



# A Freighter Airplane Cargo Fire Risk, Benefit and Cost Model

# Freighter Fire Accidents

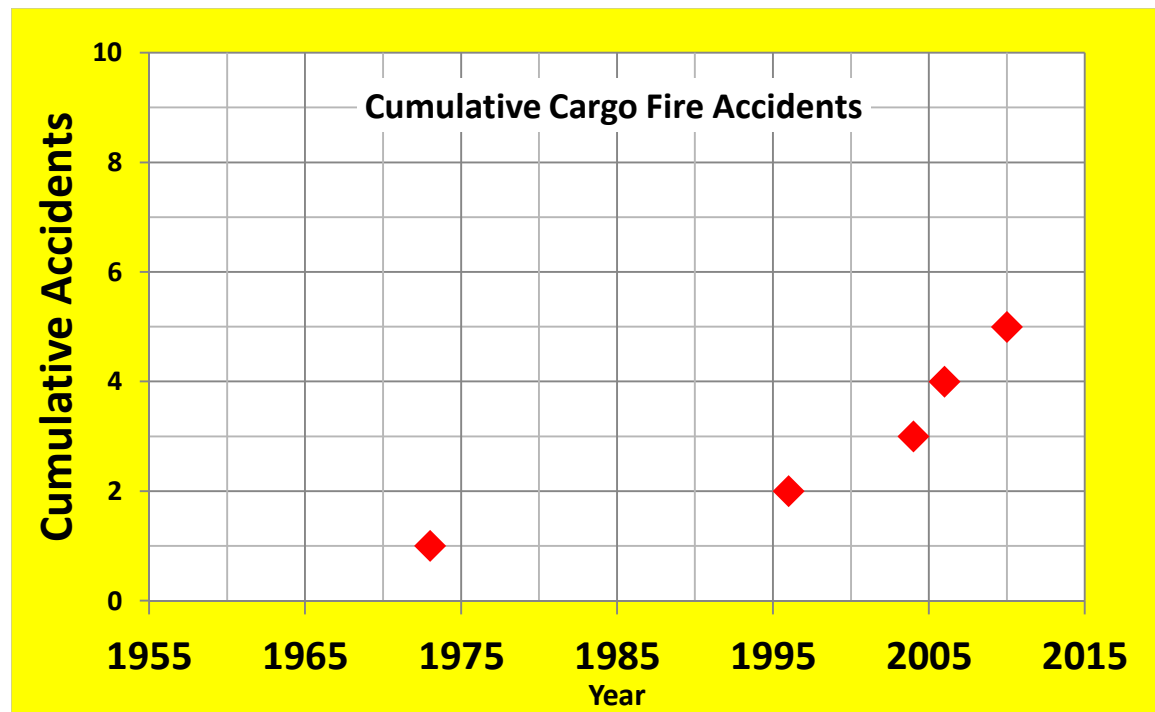
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# Freighter Fires – In-Service Occurrences

There have been 5 cargo fire accidents to US registered freighters over the period 1955 to 2013

1. Boston 1973
2. Newburgh 1996
3. Melo, Uruguay 2004
4. Philadelphia 2006
5. Dubai 2010



# Freighter Fires – In-Service Occurrences

## 1. Boston -1973 - Pan American World Airways Boeing 707

***“Although the source of the smoke could not be established conclusively, the NTSB believes that the spontaneous chemical reaction between leaking nitric acid, improperly packaged and stowed and the improper sawdust packing surrounding the acid's package initiated the accident sequence.”***

# Freighter Fires – In-Service Occurrences

## 2. Newburgh - 1996 - FedEx DC10-10CF

***“The National Transportation Safety Board determines that the probable cause of this accident was an in-flight cargo fire of undetermined origin.”***



