



Managing Risk in Battery Transportation

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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

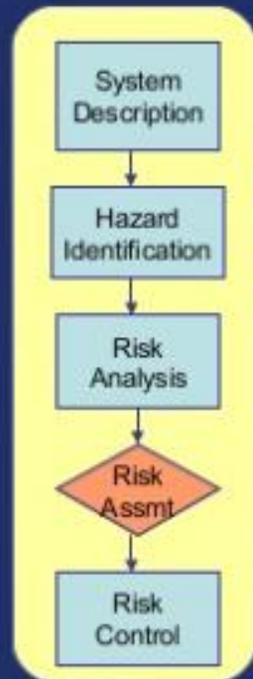
There is no ability to go back and
“fight the fire”

Aircraft manufactures 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.

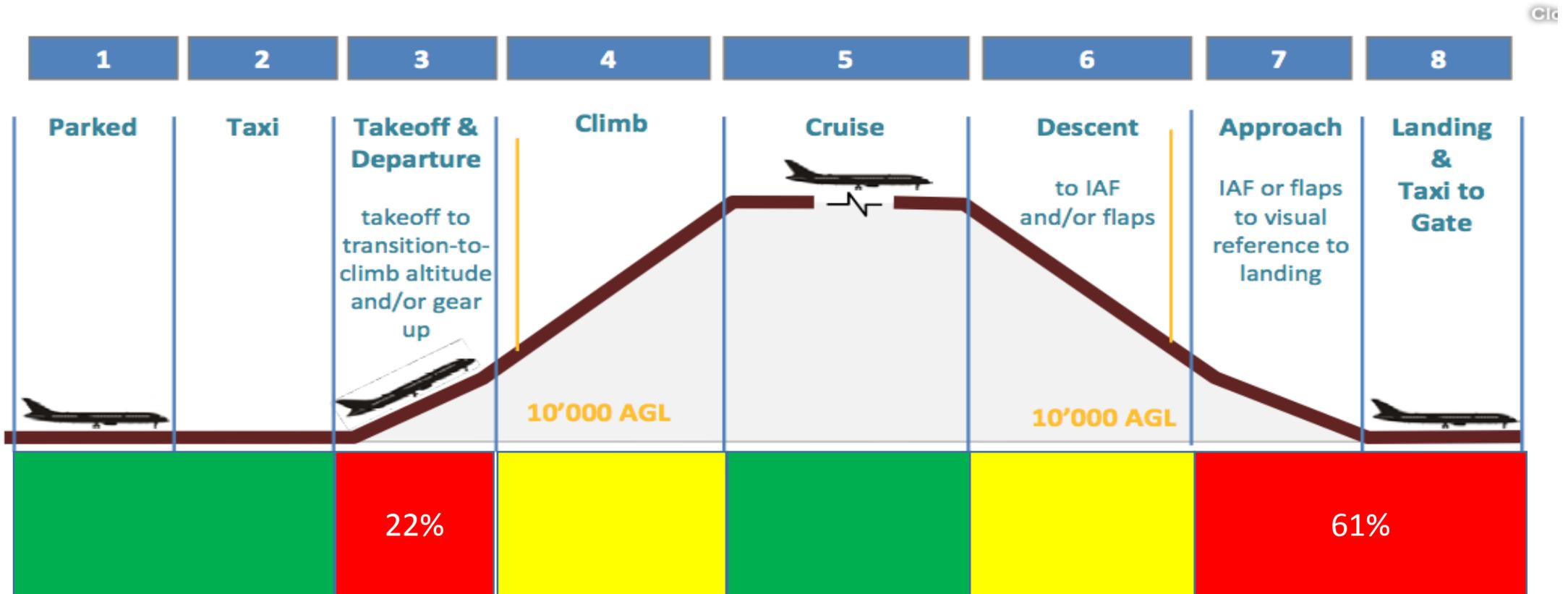


Risk Likelihood		Risk Severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

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

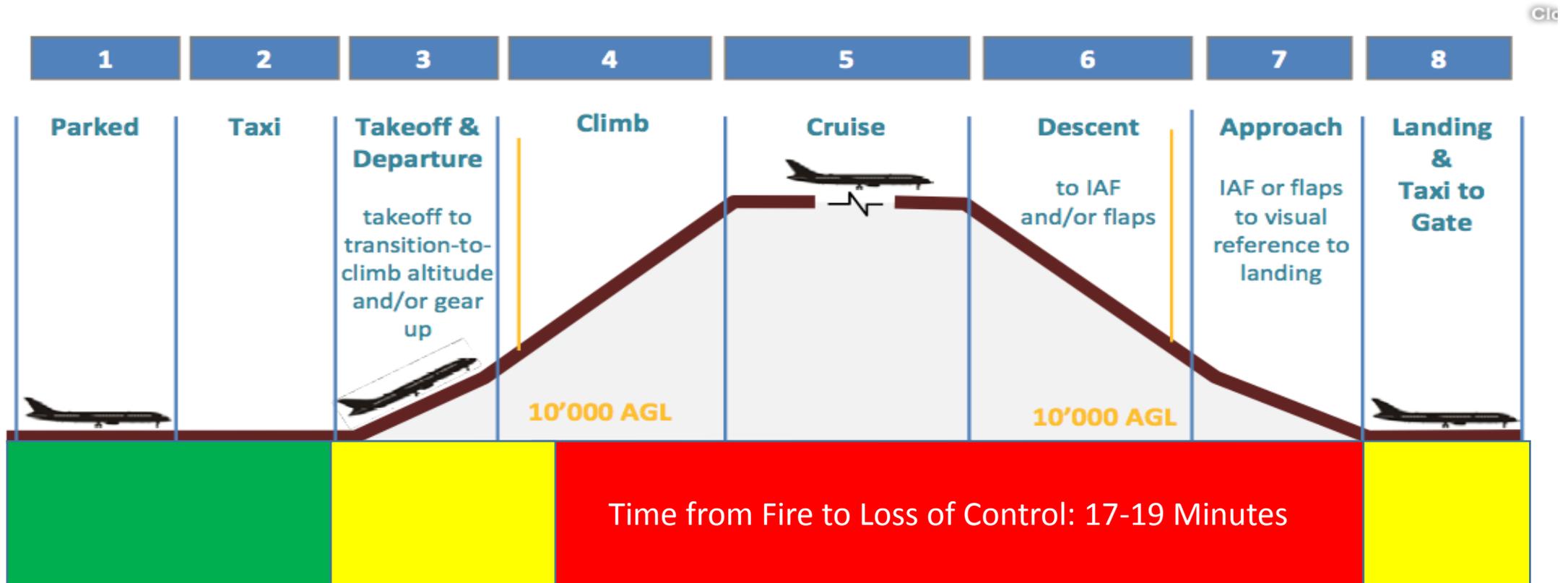


Normal Flight Profile Assumed Risk



