Lithium Battery Incidents

Presented to: The Seventh Triennial International Fire & Cabin Safety Research Conference

By: Michael D. Givens, FAA

Date: December 3, 2013
Objectives

• Overview of Two Lithium Batteries Incidents Related to Aviation

• Show how the Lithium Battery Incidents Provided the Basis for Research and Change.

• Now and in the Future, How do you Manage the Changes in Mitigating the Risk?
Aviation Lithium Battery Incidents

- Over 50+ Lithium Battery Incidents in Aviation

- The Incidents involved have encompassed both traveling passengers baggage and cargo shipments
Lithium Metal Battery Fire - Northwest/LAX

- April 28, 1999: A shipment of lithium metal batteries caught fire at the Northwest Cargo Facility at LAX.

- A pallet of lithium batteries was rolled onto its side while being offloaded at the cargo facility.
Lithium Metal Battery Fire - Northwest/LAX

• 3 hours and 40 minutes after the pallet overturned, it caught on fire

• This demonstrates the risk due to the latent affect of Lithium Batteries being damaged in handling.

• NTSB report expressed the concern that a damaged shipment of lithium batteries could subsequently be placed in an aircraft cargo compartment that could result in an in-flight fire
Lithium Metal Battery Fire - Northwest/LAX

• The Lithium Metal Batteries involved in the fire totaled 120,000 and had been off-loaded from on a passenger flight from Japan to Los Angeles prior to the fire.

• NTSB report expressed concern with the rapid spread of the fire during the incident.
NTSB Recommendations (NWA/LAX)

• NTSB Recommendations:

  – A-99-80: Pipeline & Hazardous Materials Safety Administration (PHMSA) & FAA were to evaluate fire hazards in cargo compartments posed by lithium batteries in air transportation.
FAA Research on Lithium Metal Batteries

• A series of tests were conducted to assess the flammability characteristics of nonrechargeable lithium primary batteries, both individually and as packaged for bulk shipment onboard cargo and passenger aircraft.

• Tested lithium metal batteries (CR2, PL123A)

• FAA Tech Center Report: DOT/FAA/AR-04/26
FAA Research on Lithium Metal Batteries

• The testing determined the issue of cell/battery propagation

• The testing determined that Halon 1301 fire suppression agent was ineffective
NTSB Recommendations (NWA/LAX)

• **NTSB Recommendations:**
  
  – A-99-81: Pending the outcome of the research and testing, PHMSA/FAA were to prohibit the air transportation of lithium batteries on passenger-carrying aircraft.

  – The US banned the transport of Lithium Metal Batteries on passenger aircraft in 2004 upon the issuance of the FAA Tech Center Report.
NTSB Recommendations (NWA/LAX)

• NTSB Recommendations:
  – A-99-83: Initiate action at the ICAO Dangerous Goods Panel (DGP) to prohibit the international air transportation of lithium batteries on passenger-carrying aircraft.

  – The US proposed a similar ban on lithium metal batteries on passenger-carrying aircraft at ICAO DGP.
AC Propulsion Fire in Memphis, TN

- On August 7, 2004, a shipment of lithium ion batteries being loaded on a FedEx aircraft in Memphis, TN caught fire.

- This fire incident demonstrated the in-flight fire risk of transporting Lithium Ion Batteries on aircraft as cargo.
AC Propulsion Fire in Memphis, TN

• The lithium ion batteries were transported on a flight from LAX to Memphis, TN prior to the fire being discovered.

• The fire was discovered while being loaded onto a flight destined to Paris from Memphis, TN.
AC Propulsion Fire in Memphis, TN

• The significance of this incident in time is the demonstration that a lithium ion battery can cause a fire in air transportation.

• The fact that the fire was discovered while ½ way loaded on the aircraft shows how close this was to being a potential in-flight fire.
Aviation Lithium Battery Incidents

• Is the history of incidents a predictor of a risk for future accidents and incidents related to lithium batteries in air transport?

  – We have had continued reports of incidents involving lithium batteries

  – Continued research by the FAA Tech Center on lithium batteries has validated the previous research conclusions and identified additional risks.
Aviation Lithium Battery Incidents

- UPS 006 Accident: Lithium batteries were involved in the fire on the aircraft at the cargo positions where the smoke detector first alarmed.
Safety Management System (SMS)

Reactive (Past)
Responsive to events that have already happened, such as incidents and accidents

Proactive (Present)
Actively identifies hazards through the analysis of the organization’s processes

Predictive (Future)
Analyzes system processes and environment to identify potential future problems

Resilience
SMS Depends on Risk

• Provides information to assist in prioritizing and assigning resources
  – Identifies areas of risk (low, medium, and high)

• Low Risk ➔ minimal FAA involvement
• Medium Risk ➔ moderate FAA involvement
• High Risk ➔ significant FAA involvement

Nothing black & white – systematic and data driven approach to standardize decisions
Other Predictive Examples

- Valujet Accident Report from the NTSB:

- It was determined that there was 5 separate incidents involving Oxygen Generators between 1986-1994 that initiated fires in transportation.
What Has Been Done Recently?

• In the US, by Legislation we are restricted to the same provisions as contained in the ICAO Technical Instructions for the regulation of lithium batteries

• FAA has been working for the last several years on lithium batteries at the ICAO Dangerous Goods Panel
What Needs to Continue?

• Oversight & monitoring of the data and information on lithium batteries as it develops
  – More incidents
  – Higher energy density
  – Larger battery designs
  – Evolving lithium battery chemistries
  – Research and Testing
Finding the Acceptable Level of Safety

Law/Regulations

Unattainable Regulatory Requirements

Unattainable Regulatory Requirements

“Sweet Spot” for an Acceptable Level of Safety.

Unsafe Conditions

Fire, Smoke, and a Dangerous Evolution of Heat

Lithium Battery Incidents
Aviation Safety Systems

• This is not a Hazardous Materials Risk, this Is an Aviation Safety Risk

• Therefore, it is going to require the whole Aviation Safety Community to work together to mitigate this risk
Aviation Lithium Battery Incidents

• What are the mitigation options to reduce the likelihood of future incidents and accidents?
Lithium Battery Incidents

Federal Aviation Administration

Cargo Compartment Limitations

Fire Containment Covers

International Dangerous Goods Regulations

Fire Hardened Containers

ULD Suppression

Hazardous Materials Regulations

Aircraft Fire/Smoke Detection Systems

Aircraft Fire Suppression

Battery Designs

Package Mitigation Standards
Contact Information

Michael D. Givens
FAA Hazardous Materials Safety Program
michael.givens@faa.gov

Janet McLaughlin
Deputy Director, FAA Hazardous Materials Safety Program
janet.mclaughlin@faa.gov