<td>3</td>
<td>11,500</td>
<td>5.0%</td>
<td>1 – 5%</td>
<td>2.3%</td>
<td>2040</td>
</tr>
<tr>
<td>4</td>
<td>11,500</td>
<td>15.0%</td>
<td>1 – 5%</td>
<td>3.9%</td>
<td>2032</td>
</tr>
<tr>
<td>5</td>
<td>13,750</td>
<td>2.3 – 2.8%</td>
<td>0.1 – 3%</td>
<td>1.6%</td>
<td>2054</td>
</tr>
<tr>
<td>6</td>
<td>13,750</td>
<td>7.6%</td>
<td>0.1 – 3%</td>
<td>2.0%</td>
<td>2042</td>
</tr>
<tr>
<td>7</td>
<td>13,750</td>
<td>5.0%</td>
<td>1 – 5%</td>
<td>2.3%</td>
<td>2045</td>
</tr>
<tr>
<td>8</td>
<td>13,750</td>
<td>15.0%</td>
<td>1 – 5%</td>
<td>3.8%</td>
<td>2034</td>
</tr>
</tbody>
</table>

- HTOC model assumes an average 2.5% emission rate

- Emissions estimated from atmospheric concentrations are about 4%/yr
Scenario 4 (15% aviation emission rate 11,500 metric tonnes globally available 2018)

Source: ICF (2018)
Next Steps

• HTOC will continue to work with ICAO
  – Refine emission estimates as much as possible from the current survey
  – Develop a Working Paper for the upcoming General Assembly in Sep/Oct 2019
    • Develop actions for ICAO to take to obtain data for estimating emissions
    • Recommend initiatives to reduce emissions
Summary and Conclusions

• The global amount of halon 1301 used in this analysis is based on the HTOC model
• Emissions derived from atmospheric measurements (while within the uncertainty range) are higher than HTOC estimates
• As a result, banks could be much smaller (assuming the same amount of production) by as much as 9,000 metric tonnes
• The civil aviation emission rate is still uncertain but is a major driving force in overall emissions and hence the remaining bank. A 15% emission rate would deplete the bank in the early 2030s
• Therefore, the civil aviation emission rate needs to be better understood

Based on the Run-out Dates of 2032 – 2054 and Aircraft Lifetimes of 40 Years, it is Almost Certain that Civil Aviation is Producing Aircraft Now that Cannot be Sustained with the Available Supplies of Halon 1301