Source: Flight Safety Foundation

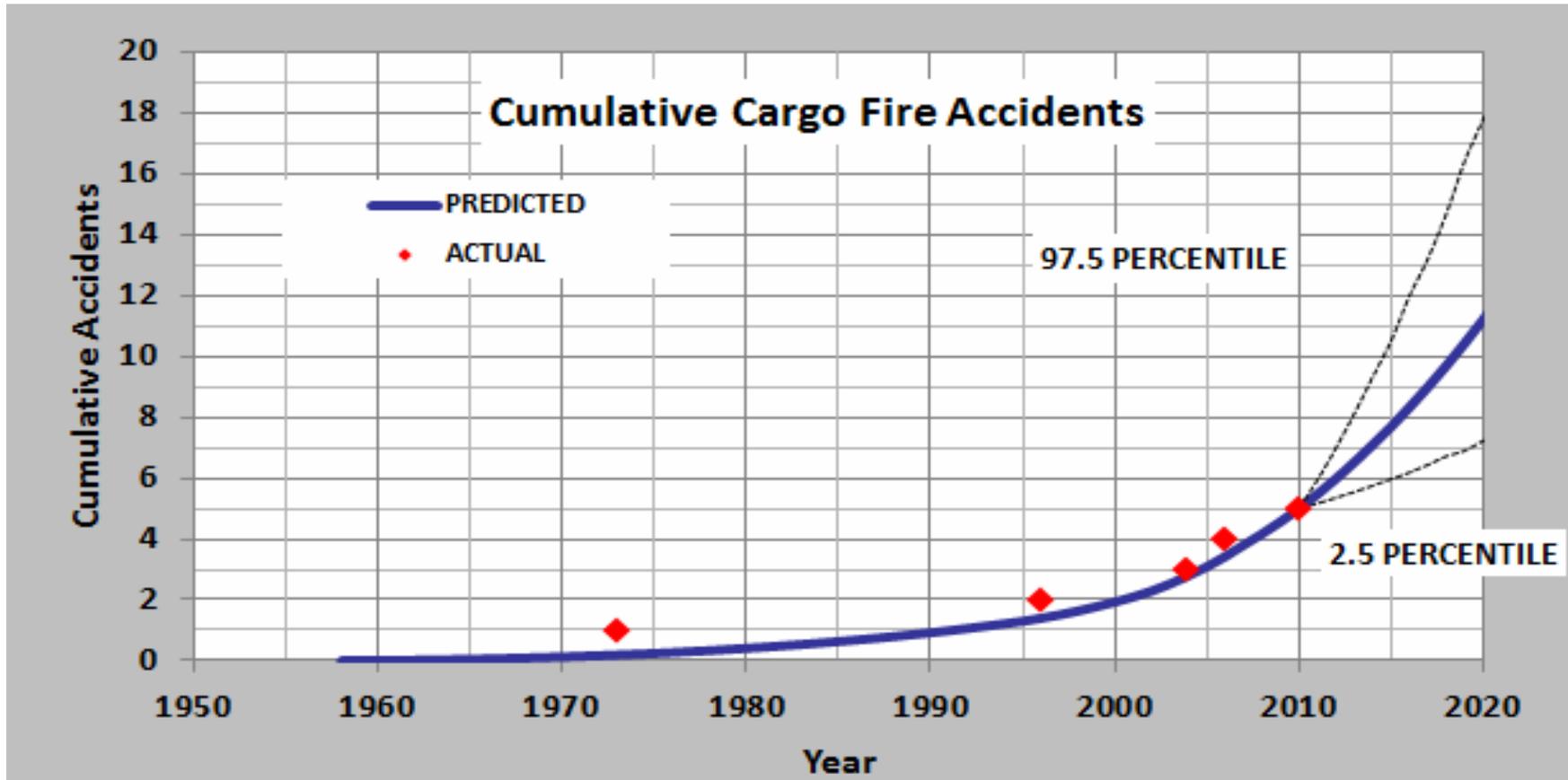
Aviation Risk Transporting Batteries



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



Factors Influencing Risk

Real



Fake



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)

