

# Freighter Fire Protection During **Smoke/Fire/Fume** Events



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UPS/IPA Safety Task Force

# Presentation Objectives

- Describe the UPS/IPA Safety Task Force
- Explain **smoke/fire/fume** risk mitigation strategies underway at UPS
- Discuss future testing

Industry Consultants



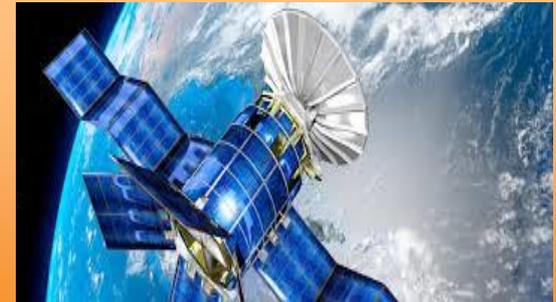
Existing Aviation Products



UPS/IPA  
Safety  
Task Force



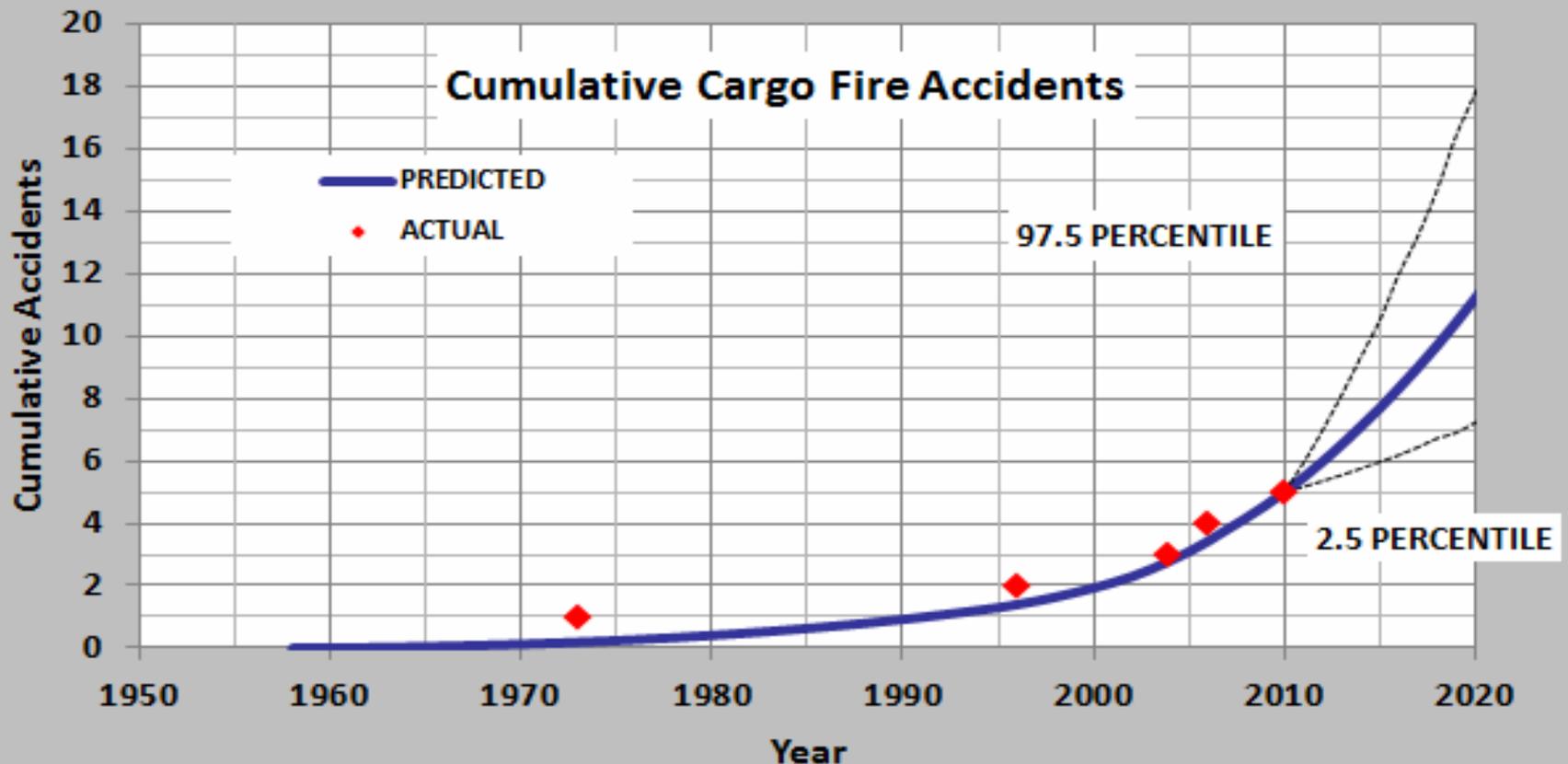
Fire Fighting Community



Aerospace

# FAA Study on Cargo Fire Accidents

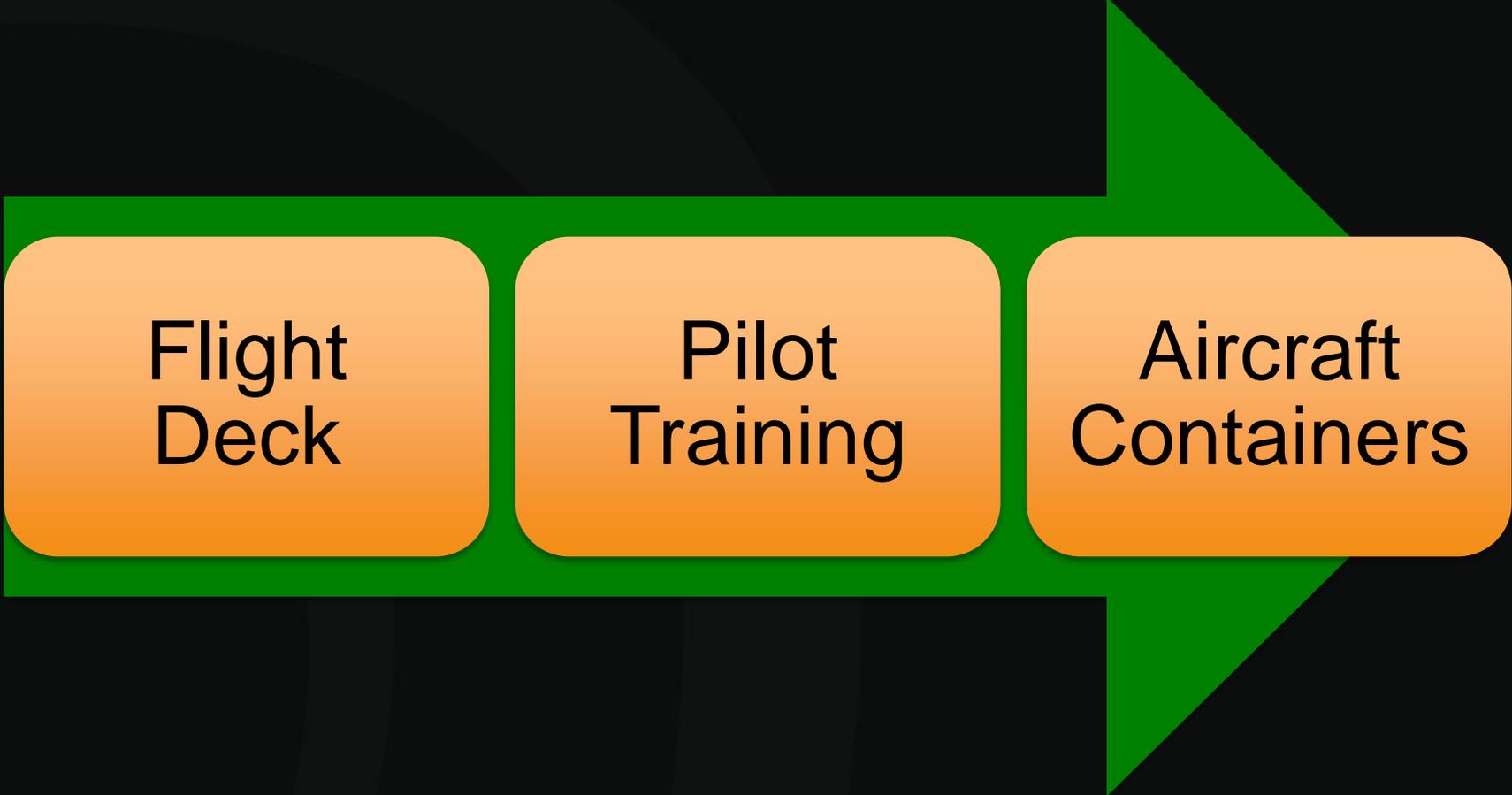
FAA Safety Analysis of U.S. domestic freighters predicts approximately six (6) accidents likely to occur from now to 2021



