SAFETY

The control of recognized hazards to achieve an acceptable level of risk..

What is Safety?

Pre-Flight Checks

ULD Use & Serviceability

Accident Risk Mitigation

Distracted cell phone use

Injury Prevention

Aircraft Fire Protection During Smoke/Fire Events

Randy Chappell

UPS Airlines
Global Manager of ULD Control

ULD Care Annual Conference
September 9, 2014
Mainz, Germany

Objectives

- Describe the Changing Nature of Air Shipments
- Introduce the UPS/IPA Safety Task Force
- Regulatory Environment
- Discuss 4 Areas for Improving Freighter Fire Protection

The Air Business Model Has Changed

- A growing percentage of aircraft payload involves batteries and technology
- $3.17/watt hour in 1991
- $0.12/watt hour in 2014

1988

2014

Transportation of high energy batteries is a game-changer for the Aviation Industry

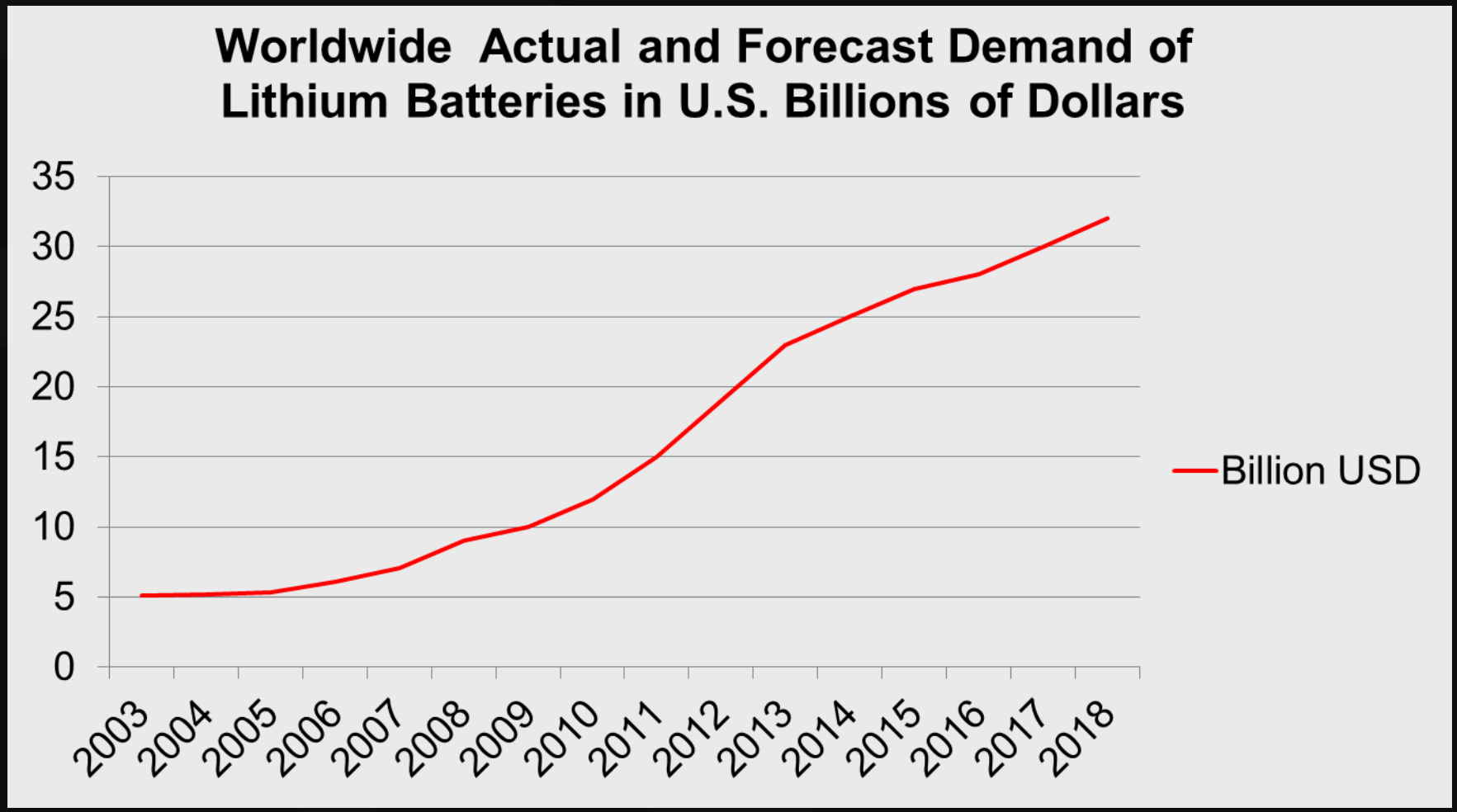
The Battery Market is Growing

- The global lithium-ion market in 2012 was $11.7 billion
- That market is expected to double by 2016
- Today 64% of the lithium-ion market is in consumer batteries
- North America will remain the largest market for industrial lithium-ion batteries in 2016

Frost and Sullivan Report for NAATB

National Alliance for Advanced Technology Batteries

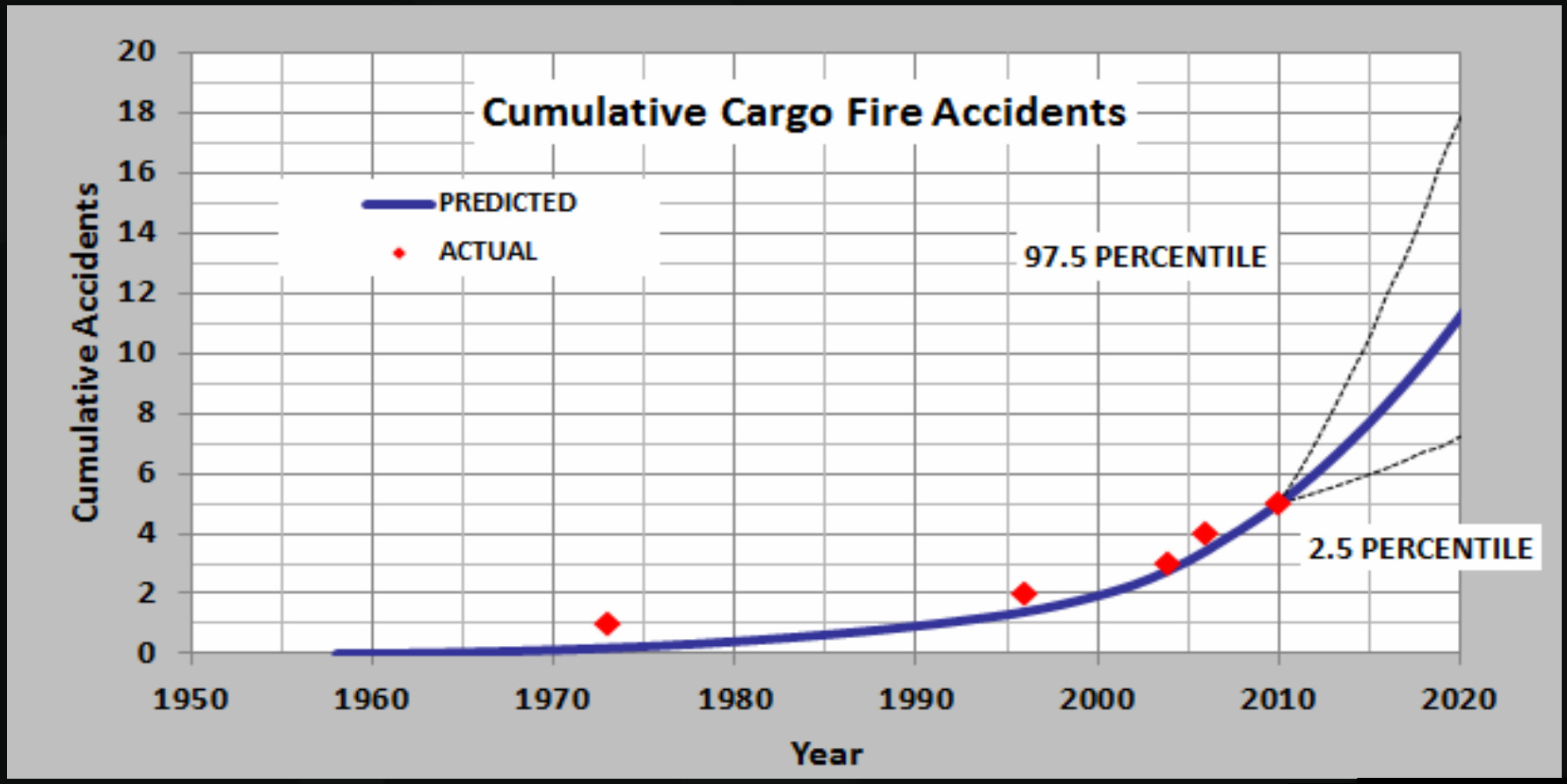
Global Lithium Battery Market in ($US) Billions