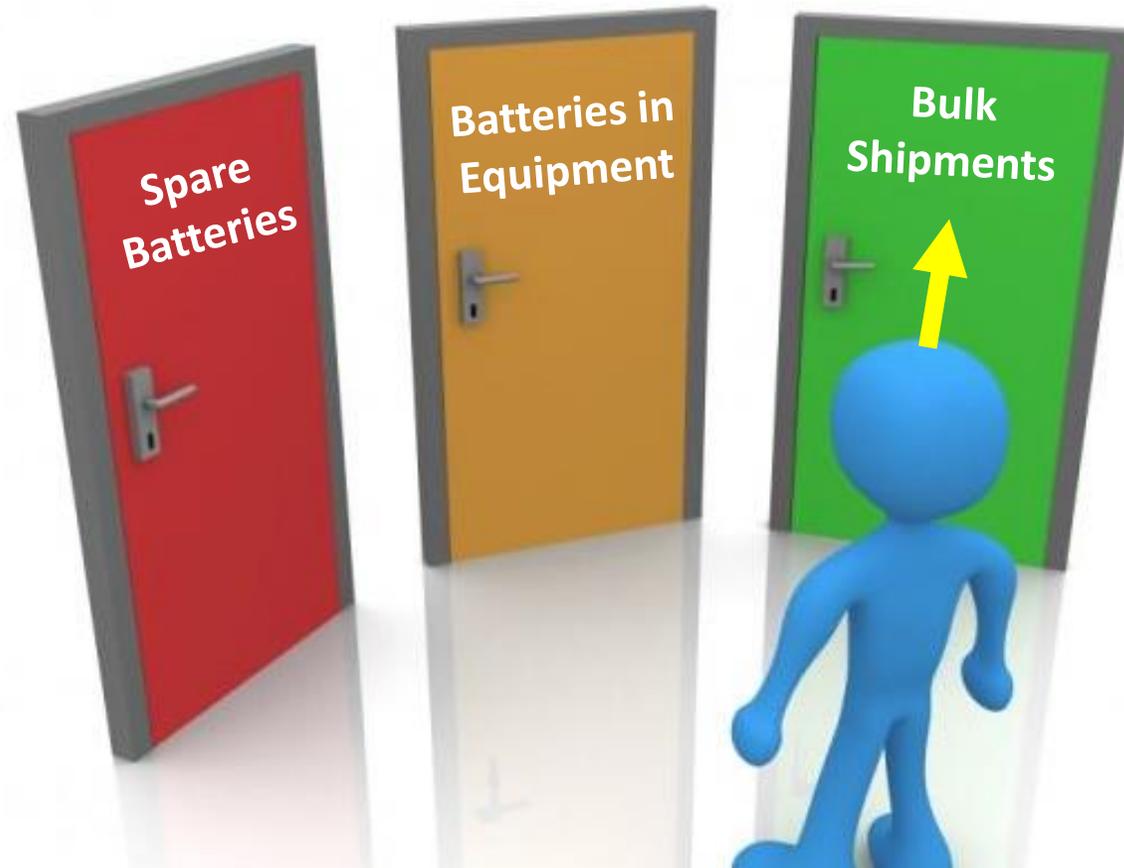
- 54 documented Hoverboard fires in the U.S

(US Consumer Product Safety Commission)

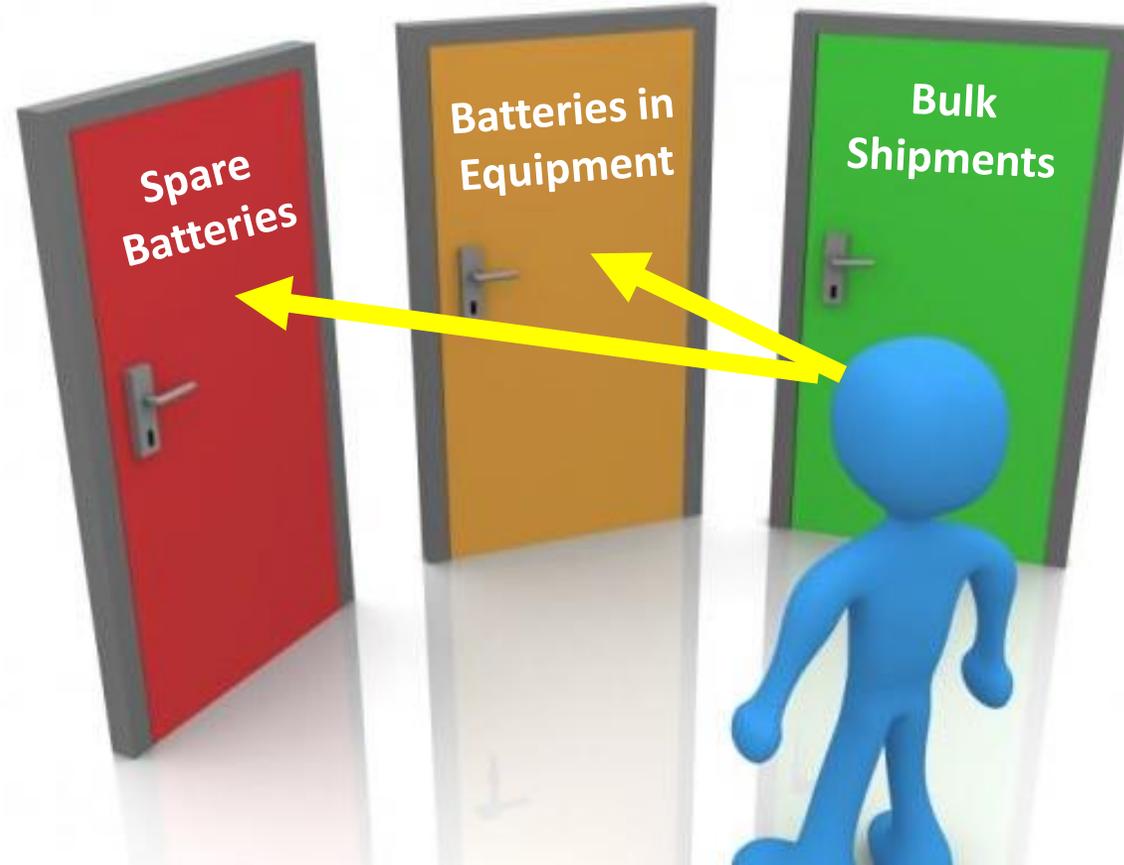
Hover boards took the Lithium ion battery fire issue out of aviation and into American homes