# The Issue is Safely Transporting High Energy Shipments by Air



# Layered Mitigation Strategy



Flight  
Deck

Pilot  
Training

Aircraft  
Containers

**Flight Deck**

Protection

# Pilots and the Flight Deck

**The Last Line of Defense**



# The Combination of Two Technologies Greatly Improves Safety



# Emergency Vision Assurance System

Independent testing by UPS  
validated the importance of EVAS

All UPS aircraft are being  
equipped with EVAS

All 747, MD-11 and 767 aircraft  
are currently equipped

Other cargo airlines have started  
to place orders for EVAS



# Emergency Vision Assurance System



# Full-Face Oxygen Masks

All UPS aircraft retrofitted with full-face oxygen masks in Captain, First Officer and First Observer positions

Supernumerary positions on 747 aircraft retrofitted with pressure masks (replacing Dixie-cup type mask)



**Training**

# **Pilot Training**

**Improving the Process**



# Checklist Design

## Human Factors Example: Condition and Confirmation Steps

Training

**ENGINE FIRE, Severe  
Damage or Separation**

**MESSAGE:** L or R ENGINE FIRE

AUTOTHROTTLE ARM SWITCH ..... OFF

THRUST LEVER (Affected side) ..... CLOSE

**FUEL CONTROL  
SWITCH (Affected side) ..... CUT OFF**

ENGINE FIRE SWITCH (Affected side) ..... PULL

**If Engine Fire Warning light remains illuminated:**

ENGINE FIRE SWITCH ..... ROTATE

Rotate to stop and hold for 1 second.

**After 30 seconds, if Engine Fire Warning light remains illuminated:**

ENGINE FIRE SWITCH .... ROTATE TO REMAINING BOTTLE

Rotate to stop and hold for 1 second.

**If high airframe vibration occurs and continues after engine is shut down:**

Without delay, reduce airspeed and descend to a safe altitude which results in an acceptable vibration level. If high vibration returns and further airspeed reduction and descent is not practical, increasing the airspeed may reduce the vibration.

APU (If available) ..... START

(CONTINUED)

**ENGINE FIRE  
or  
Engine Severe Damage or  
Separation**

**N301UP through N315UP**

Messages: L ENGINE FIRE      R ENGINE FIRE

Condition: One or more of these occur:

- Engine fire warning
- Airframe vibrations with abnormal engine indications
- Engine separation

- 1 A/T ARM switch ..... OFF
- 2 Thrust lever (affected side) . Confirm ..... Idle
- 3 FUEL CONTROL switch  
(affected side) ..... Confirm ... CUTOFF**
- 4 Engine fire switch  
(affected side) ..... Confirm ..... Pull
- 5 **If the engine fire warning light is illuminated:**  
Engine fire switch . . . . . Rotate to the stop and hold for 1 second