Source: Institute of Information Technology

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



DOT/FAA/AR-11/18 Freighter Airplane Risk Model, April 2013

Industry Consultants

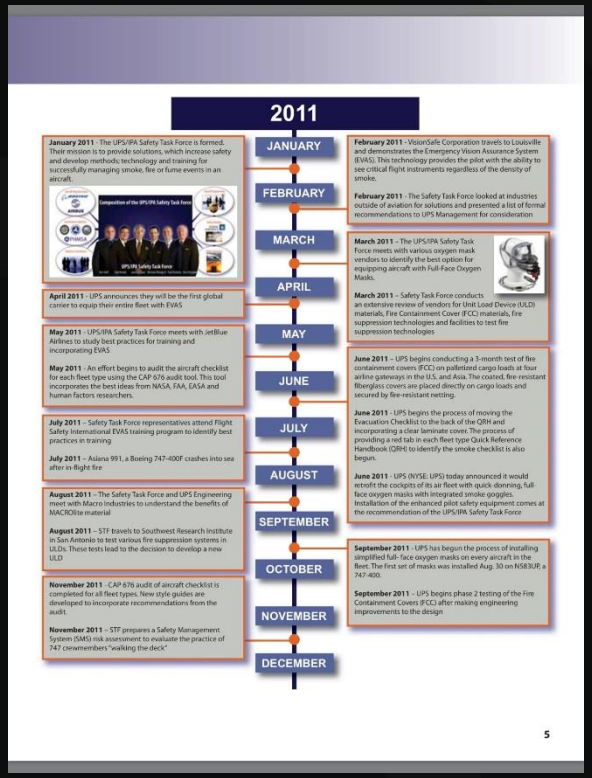
Existing Aviation Products

UPS/IPA Safety Task Force

Fire Fighting Community

Aerospace

Safety Task Force Accomplishments



2011

January 2011 - The UPS/IPA Safety Task Force is formed. Their mission is to provide solutions, which increase safety and develop methods, technology and training for successfully managing smoke, fire or fume events in an aircraft.

April 2011 - UPS announces they will be the first global carrier to equip their entire fleet with EVAS

May 2011 - UPS/IPA Safety Task Force meets with JetBlue Airlines to study best practices for training and incorporating EVAS

May 2011 - An effort begins to audit the aircraft checklist for each fleet type using the CAP 676 audit tool. This tool incorporates the best ideas from NASA, FAA, EASA and human factors researchers.

July 2011 – Safety Task Force representatives attend Flight Safety International EVAS training program to identify best practices in training

July 2011 – Asiana 991, a Boeing 747-400F crashes into sea after in-flight fire

August 2011 – The Safety Task Force and UPS Engineering meet with Macro Industries to understand the benefits of MACROlite material

August 2011 – STF travels to Southwest Research Institute in San Antonio to test various fire suppression systems in ULDs. These tests lead to the decision to develop a new ULD

November 2011 - CAP 676 audit of aircraft checklist is completed for all fleet types. New style guides are developed to incorporate recommendations from the audit.

