



# 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

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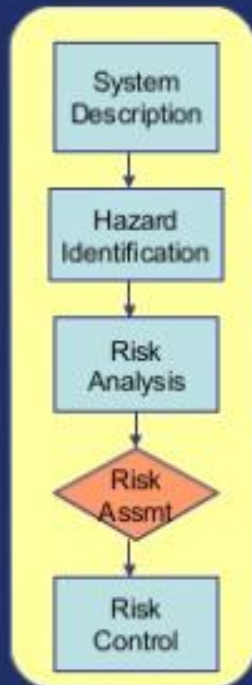
There is no ability to go back and  
**“fight the fire”**

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.

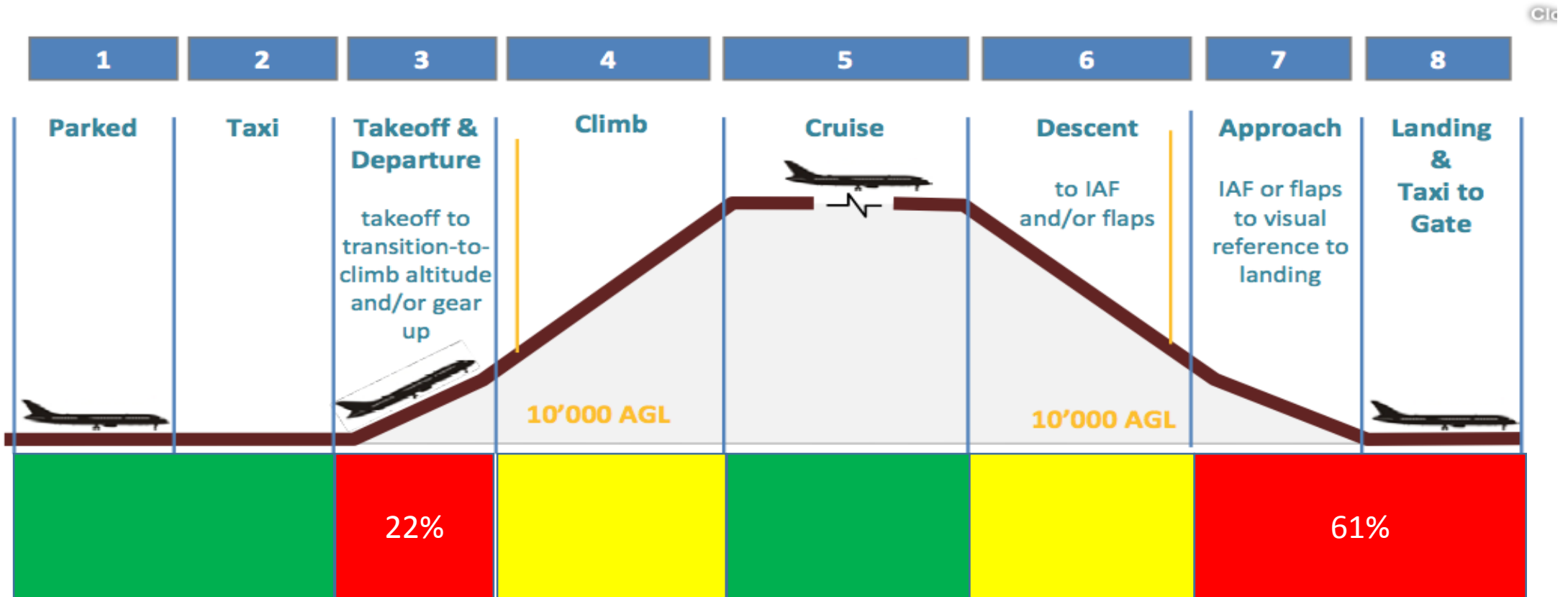


Risk Likelihood		Risk Severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

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

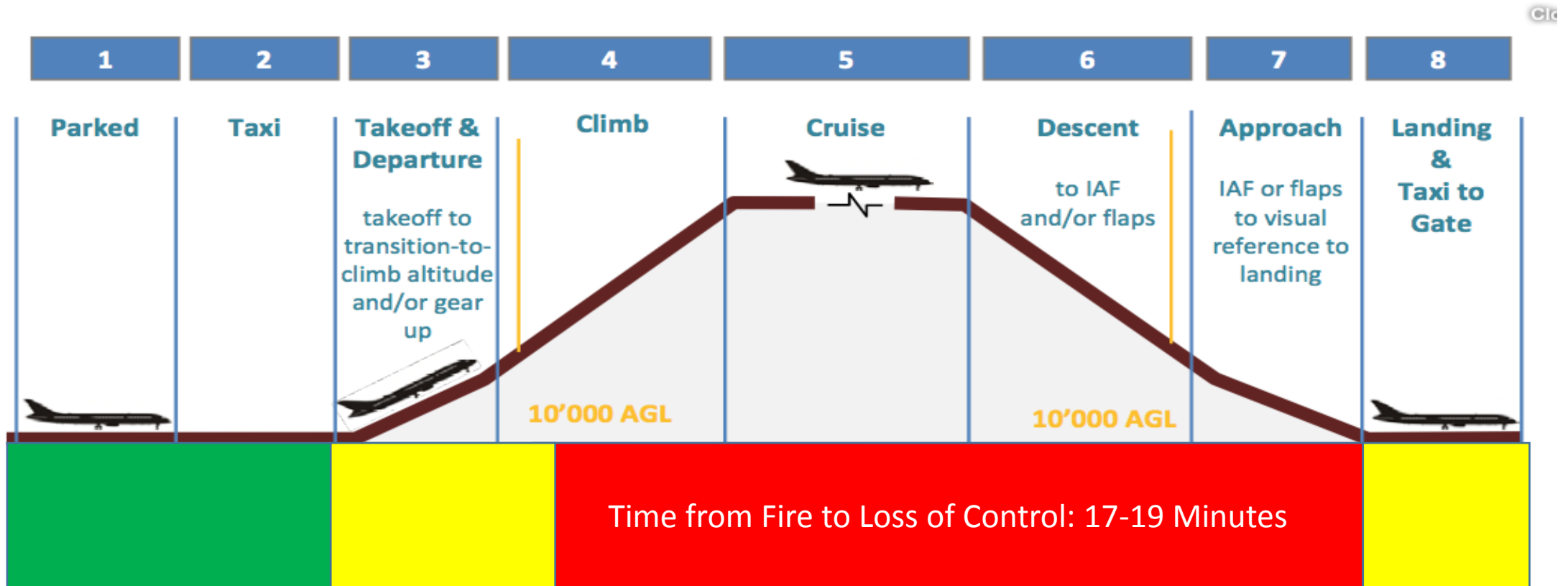


# Normal Flight Profile Assumed Risk



Source: Flight Safety Foundation