# Freighter Fires – In-Service Occurrences

## 3. Melo, Uruguay 2004 – Mountain Air Cargo F27-500

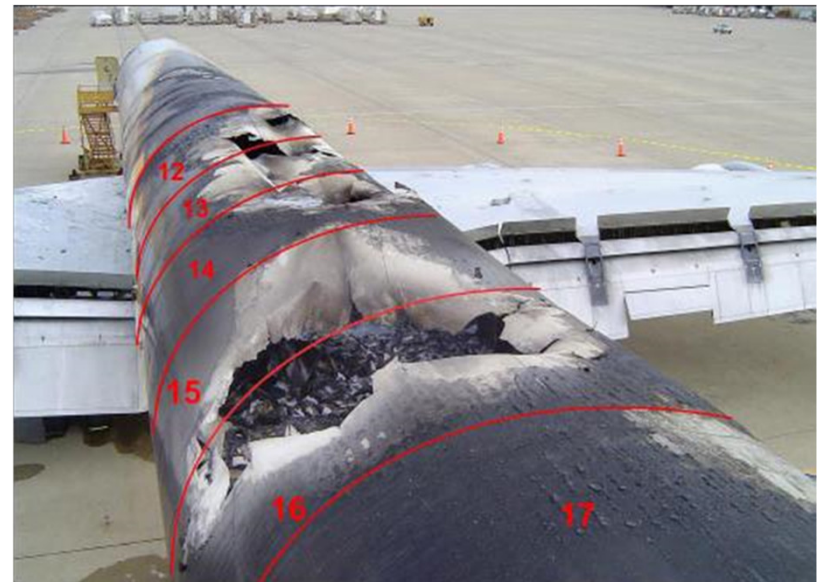
***“A FedEx flight operated by Mountain Air Cargo. The flight diverted after discovery of a fire in the cargo bay. The cause of the fire was unknown.”***



# Freighter Fires – In-Service Occurrences

## 4. Philadelphia - 2006 – United Parcel Service DC8

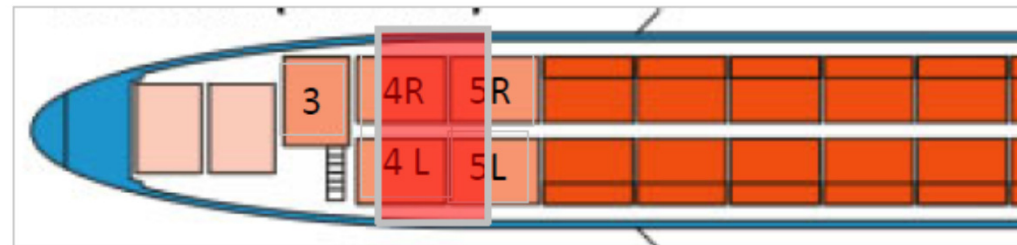
***“The cause of the in-flight fire could not be determined .... However, the presence of a significant quantity of electronic equipment in the containers where the fire most likely originated led the Safety Board to closely examine safety issues involving the transportation of rechargeable lithium batteries on commercial aircraft.”***



# Freighter Fires – In-Service Occurrences

## 5. Dubai - 2010 – United Parcel Service B747- 44AF

***“A large fire developed in palletized cargo on the main deck at or near pallet positions 4 or 5, in Fire Zone 3, consisting of consignments of mixed cargo including a significant number of lithium type batteries and other combustible materials. The fire escalated rapidly into a catastrophic uncontained fire.*”**





# Background

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# BACKGROUND

- ✓ **Resulting from the Philadelphia DC 8 accident the NTSB recommended that fire suppression systems be installed in the cargo compartments of all cargo airplanes operating under 14 CFR Part 121.**
- ✓ **Currently, Class E cargo compartments, which are the primary cargo compartment type used in cargo airplanes, do not require fire suppression systems.**

# BACKGROUND

**An initial Cost Benefit Analysis carried out for the FAA concluded that:**

***“Halon fire suppression systems, or alternatives that are likely to be developed for below floor cargo compartments, are unlikely to be cost beneficial for the main deck cargo compartments of cargo aircraft of any weight category.”***

# Risk and Cost Benefit Model

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# OVERVIEW

**Following the Boeing 747 freighter airplane accident on September 3rd 2010, the FAA, Transport Canada and the UK CAA requested that a Risk and Benefit Cost Model be developed to assess :**

- The likely number of U.S.-registered freighter fire accidents through to 2021**
- The Benefit Cost Ratio associated with seven mitigation strategies identified by the FAA.**