**If after 30 seconds the engine fire warning light stays illuminated:**

Engine fire switch. . . . . Rotate to the other stop and hold for 1 second

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# Sequence Based Learning



————— Inflight Smoke/Fire —————>



**Aircraft**

FCC and FRC

# Aircraft Containers

**Fire Containment Covers  
(FCC)**

**Fire Resistant Container  
(FRC)**



# Fire Containment Covers

**Engineering and design changes  
Improve performance**



# Fire Containment Covers

FCC's are designed to starve a fire of oxygen and contain it for four hours

UPS placed 10 FCC's into the air operation in 2013 to determine usability and durability.



# Fire Containment Covers

FCC

FCC requires no additional time and are used on palletized freight

Demonstrated 1500F fire containment for 4 hours

575 currently in use

6200+ shipments covered



# FCC Battery Testing

FCC Fire test with **5000 lithium-ion** batteries conducted March 18, 2014

Test duration of 4 hours was obtained with a peak temperature of 1500F

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FCC test with **4800 lithium metal** batteries performed March 25, 2014

Test limited to 15 minutes with peak temperature of 3000F



# Fire Resistant Container

FRC

The initial goal was:

- Contain a Class-A fire in a ULD for 4 hours
- 4 hour+ containment achieved with Class-A fires



# Fire Resistant Container

FRC

UPS is pleased with the benefits of MACROlite FRCs including:

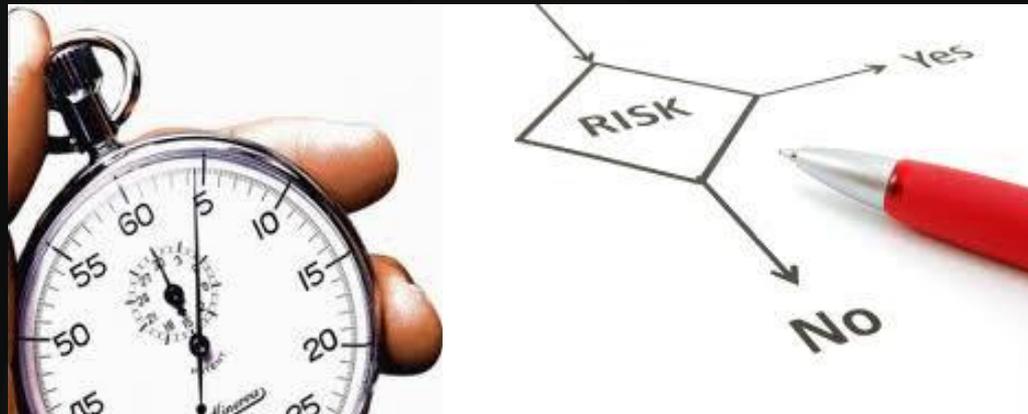
- Enhanced fire safety
- Weight savings
- Reduced repair frequency and cost