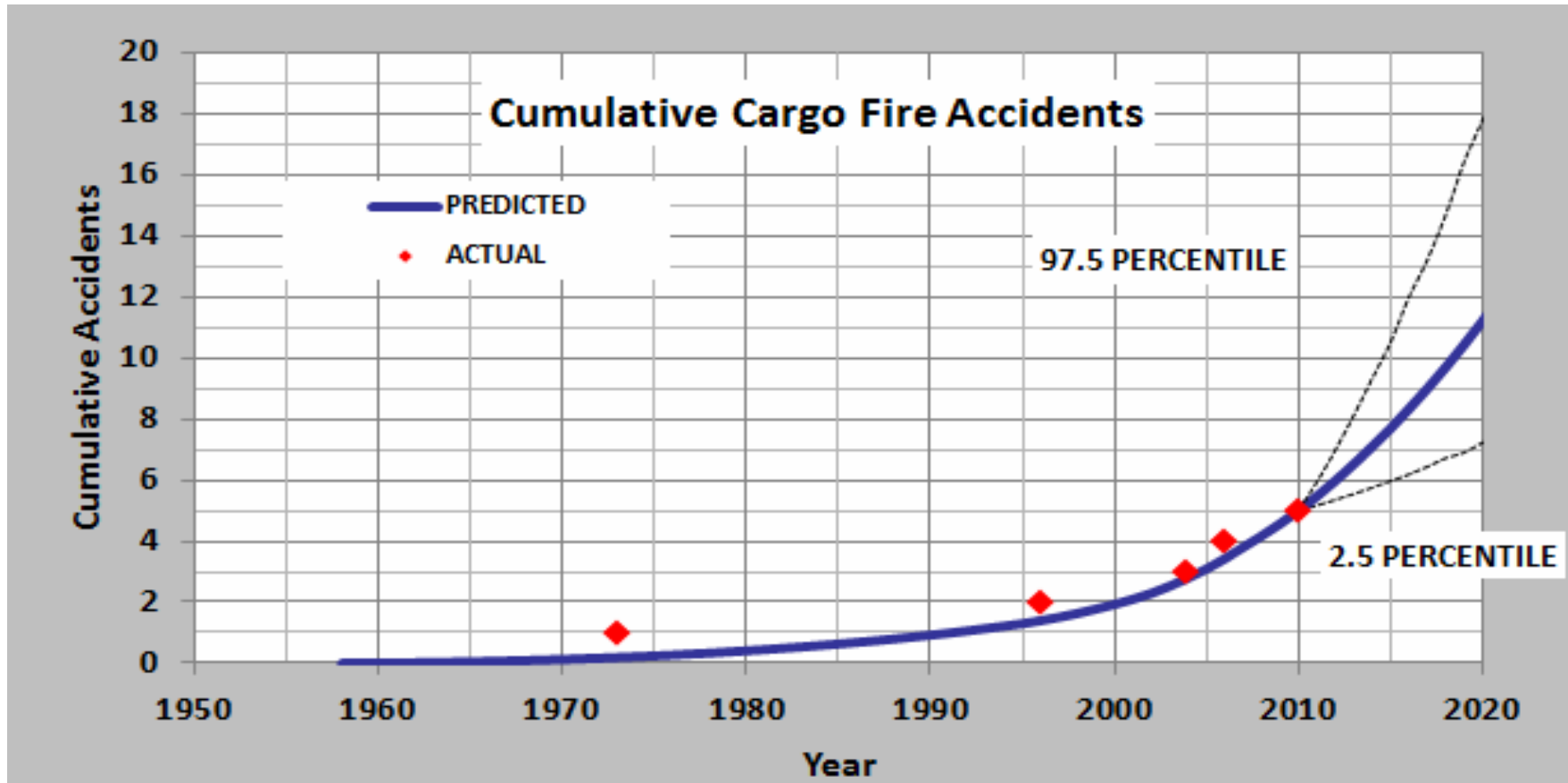
# Aviation Risk Transporting Batteries



Source: Transport Canada

# FAA Risk Analysis Study

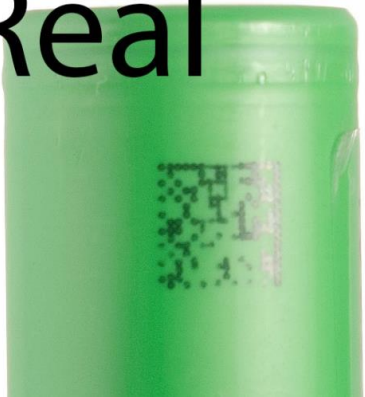
FAA Safety Analysis of U.S. domestic freighters predicts approximately six (6) accidents likely to occur from now to 2021