Where is our focus



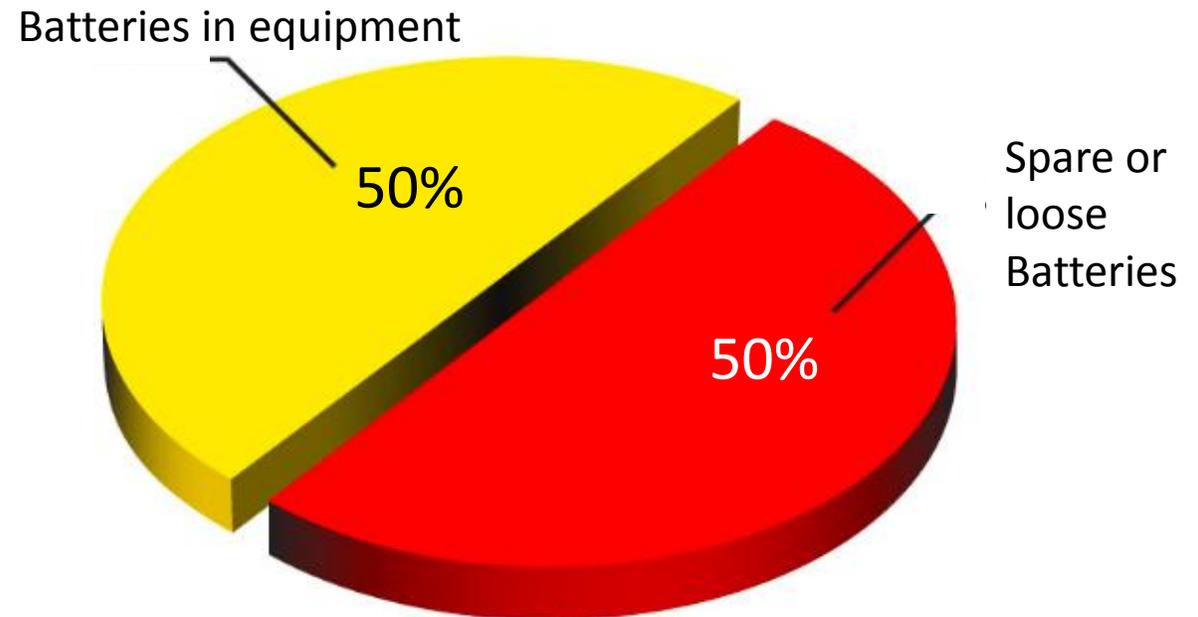
Where should we focus?