# OVERVIEW

## The Monte Carlo Simulation model:

- **Considers each freighter airplane type in the 2011 US fleet**
- **Allows User input of the mitigation means to be adopted and other base data**

# PROPOSED MITIGATION STRATEGIES

**Mitigation**

**All**      **None**

- CONTAINER SUPPRESSION - EXTERNAL
- CONTAINER SUPPRESSION - INTERNAL
- PALLET COVERS
- BATTERY BOXES PRIMARY
- BATTERY BOXES SECONDARY
- FIRE HARDENED CONTAINERS
- COMPARTMENT SUPPRESSION

# USER VARIABLES

- **Airplane Type and Mitigation Selection**
- **Mitigation effectiveness values**
- **Mitigation introduction dates**
- **Mitigation costs – introduction & maintenance**
- **Mitigation weights**
- **Labour rates and fuel costs**
- **Lithium battery shipment data**
- **Proportion of freight that is palletized versus containerized**
- **Default Button available**

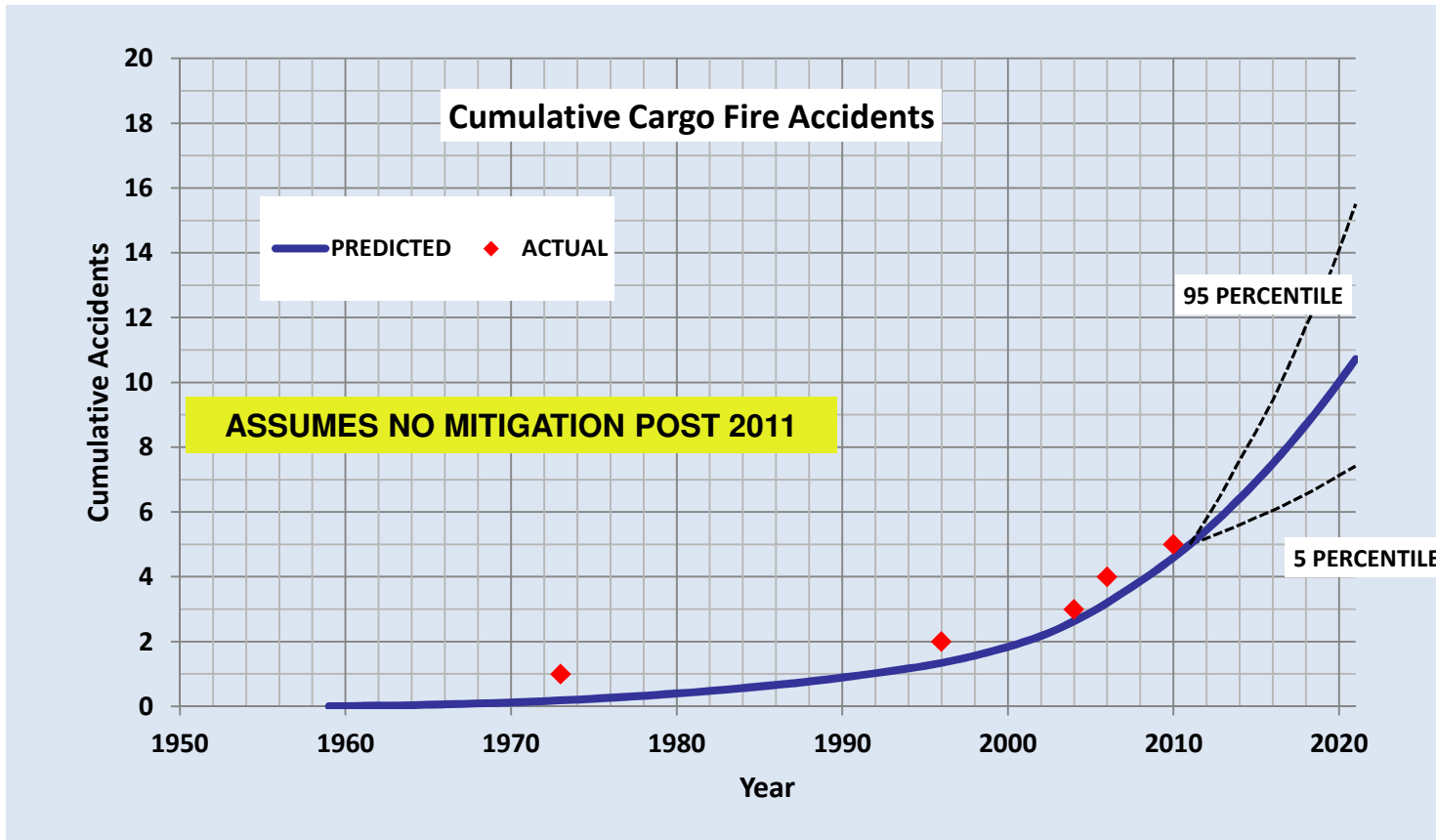


# Accident Projection

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# Freighter Fires – Accident Projection



# Freighter Fires – Accident Projection

<u>Accidents Predicted Over 10 Years (2012 - 2021)</u>			
	5 %	Ave	95 %
Battery Fire Accidents		<b>4.1</b>	
Non-Battery Fire Accidents		<b>1.6</b>	
Total Accidents	<b>2.4</b>	<b>5.7</b>	<b>10.3</b>

- ❖ Prediction is primarily dependent on the forecast of the number of revenue ton-miles through to 2021
- ❖ However, with no increase in threat due to lithium batteries then it would still be expected that there would be a further 3 accidents over the period.