# 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)

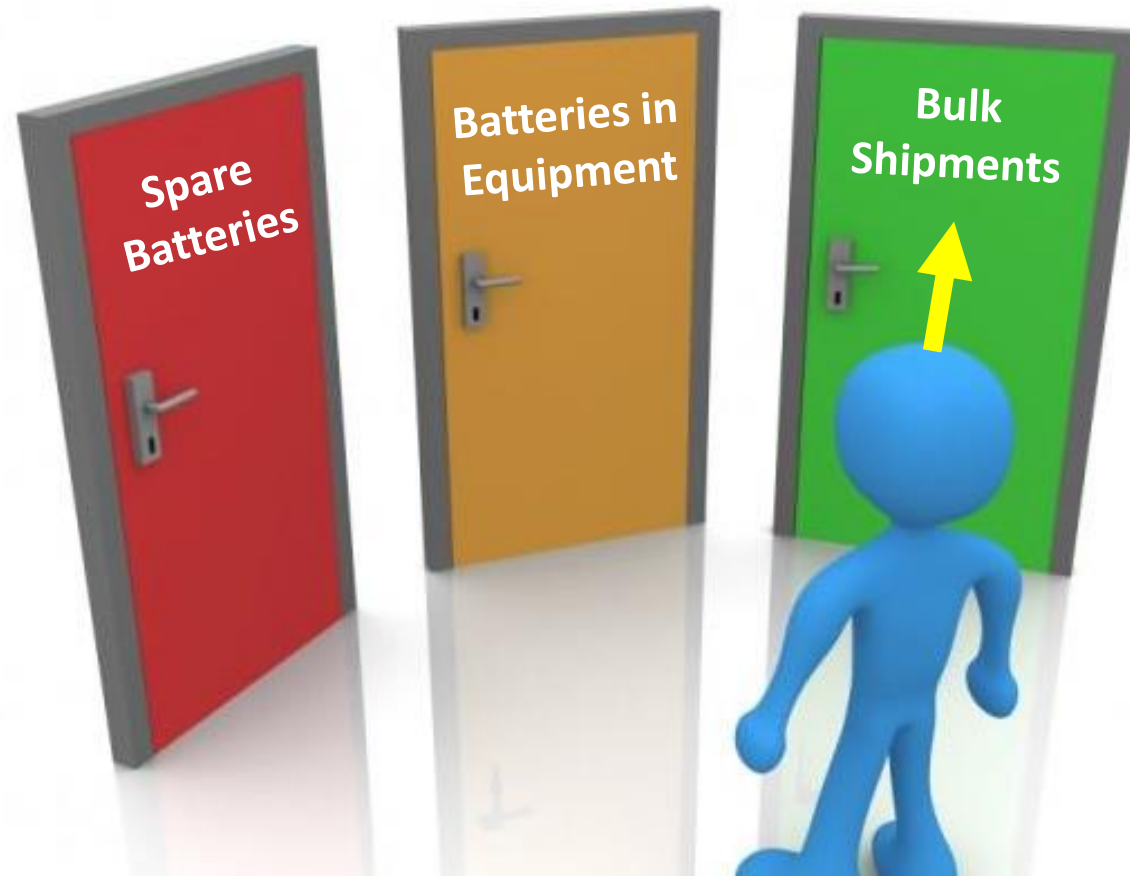
- 54 documented Hoverboard fires in the U.S

(US Consumer Product Safety Commission)

