Lithium Battery - Risk Mitigation

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1. The Risk
2. Experience
3. Mitigating the Risk
4. Where next
5. Conclusions
1. The Risk
The Lithium (Li) Battery risk has emerged…

UPS Cargo Plane Crashes Near Dubai - WSJ

Asiana Air Freighter Crash Raises Questions Again On Lithium Battery

Fire forces UPS plane to make emergency landing - CNN
Two main type of Lithium Batteries

**Lithium Ion**
- Rechargeable
- Halon is effective

**Lithium Metal**
- Non-rechargeable
- Halon is *not* effective
Batteries are everywhere!

- Lithium-ion batteries are widely used as a power source in portable electrical and electronic products.
- Approximately 5.5 billion lithium batteries manufactured in 2013 growth rate of 25-30% per annum.
- Market for lithium batteries is projected to reach nearly $10 billion 2014
- 86% of the market is lithium-ion batteries
Quality and Design

Physical properties (size, power & design) and use vary considerably.
Battery Failure Modes

- Overrun
- Overheat
- Design issues
- Manufacturing techniques
- Handling
- Packaging and Shipping
- Environment
Carriage of batteries

- Passengers
  - Cabin Baggage
  - Checked Baggage
  - Mobility Devices

- Cargo
  - DG shipments
    - Regulated Class 9
    - Excepted ELM / ELI

- Mail
  - Authorised Postal Provides only
Battery verses Aircraft

The time from initial smoke indication to Hull loss can be very short and depends on either:

- Fire suppression systems onboard.
- Emerging Supplemental fire suppression systems.
Passenger Aircraft Fire Suppression

• Lower Deck – Class C Halon System
  – FAA tests have shown that Lithium Ion fires can be put out using Halon in the lower deck.
  – FAA tests have shown that Lithium Metal exhibit a much higher risk and Halon will not extinguish a LI Metal Fire.

• Passenger Cabin – Cabin Crew
  – Cabin Crew are trained to deal with passenger Cabin Fires.
Freighter Aircraft Fire Suppression

- **Lower Deck – Class C Halon System**
  - Same as the Passenger Aircraft.

- **Main Deck Cargo – Class E System**
  - Depressurisation of the Main Deck to starve the fire of oxygen.
2. Experience
Lithium fire events continue to happen…

Selected incidents over the last three years:

- Mail bag fire, LHR, APR12
- Mail bag fire, HEL, JAN12
- Cargo fire, Warsaw, MAY12
- Cargo fire, YVR, JUN12
- Warehouse fire, AUG12
- Dropped package, AKL, NOV 12
- Lithium Battery Fire in Baggage, HKG, MAY 14
- Cargo fire during re-sort, SIN, AUG 2014
- FSS Activation and Diversion, STL, FEB 2015
Mail Shipment Fire – April 2012
Cargo Shipment Fire – May 2012
Checked Baggage Fire - May 2014
Cabin Fires
Regulation Complexity

• It’s becoming more and more complex to understand the regulations.

• The rules are constantly changing to keep up with the risk.

• Training of Shippers and forwarders is a challenge.

As regulations increase the methods and lengths in which shippers will go to is alarming
Passenger baggage – Lack of awareness?

2 x check-in bags containing 300-400 lithium batteries each found during transfer due to the zip bursting open.

400 Lithium batteries detected by routine scanning

Security detected 600 Lithium batteries in carry on baggage.
Several thousand undeclared **Lithium batteries** found on arrival
Was there an intent to mis-declare?
Or just blatantly breaking the rules!

Hi dear friends, this power of this kind battery is more than 100W, we will attach the real label inside the cover of the battery and attach one wrong label for battery which is below 100W, on the surface of the battery. Because if the power of the battery is more than 100W, it can’t be transported by air. Hope you can understand us. We are so apologized to you for this inconvenience. Thanks.

Description
22.2 10000mAh 25C Max 40C 6S RC LiPo Li-Poly Battery For Airplane Model
3. Risk Mitigations
The Risk has clearly been identified

- **Severity**
  - Catastrophic, event leading to multiple fatalities or hull loss.

- **Likelihood**
  - Unlikely, unlikely to occur.

- **Risk**
  - High, risk must be understood and a high Level of risk reduction put in place.
Immediate Areas of Concern

Li Metal

Battery Only Shipments

Main Deck

Biggest Risks
Immediate Areas of Concern

- Li Metal
- Battery Only Shipments
- Class C ONLY
- Initiate Solutions

Biggest Risks
Immediate Internal Risk Mitigations Completed

- Additional DG Segregation for ELM/ELI
- ELM/ELI on Pallet Tagging
- Internal Prevention
- Random Screening PAX & Cargo
- ELM/ELI On NOTOC
Immediate External Risk Mitigations initiated…

- Close liaison with HK Post
- Shipper Engagement
- Training or Shipper & Forwarders
- Industry Bodies

External Prevention
Immediate - Education of Staff and Passengers

• Passenger education
  – Updated info on Website
  – Additional questions at check-in touch-points
  – Limits for “spare batteries” in checked baggage

• Staff education
  – Updated information in SOPs
  – Dedicated training concerning Li Batteries
Immediate - Cabin Mitigations

- Revised and Re-enforced Training for Cabin Crew
- Introduction of Firebane® and Aircare FireSock™
Two possible options identified

• Active Fire Suppression System
  – Class E Modification

• Passive fire suppression
  – Fire Containment Covers
  – Fire Resistant Containers
Enhanced Class E on the Main deck
Fire Containment Covers
To implement FCCs or not?

Risk Reduction

Operation & Costs

Only Viable solution available

- Additional Weight
- Expensive
- Complexity
- Time

- Buys Time
- Saves the Aircraft
What to Cover?

- Impossible to install an FCC on every Main Deck Pallet.
- Initially 6 types of shipment were identified representing the highest risk.
- Adopt a risk-prioritised and progressive approach, focussing on ex HKG.
- Approx: 10 FCCs will be deployed on every HKG departure.
- However, there is always a chance that not all MDPs which contains undeclared or hidden DG are covered.

Proving too complex to manage so many priorities.
Currently revising the approach.
Emergency Vision Assurance System (EVAS)
Screening – Auto-detect for Li Batteries
4. Where next?
All this is great but it’s just individual Airlines!!
Battery and Aircraft Design and Resilience

- Research and Development
- New Technologies
- Use of better materials
Education and Enforcement

- Enforcement of existing regulations.
- Share inelegance on Li Battery events.
- Share inelegance on non-compliant shippers.
- Additional guidance and education for passengers and shippers.
Up the Supply Chain

- Employ and Train sufficiently qualified staff
- Follow the rules!
- Manage site content and ban sellers who knowingly breach the law
Manage your own Risks

- Risk assess your own operations and mitigate against your risks!!
- Join us in spreading the word and increasing awareness.
5. Conclusions
Conclusions

• Need to buy extra time to get the aircraft on the ground.
  – Active solutions - Aircraft Design improvements.
  – Passive Solutions – FCCs & FRCs.

• Hardened Battery design.
  – Better Technologies.
  – Better Quality controls.

• Increase Awareness to passengers and shippers
  – Educations & Training
  – Enforcement of the regulations