Managing Risk in Battery Transportation

Captain Bob Brown, Independent Pilots Association
Ed Walton, UPS Director of Engineering
Presentation Objectives

• Explain the risk transporting batteries by air

• Describe factors influencing risk and FAA industry statistics

• Describe efforts underway at UPS to mitigate risk
Risk in Aviation

- From 1990 to 2015 there have been 19 major accidents involving in-flight fire. (Flight Safety Foundation)

- These accidents resulted in 425 fatalities. (Flight Safety Foundation)

- Testing at FAA Technical Center proved battery smoke is different from theatrical smoke and enters the cockpit. (FAA TECH Center Report, Feb. 26, 2013)
Risk in Cargo Airline Operations

- UPS 1307
- UPS Flight 6
- Asiana 991

There is no ability to go back and “fight the fire”

Aircraft manufacturers have stated their aircraft were never designed to transport the types of HAZMAT being transported today.
Assessing Risk in Aviation

Risk assessment determines the level of risk to use in making a bottom line decision.

- **Risk Likelihood**:
  - Frequent
  - Occasional
  - Remote
  - Improbable
  - Extremely improbable

- **Risk Severity**:
  - Catastrophic
  - Hazardous
  - Major
  - Minor
  - Negligible

A risk matrix is a tool used for risk assessment. It can vary in form yet it accomplishes the same purpose.
Normal Flight Profile Assumed Risk

Source: Flight Safety Foundation
Aviation Risk Transporting Batteries

Time from Fire to Loss of Control: 17-19 Minutes

Source: Transport Canada
FAA Risk Analysis Study

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
Factors Influencing Risk
Battery Production is Increasing

- Tesla Gigafactory will churn out half a million battery packs at only 70% of current costs (Tesla)

- Three Gigafactories currently under construction worldwide

- The Tesla Nevada Gigafactory will produce more batteries in 2018 than were produced worldwide in 2013

Bottom Line: The Public wants more portable and accessible energy from stored sources
Counterfeit Products are in the Marketplace

- A shared concern between quality manufacturers and transportation companies
- Improved detection methods need to be established
- Prosecution for offending counterfeit product manufacturers is necessary
Additional Risk Factors

- Undeclared shipments
- Sub-par Manufacturers
- Disposable consumer products (e.g. E-Cigarettes)
- New applications emerge and are shipped in large quantities
The Most Recent Threat: Hoverboards

- 12 incidents in US where Hoverboard fires damaged or destroyed homes (US Consumer Product Safety Commission)

- 54 documented Hoverboard fires in the U.S (US Consumer Product Safety Commission)

Hover boards took the Lithium ion battery fire issue out of aviation and into American homes
Where is our focus
Where should we focus?

Setting the wrong goals can easily prevent success
2015 FAA Industry Statistics

• 12 events in passenger aircraft

• 8 events in cargo aircraft

• Over twice as many events as in 2014

• More events per year since FAA began keeping records in 2005
UPS Mitigation Strategies
The Combination of Two Technologies Greatly Improves Safety
Polypropylene in Aviation
Good Qualities of Polypropylene

- Polypropylene is water repellant and lightweight
- It is specifically designed for repeated bending and will not tear easily
- Polypropylene used in aviation can meet FAA material specifications (FAR 25.853(a), Appendix F. Part 1 paragraphs (a)(1)(v) and (a)(2)(iv)).
Bad Qualities of Polypropylene

• Polypropylene acts as an additional fuel!

• The greater release of heat energy from a polypropylene container fire may penetrate a cargo liner and damage the underlying structure, systems and avionics.
Information demonstrating the significant heat release from polypropylene can be found on the public web site:


The peak heat release rate (HRR) is more then twice as great in a polypropylene ULD vs a standard ULD
Fire Containment Covers

- FCCs are treated fabric covers designed to starve a fire of oxygen and contain to for 4+ hours
- FCC requires no additional time to place on a pallet than a cargo net
- 575 currently in use
MACROlite FRCs

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 as of May 2016
FRC Fire Containment Strategy

- ULD Materials
- ULD Design
- Suppression Agent

SAFETY

TIME TO MANAGE IN-FLIGHT EMERGENCY
FRC Suppression Testing

- UPS has applied for an STC and is in the process of certificating a ULD suppression system.

- FAA test conducted April 15, 2014 led to an unanticipated explosion from vented gases when detector failed to function.

- Awareness of explosive gases led to FRC redesign to mitigate gas build-up.
To address the scenario of a buildup of hydrogen gases, UPS Engineering removed the lower door seal to allow gases to vent and burn off.

Testing conducted at an independent lab validated the effectiveness of the redesign.
Next Steps

- UPS will resume testing in June 2016
- FRC with suppression and detection will be tested for STC certification
- Testing will continue with Lithium-ion batteries
- Upon receiving an STC, a small sample of FR Cs with suppression will be placed into operation for durability testing
Final Thoughts...

- A greater level of aviation safety is possible

- Industry, manufacturers and regulators need to work together to develop fire-safety certification rules and standards reflecting current (and future) technologies

- New technologies, materials and designs show great promise

- If we do our jobs well, aviation safety will be greatly enhanced
Questions