3400+ Fire Resistant ULD's  
in service by Dec. 2015

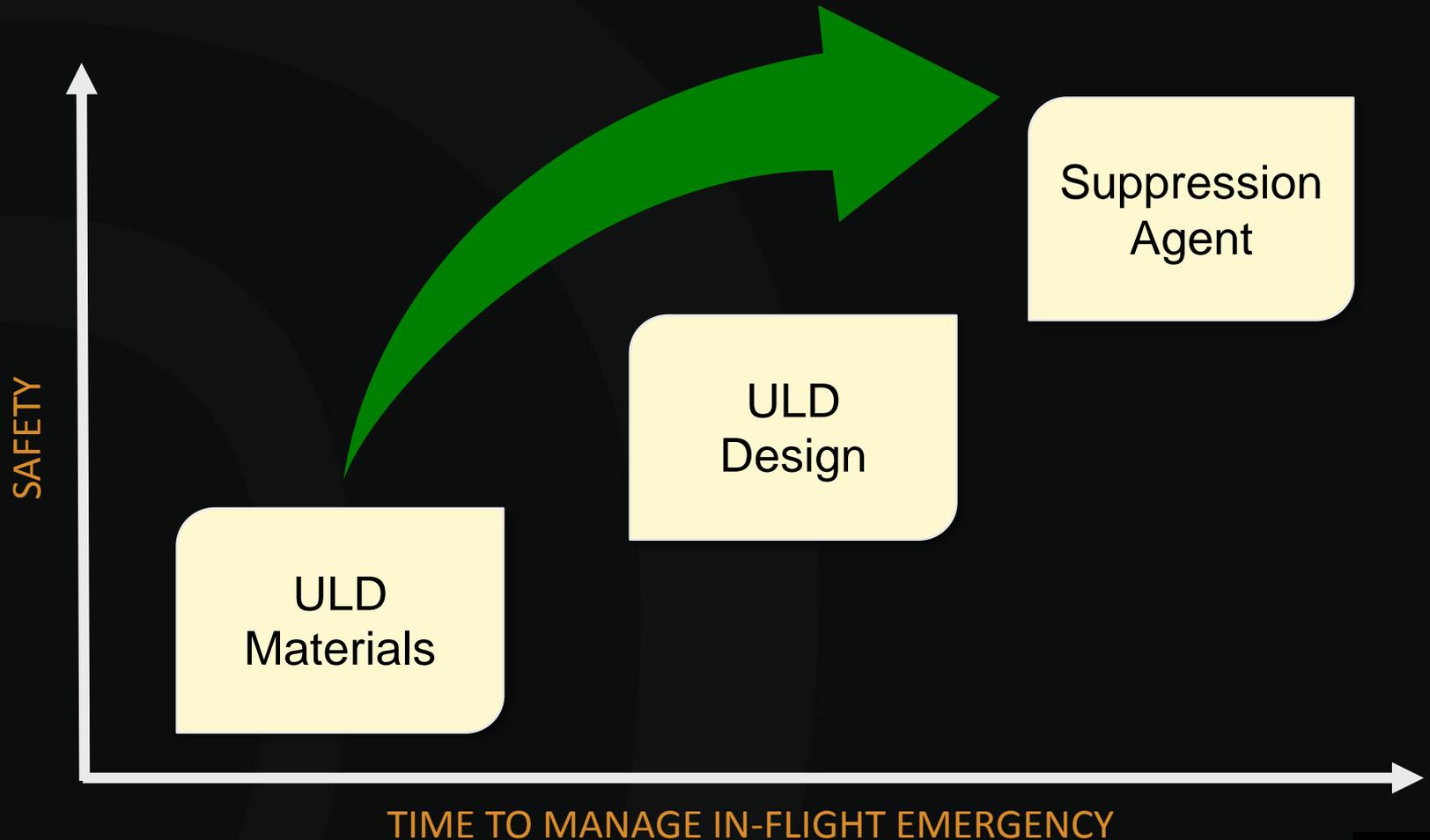


# Fire Suppression

## In- Container Fire Suppression



# Designing a Solution for Suppressing Battery Fires



# ULD Suppression Advantages

Suppression

Both FedEx and UPS fire suppression systems recognize you have to fight the fire in the container

All aircraft positions covered

Fire protection offered in aircraft, truck, rail & building



# ULD with Suppression

Suppression

UPS has applied for an  
STC

FAA Issue Paper to  
specify certification  
requirements signed  
April 2014

Finalizing detector  
design



# Future Testing Plans...

- UPS testing will continue
- Reexamining leakage rate and design of FRC
- Working to determine optimal configuration for large quantities of lithium-ion batteries



# Final Thoughts...

- Enhancing aviation safety is possible and necessary
- More testing is required
- We need to work together
- Cargo fires can become survivable events

# Questions