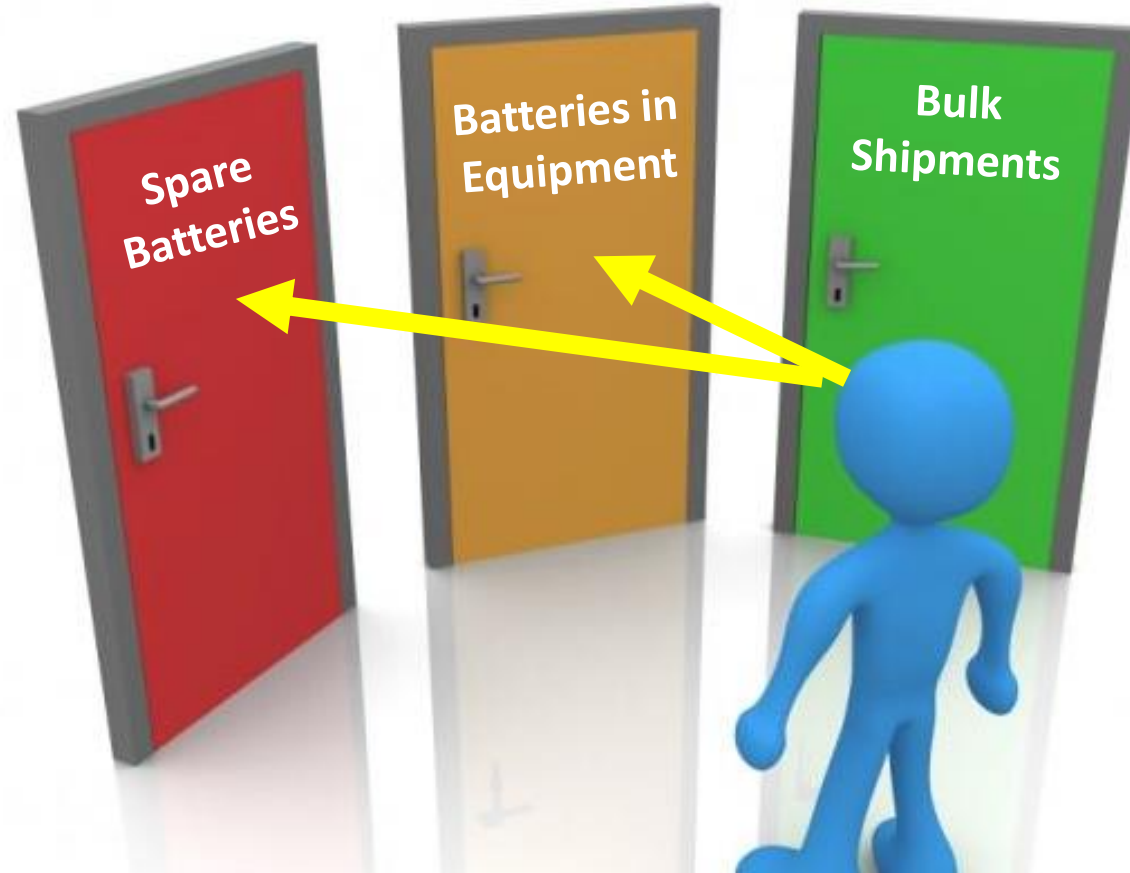
Hover boards took the Lithium ion battery fire issue out of aviation and into American homes