November 2011 – STF prepares a Safety Management System (SMS) risk assessment to evaluate the practice of 747 crewmembers "walking the deck"

JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER

February 2011 - VisionSafe Corporation travels to Louisville and demonstrates the Emergency Vision Assurance System (EVAS). This technology provides the pilot with the ability to see critical flight instruments regardless of the density of smoke.

February 2011 - The Safety Task Force looked at industries outside of aviation for solutions and presented a list of formal recommendations to UPS Management for consideration

March 2011 – The UPS/IPA Safety Task Force meets with various oxygen mask vendors to identify the best option for equipping aircraft with Full-Face Oxygen Masks.

March 2011 – Safety Task Force conducts an extensive review of vendors for Unit Load Device (ULD) materials, Fire Containment Cover (FCC) materials, fire suppression technologies and facilities to test fire suppression technologies

June 2011 – UPS begins conducting a 3-month test of fire containment covers (FCC) on palletized cargo loads at four airline gateways in the U.S. and Asia. The coated, fire-resistant fiberglass covers are placed directly on cargo loads and secured by fire-resistant netting.

June 2011 - UPS begins the process of moving the Evacuation Checklist to the back of the QRH and incorporating a clear laminate cover. The process of providing a red tab in each fleet type Quick Reference Handbook (QRH) to identify the smoke checklist is also begun.

June 2011 - UPS (NYSE: UPS) today announced it would retrofit the cockpits of its air fleet with quick-donning, full-face oxygen masks with integrated smoke goggles. Installation of the enhanced pilot safety equipment comes at the recommendation of the UPS/IPA Safety Task Force

September 2011 - UPS has begun the process of installing simplified full-face oxygen masks on every aircraft in the fleet. The first set of masks was installed Aug. 30 on N583UP, a 747-400.

September 2011 – UPS begins phase 2 testing of the Fire Containment Covers (FCC) after making engineering improvements to the design

UPS/IPA Safety Task Force – Working Together for Safety

2012

January 2012 – N251UPS becomes the first MD-11 to become equipped with full-face oxygen masks.

April 2012 – Safety Task Force representatives attend the World Aviation Training Conference (WATS) conference to gather ideas and best practices for training Smoke/Fire/Fumes.

September 2012 – STF issues a formal recommendation and implementation plan for integrating Fire Containment Covers (FCC) into UPS air operation.

September 2012 - UPS begins an operational evaluation of a new material to construct cargo containers, one that potentially offers both greater durability and lighter weights. The new material, called MACROlite, is a fiber-reinforced plastic that is similar to materials used to make body armor, so it is extremely tough.

September 2012 – A 747 Main Deck Security Check is implemented based on a Safety Management System (SMS) report prepared by the Safety Task Force.

November 2012 – Safety Task Force and UPS Engineering representatives meet with the FAA Certification Office in Seattle to discuss plans for obtaining a Supplemental Type Certificate (STC) for a ULD suppression system.

November 2012 – The NTSB issues a formal set of Cargo Fire Safety recommendations in a public hearing in Washington, DC.

November 2012 – Wall Street Journal issues a favorable report stating "UPS Pushes Technology to Reduce Dangers of Cargo Plane Fires".

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February 2012 - UPS moves into the third phase of testing fire containment covers for palletized air cargo.

February 2012 - Testing and evaluation of fire suppression systems begin.

June 2012 – A successful 4-hour burn test of a Fire Containment Cover (FCC) was conducted at the FAA Tech Center with temperatures reaching as high as 1200F.

August 2012 – UPS Industrial Engineering and Safety Task Force conduct an audit to determine best use of FCCs and identify 17 Asian gateways as optimal locations.

October 2012 – The Safety Task Force addresses a Society of Automotive Engineers (SAE) conference to highlight the need for a new ULD design. SAE recommendations are developed for the FAA in support of new rule making.

October 2012 – All UPS Boeing 747 aircraft are retrofitted with crew-style oxygen masks, which provide positive pressure rather than passenger-style "Dixie cups." UPS is the only 747 operator in the world to take this step.