- ❖ And with no increase in threat due to the shipment of lithium batteries and the annual revenue ton-miles constant through to 2021 at the 2011 annual level a further 2 accidents would be expected

# Cost Benefit

# Freighter Fires – Costs

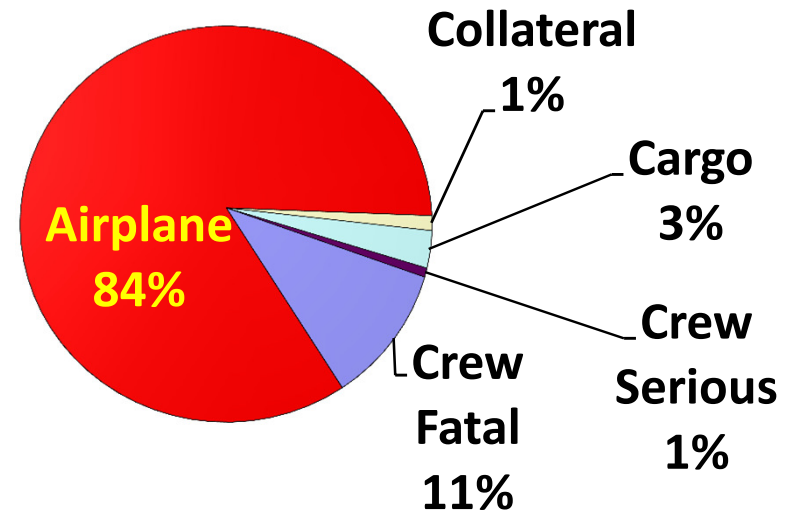
- ❖ **Whilst the costs of implementing the proposed mitigation strategies are currently not known to a sufficient level of accuracy to make accurate determinations of benefit/cost ratios the potential benefit that exists is more predictable.**

# Freighter Fires – Accident Costs (Potential Benefit)

- ❖ If no mitigation action is taken, accident costs are likely to average approximately \$44 million (U.S.) per annum over the period 2011 to 2025.
- ❖ The primary contribution to freighter fire accident costs is the value of the airplane—with average values of approximately 84% of the total accident cost (90% for the larger freighter airplanes).

Accident Cost Breakdown: Average for US Fleet - Prior to Mitigation

- ❖ The Model predictions of accident costs are based on the assumption that the composition of the U.S.-registered freighter fleet will be largely unchanged from 2010 through 2025.



# MODEL AND REPORT

Both the Model  
and the Report  
may be  
downloaded from  
the FAA website.



**Risk Model and Report (DOT/FAA/AR-12/3)  
published by FAA March 2012**

<http://www.fire.tc.faa.gov/reports/listresults.asp?searchList=DOT%2FFAA%2FFAR-12%2F3&listSubmit=Submit>