# Where is our focus



# Where should we focus?

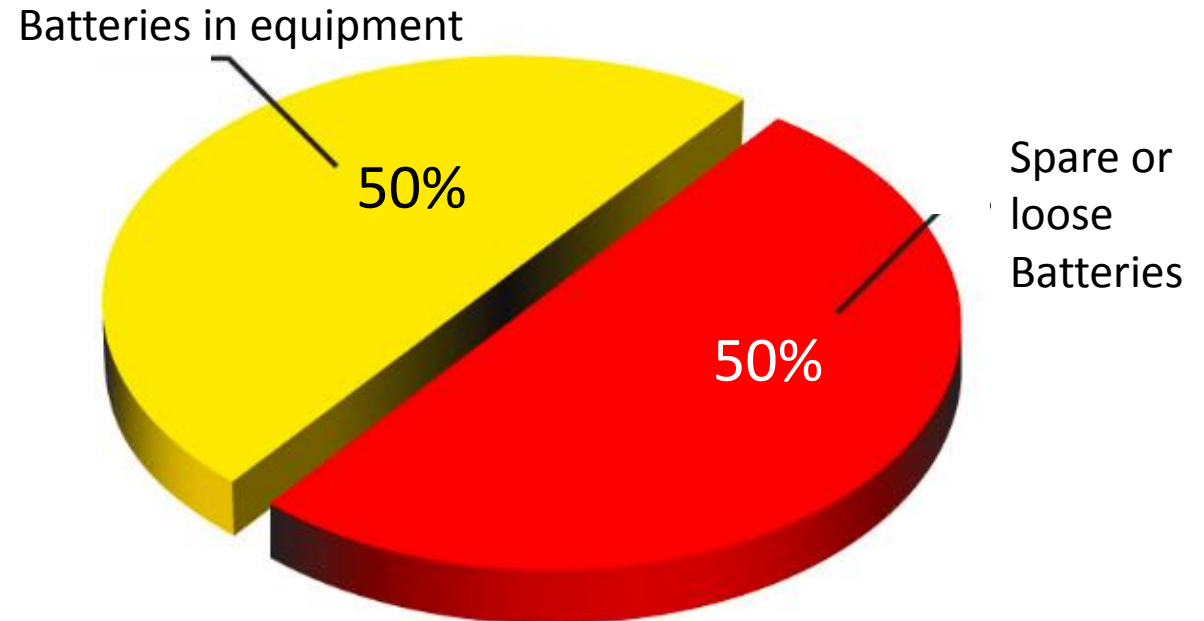


Setting the wrong goals can easily prevent success



# 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

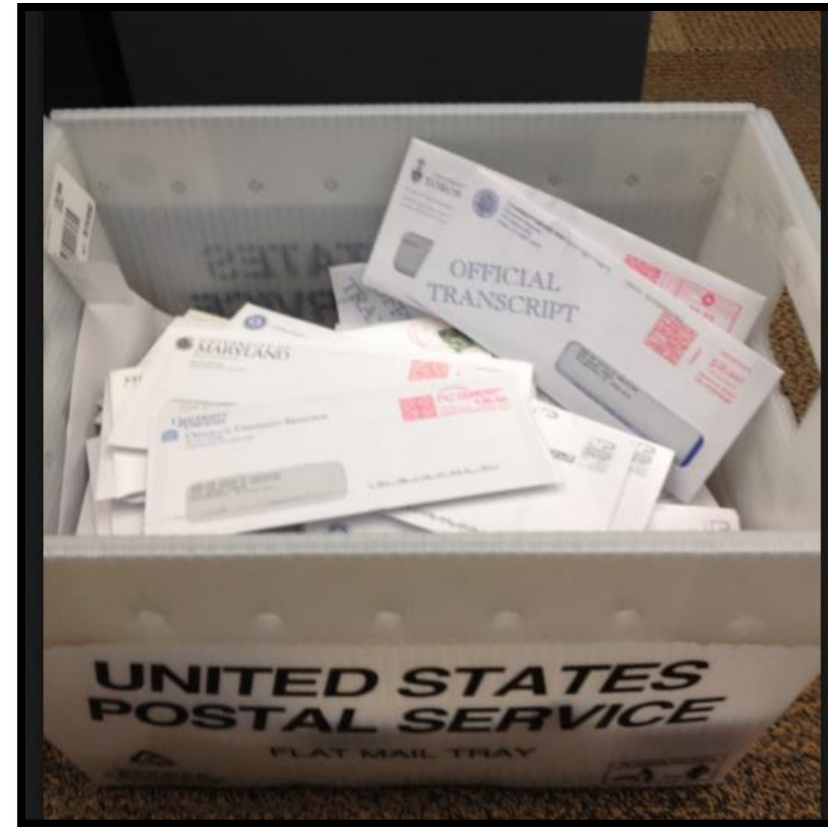


# Polypropylene in Aviation



# 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.