October 2012 - UPS conducts a test at the FAA Technical Center in Atlantic City, N.J. The test involves igniting a lithium-ion battery fire in a fully loaded unit load device (ULD) manufactured with Macrolite. The ULD was also fitted with an onboard fire suppression device using a potassium aerosol powder. The ULD contains 20 working laptops, 50 cell phones with batteries, 300 bulk-shipped lithium-ion batteries and an additional 190 packages containing a variety of items typically shipped through UPS. With the NTSB and FAA observing, the fire is ignited and container temperatures reach as high as 1200 degrees Fahrenheit. The suppression system activates and the fire is contained in the ULD up to four hours. When the door is opened, observers noted the fire has been extinguished, the laptops and cell phones still function and 95 percent of the packages are undamaged.

2013

January 2013 – A new door design is evaluated and suppression agent and material testing continues.

March 2013 – UPS began operational use of Fire Containment Covers (FCCs) in Hong Kong. A total of 575 FCCs have been ordered and will be utilized in origin shipments from 17 Asian gateways.

July 2013 –The United Arab Emirates General Civil Aviation Authority issued its final report into UPS Airlines 2010 aircraft accident in Dubai.

July 2013 – UPS issues press release – UPS Pioneers Aviation Safety - Implements New Fire Resistant Shipping Containers.

July 2013 – Safety Task Force representatives meet with the UPS/IPA CQ Advisory Group to discuss ways to enhance smoke/fire/fume training.

July 2013 – Safety Task Force member Bob Brown and Ed Geers, UPS Vice President of Ground Support Equipment are asked to join the Commercial Aviation Safety Team (CAST) to address issues of HAZMAT Fire Mitigation and Cargo Fire Containment.

September 2013 – Safety Task Force representatives attend the Bombardier Safety Standown and learn new techniques for training smoke/fire/fume events.

September 2013 – All 17 Asian gateways are utilizing Fire Containment Covers (FCCs) having covered over 1400 pallets to date. The entire project was completed 7 weeks ahead of schedule

September 2013 – N469UP becomes the first Boeing 757 to have a full-face oxygen mask installed.

November 2013 – Ed Geers, UPS Airlines Vice President Ground Support Equipment is named Co-Chairman of the Commercial Aviation Safety Team (CAST) representing HAZMAT and cargo fire issues.

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February 2013 – N582UP becomes the first 747 to become equipped with EVAS.

February 2013 – Ed Wolton, UPS Director of Engineering replaces Captain Don Drysdale on the Safety Task Force

April 2013 – John Pass, MD-11 Chief Pilot replaces Captain John Ransom on the Safety Task Force

May 2013 – Safety Task Force representatives address the International Aircraft Systems Fire Protection Working Group to discuss the latest concepts in improving safety in cargo operations.

May 2013 – The Safety Task Force presents training center representatives with recommendations to improve smoke/fire/fume training for crewmembers.

June 2013 – A new door design combined with MACROLite is tested using a Class-A fire load.

June 2013 – UPS commits to purchase 1,821 new ULD containers built with a revolutionary new panel material that is highly effective in containing cargo fires. The material, MACROlite, is a fiber- reinforced plastic composite similar to the material used in ballistic body armor.

August 2013 – Safety Task Force and UPS Engineering representatives test a new door design at Southwest Research Institute. The test with a Class-A fire load lasts for 6 hours.

August 2013 – A-300 Training Supervisor Dan Sherlock replaces Ken Hoff on the Safety Task Force. Ken Hoff remains actively involved in fire suppression certification efforts.

October 2013 – Safety Task Force issues formal guidance about crew oxygen masks and portable oxygen bottle incompatibility.

October 2013 – FAA Government Shutdown delays certification and approval efforts.

December 2013 – The Safety Task Force makes a presentation on Freighter Fire Protection at the 7th Annual Triennial Fire Safety Conference in Philadelphia.