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

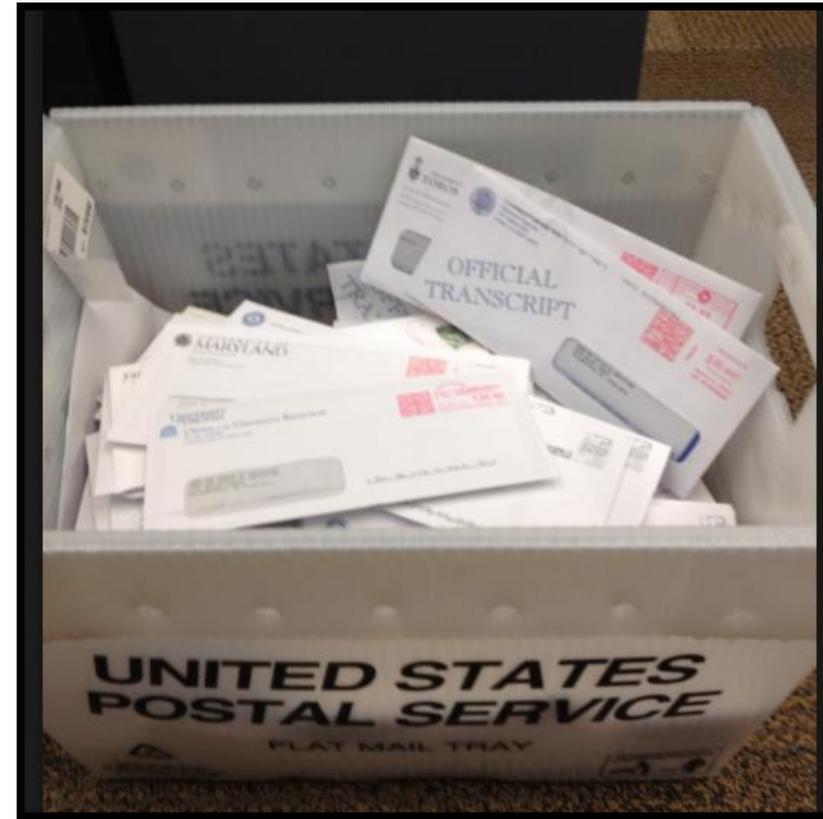


Polypropylene in Aviation



Good Qualities of Polypropylene

- Polypropylene is water repellent 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

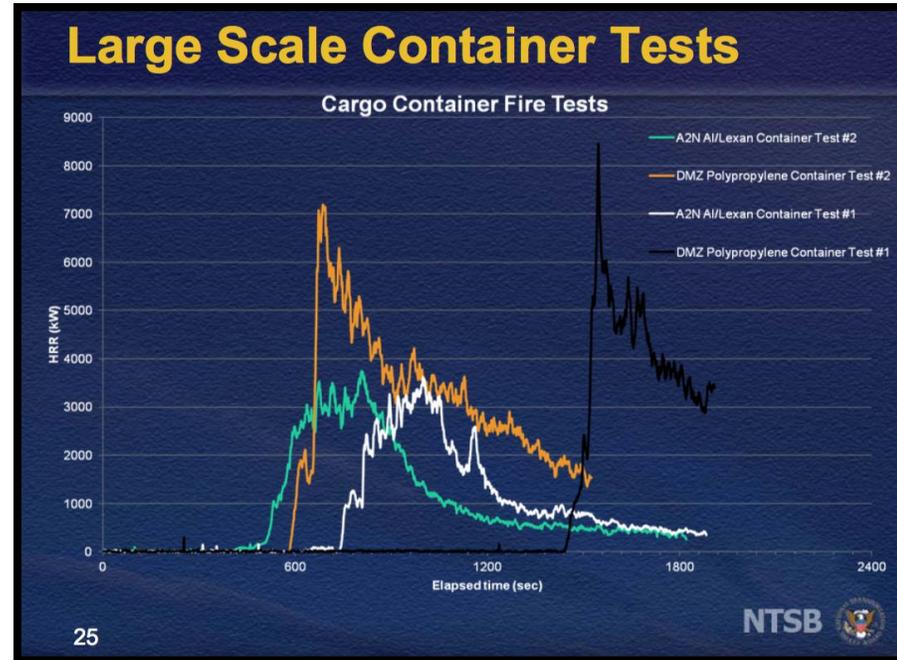
- **Polypropylene acts as an additional fuel!**
- The greater release of heat energy from a polypropylene container fire may penetrate a cargo liner and damage the underlying structure, systems and avionics.



