Freighter Fire Suppression Risk & Cost Benefit Model
OVERVIEW

Following in-flight fire occurrences on US registered freighter airplanes, where it is suspected that lithium batteries have had an involvement, the Federal Aviation Administration (FAA) AND Transport Canada have commissioned the development of Risk and Cost Benefit Models to evaluate potential mitigation strategies.
OBJECTIVES
The Broad Objectives of the Study are to:

- Develop a Risk Model to assess the number of accidents likely to be experienced by the US fleet attributable to Freighter Fires
- Develop a Cost Benefit Model to assess Cost Benefit Ratios based on User Inputs for 7 Mitigation Strategies identified by the FAA
MITIGATION STRATEGIES

1. Cargo Compartment Suppression
2. External Container Suppression
3. Internal Container Suppression
4. Fire Hardened Containers
5. Pallet Covers
6. Primary Lithium Battery Boxes
7. Secondary Lithium Battery Boxes
MODEL OVERVIEW

- A Monte Carlo Simulation model has been developed in Microsoft Excel
- The model considers each freighter airplane type in the 2010 US fleet individually and in combination
- The model assesses Cost Benefit Ratios and the likely future number of accidents, through to 2025 for any selected combination of proposed mitigation strategies.
## MITIGATION FACTOR

Currently Assumed Mitigation Factor Values

<table>
<thead>
<tr>
<th>Mitigation System</th>
<th>Battery Cargo</th>
<th>Other Cargo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Containers</td>
<td>Pallets</td>
</tr>
<tr>
<td>CARGO COMPARTMENT SUPPRESSION</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>EXTERNAL CONTAINER SUPPRESSION</td>
<td>0.8</td>
<td>0</td>
</tr>
<tr>
<td>INTERNAL CONTAINER SUPPRESSION</td>
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</tr>
<tr>
<td>FIRE HARDENED CONTAINERS</td>
<td>0.95</td>
<td>0</td>
</tr>
<tr>
<td>PALLET COVERS</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>PRIMARY LITHIUM BATTERY BOXES</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>SECONDARY LITHIUM BATTERY BOXES</td>
<td>0.4</td>
<td>0.4</td>
</tr>
</tbody>
</table>
If there was no increase in the threat of freighter fires due to batteries:

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>CUMULATIVE RTM</th>
<th>NUMBER OF FIRE ACCIDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967 - 2010</td>
<td>$624 \times 10^9$</td>
<td>5</td>
</tr>
<tr>
<td>2011 - 2020</td>
<td>$365 \times 10^9$</td>
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</tr>
</tbody>
</table>
BATTERY FIRE RELATED INCIDENTS

- Incidents (PHMSA & FAA Data)
- Expected Number of Incidents Based on Secondary Lithium Market Growth

ANNUAL INCIDENTS

DATE
FUTURE CARGO FIRE ACCIDENT PREDICTION FOR THE US FREIGHTER FLEET

Cumulative Cargo Fire Accidents

Year

Cumulative Accidents

Predicted

Actual

2.5 PERCENTILE

97.5 PERCENTILE


Cumulative Cargo Fire Accidents

Freighter Fire Suppression Cost Benefit Analysis & Risk Model