The Current Regulatory Environment

The Current Regulatory Environment

PHMSA and FAA recently modified the requirements governing the transportation of lithium cells and batteries

Harmonizes the Hazardous Materials Regulations (HMR)

Compliance is mandatory February 6, 2015

Comments on New Regulations

Rules simplify training for shippers and employees

Improves safety through more robust packaging requirements

Improves hazard communication by requiring all batteries (shipped on their own) to be marked

FAA Advisory Circular 120-85
Current Language

2.9.5 OPERATOR PROGRAM FOR VENDORS TO USE IN ULD BUILDUP OR LOADING. Given that it is common practice for an operator to carry cargo loads that vendors have built up or loaded, an operator should have a program that ensures vendors perform cargo buildup and loading using the operator's procedures. Under such a program, an operator should have procedures to:

a) Train vendor employees, train a vendor employee to train other vendor employees (train-the-trainer method), or accept the vendor's training program and procedures provided they meet or exceed the standards established in the operator training program and procedures.
b) Designate a trained, qualified, and authorized person to oversee the vendor services to ensure the vendor performs the services in accordance with the operator procedures.
c) Audit vendors for compliance with operator procedures and training programs.
d) Have a record keeping system to track all trained individuals, including vendors, in cargo operations that are authorized, qualified, and trained by the operator.

NOTE 1: All cargo built by authorized, trained and qualified personnel must meet operator standards before being loaded.

FAA Advisory Circular 120-85 A
Proposed New Langage

2.9.4 VENDORS. As previously mentioned, the operator is ultimately responsible for the security of the cargo and safety of flight. There are multiple entities involved in the movement of cargo. Examples of these entities include shippers, vendors, freight forwarders, contractors and service providers. All play a role in the air transportation of cargo, and these roles may include cargo build-up, freight staging, cargo loading and tie down. Freight forwarders or customs brokers performing ULD handling or build-up must ensure that:

a) Requirements are met in accordance with the instructions of the operator;
b) Sufficient and proper ULD storage capacity is available for all units handled;
c) All staff and supervising staff receive training appropriate to the tasks performed; and
d) Full access is guaranteed to enquiries or audits from the operator's quality control departments.

The FAA recommends that the freight forwarder or customs brokerage provider maintain its own internal evaluation program recognized to an equivalent industry standard.

Challenge: Safely Transporting High Energy Shipments

Flight Deck

Facts About Cockpit Smoke

In-flight smoke events on transport jets are twice as likely as in-flight engine failures
(ALPA Safety Report)

"The time from first indication of smoke to an out-of-control situation may be very short." (*Boeing Aero 14)*

The average time from first indication of fire to a catastrophic event is only 18 minutes (Transport Canada)

4 Areas for Improving Aircraft Fire Protection

Flight Deck

Fire Containment Covers

Fire Resistant Containers

In-Container Fire Suppression

4 Areas for Improving Aircraft Fire Protection

Flight Deck

Fire Containment Covers

Fire Resistant Containers

In-Container Fire Suppression

Flight Deck

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)

Flight Deck

Vision Safe
Emergency Vision Assurance System

Independent testing by UPS validated the importance of EVAS

All UPS aircraft are being equipped with EVAS

All 747 and 767 aircraft are currently equipped

Other airlines have started to place orders for EVAS

4 Areas for Improving Aircraft Fire Protection

Flight Deck

Fire Containment Covers

Fire Resistant Containers

In-Container Fire Suppression

FCC

Fire Containment Covers in the UPS Operation

- Over 700 FCCs in daily use
- Covers palletized high-energy shipments
- FCCs used 6000+ times since implementation