NTSB Polypropylene Testing

Information demonstrating the significant heat release from polypropylene can be found on the public web site:

<http://www.fire.tc.faa.gov/pdf/systems/Nov11Meeting/Panagiotou-1111-HeatReleaseRate.pdf>



The peak heat release rate (HRR) is more than 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

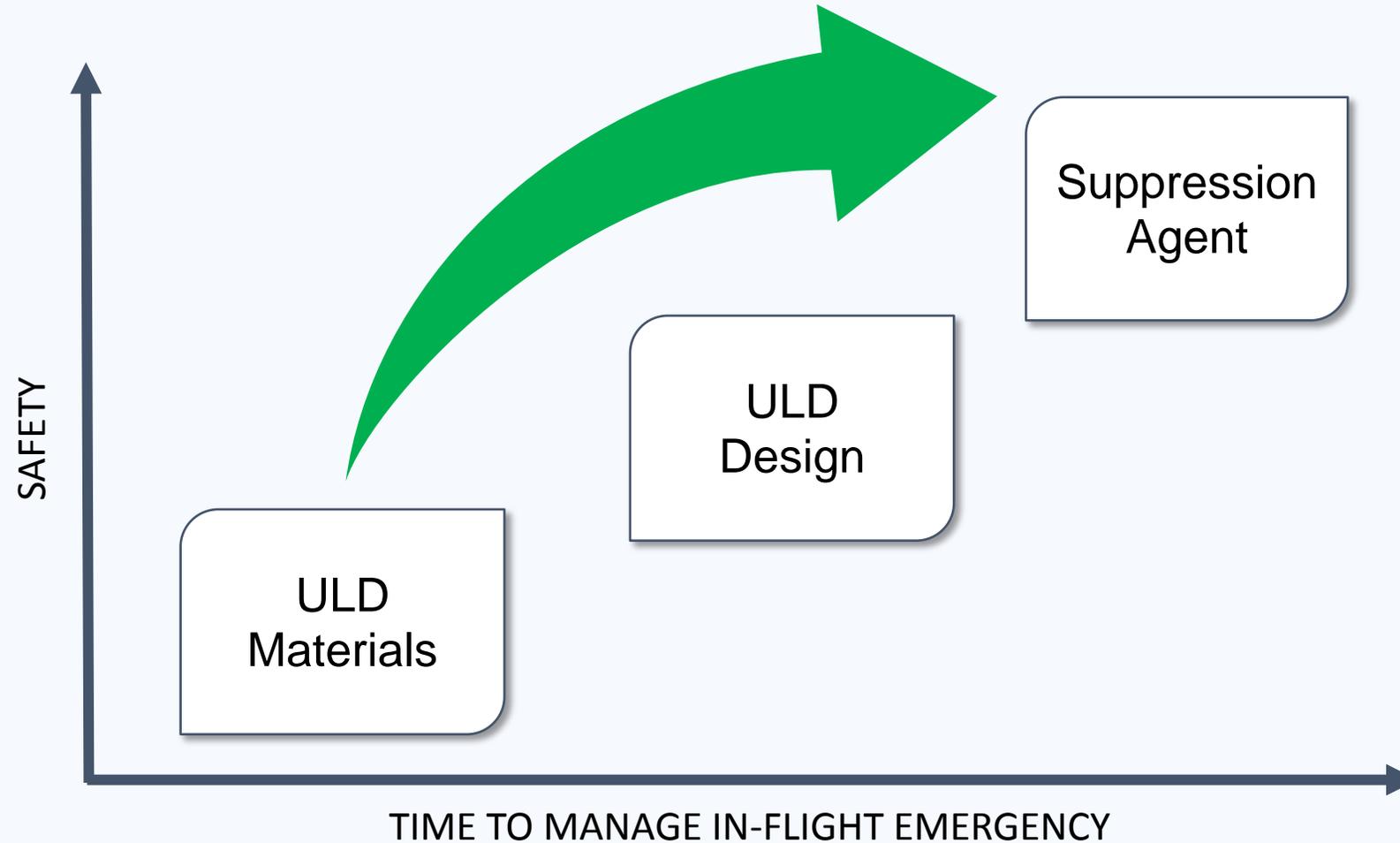
UPS is pleased with the benefits of MACROlite FRCs including:

- 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



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



FRC Redesign

- 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 FRCs 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