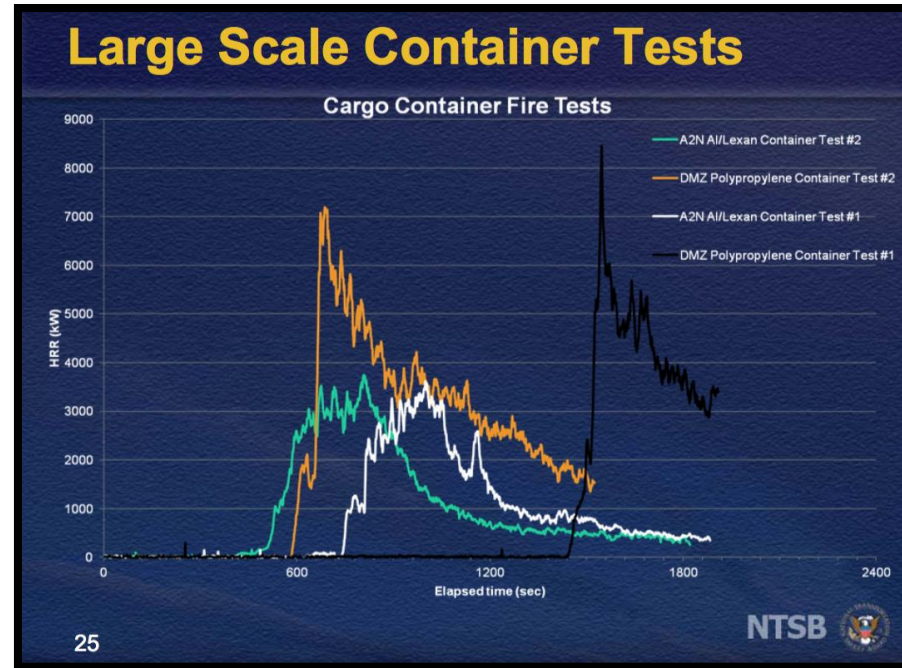




# NTSB Polypropylene Testing

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

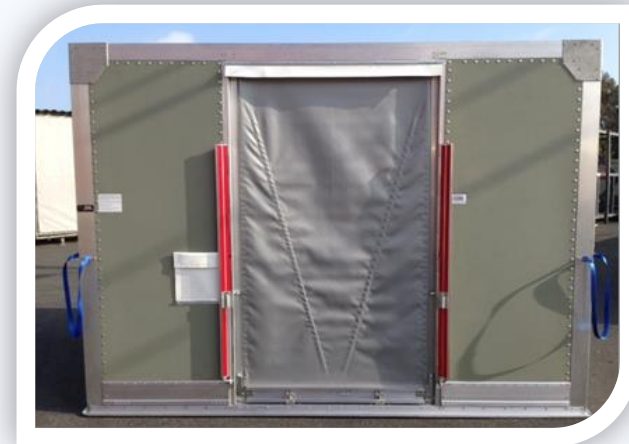


## MACROlite FRCs

UPS is pleased with the benefits of MACROlite FRCs including:

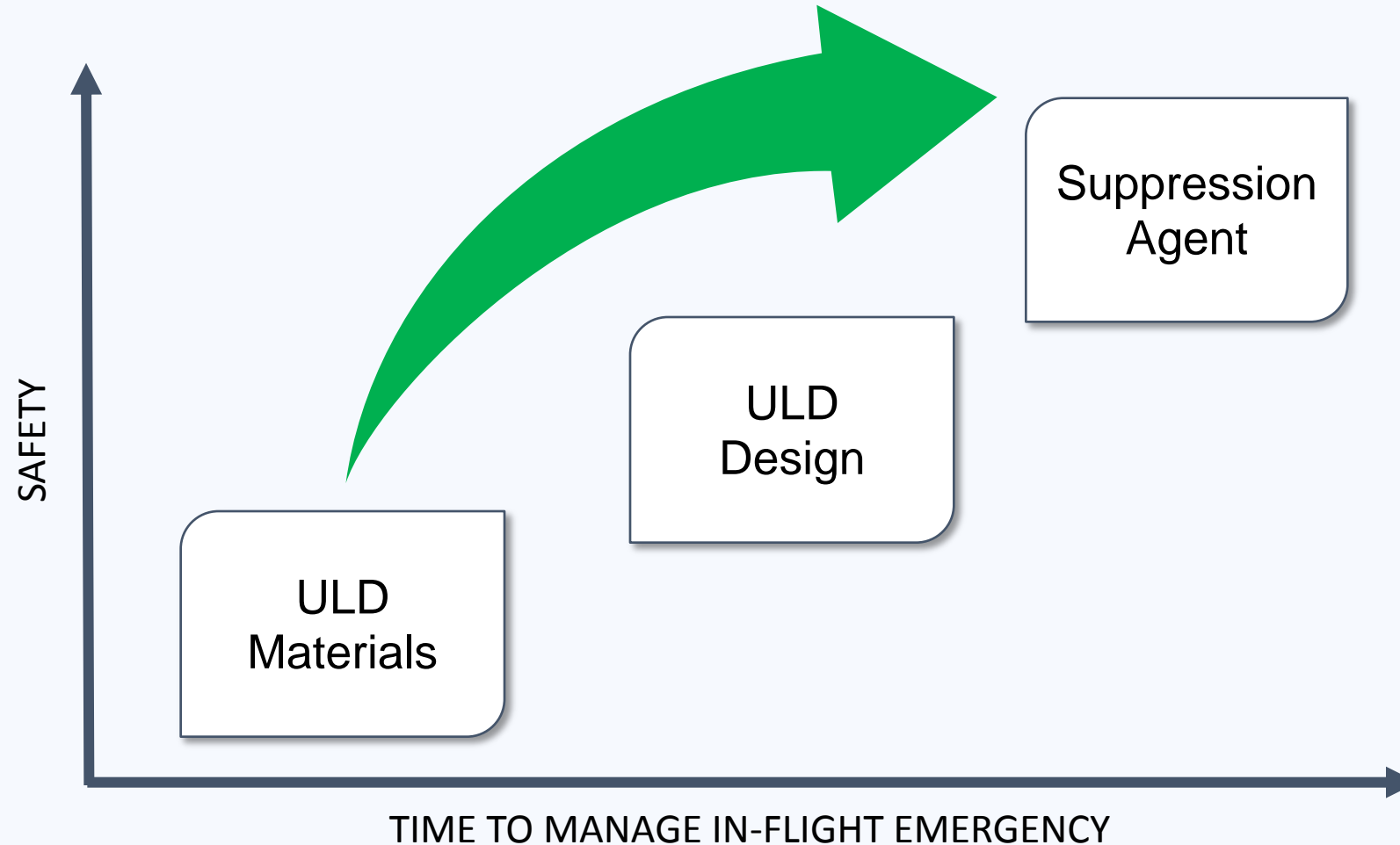
- Enhanced fire safety
- Weight savings
- Reduced repair frequency and cost

3400+ Fire Resistant ULD's  
in service as of May 2016



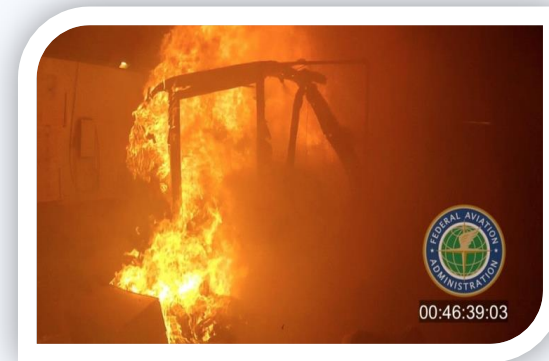


# FRC Fire Containment Strategy



## 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