4 Areas for Improving Aircraft Fire Protection

Flight Deck

Fire Containment Covers

Fire Resistant Containers

In-Container Fire Suppression

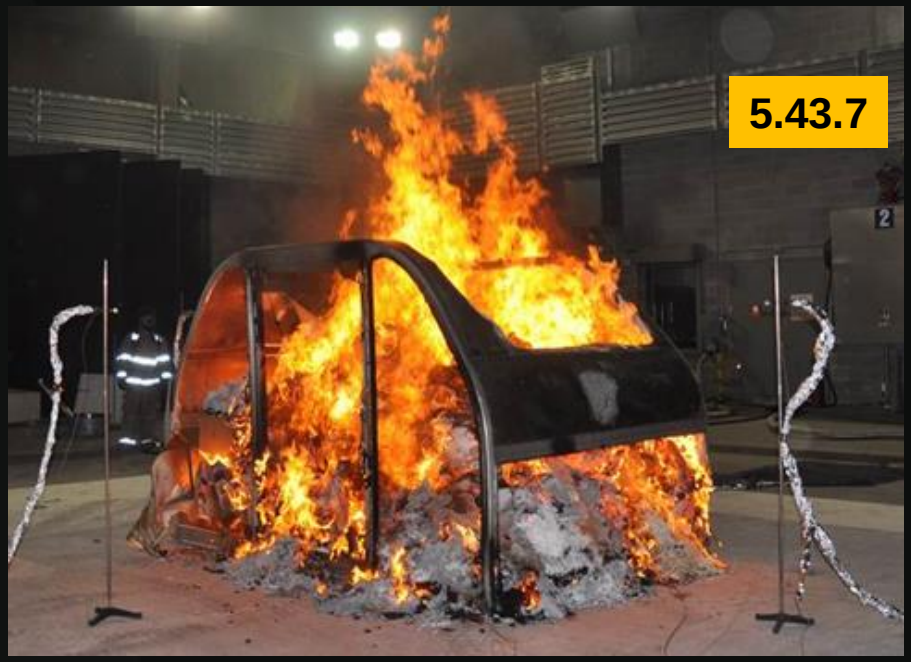
FRC

Existing ULD Containers

UPS, NTSB and FAA conducted full scale burn tests of standard TSO C90c aluminum/polycarbonate AAY ULD

Standard fire load consisting of 18X18X18 boxes with 2.5 pounds shredded paper in each

Ignition achieved by nichrome wire wrapped in paper towels inside one of the cardboard boxes



UPS Fire Mitigation Goal

The fire mitigation goal for the FRC project was to:

- Contain a Class-A fire to the ULD for 4 hours
- Produce testing that 4+ hour containment can be achieved

FRC

ULD Engineering Strategy

UPS began testing new ULD designs in November, 2011

Optimal air exchange rates were determined using a steel ULD (5 cfm vs. 25 cfm)

Various ULD materials were tested

Door types and door seal designs were evaluated

FRC

UPS ULD Strategy

- Replacing Lexan or aluminum ULD panel material with MACROlite
- Engineer a fire resistant roll-up door design
- Establishing a 1.3 cfm door threshold air exchange rate (vs. 25 cfm in standard ULD)
- Meet TSO C-90

FRC

Fire Resistant Container

UPS is pleased with the benefits of MACROlite FRCs including:

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

UPS has 2000 FRCs in service and 1400 on order for 2014 delivery

4 Areas for Improving Aircraft Fire Protection

Flight Deck

Fire Containment Covers

Fire Resistant Containers

In-Container Fire Suppression

Fire

Suppression

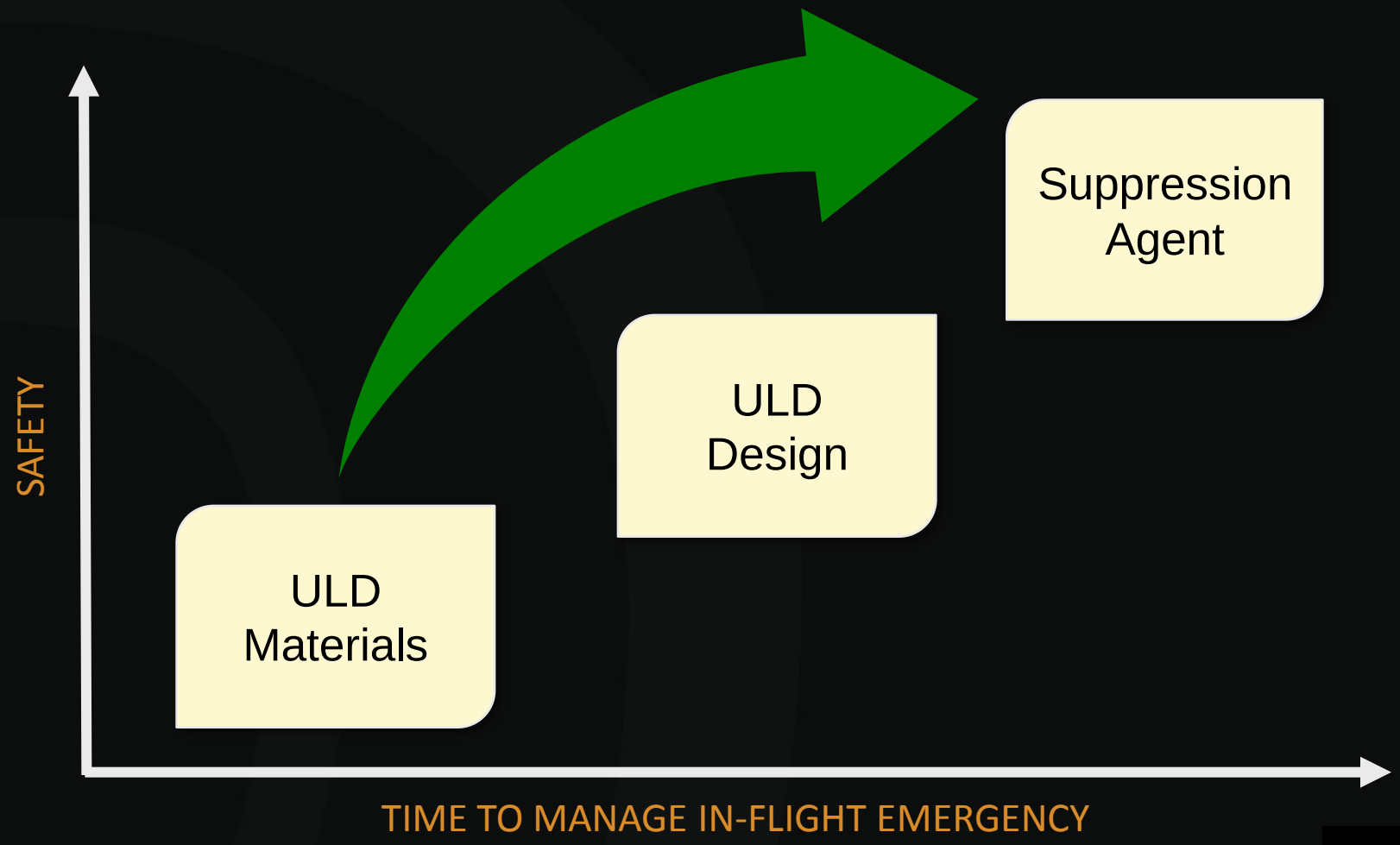
Video of Real World Package Test

FAA Technical Center

Atlantic City, NJ

October 23, 2012

Designing a Solution for Suppressing Battery Fires



ULD with Suppression

Suppression

- UPS has applied for an STC to install suppression in a ULD
- No regulatory requirement or guidance
- FAA Issue Paper to specify certification requirements signed April 2014
- Finalizing detector design
- STC expected 2015

ULD with Suppression

Suppression

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

Fire suppression agent shows great promise on lithium-ion battery fires

ULD Suppression Advantages

Suppression

- All aircraft positions covered
- Fire protection in aircraft, truck, rail & building
- Scalable to meet future battery technology
- Certification testing underway

Fire

Suppression

Video of 5000 Lithium-ion Batteries in an unsuppressed MACROlite ULD

FAA Technical Center

Atlantic City, NJ

April 15, 2014

ULD Fire Test Analysis

Suppression

Ceiling temperatures remained at ambient

The fire detector never detected a fire

Detector design would trigger on CO and Temp threshold

Next Steps

Suppression

UPS has validated the effectiveness of the fire suppressant on lithium-ion batteries

Work is ongoing to incorporate a particle based optical detector into the design

More testing with Lithium batteries is planned

Final Thoughts…

- Enhancing aviation safety is possible
- New technologies show promise
- Regulators, Manufacturers and Operators need to work together
- Next-Gen ULDs are the key to flight safety in the future.
- If we do our jobs well, aviation safety will be greatly enhanced

Questions