Shipping Lithium Batteries: Hysteria
New Regulations Imminent

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Overview

• Why the hysteria?
• How did we get here?
• Likely outcomes
• Common mistakes
• Questions
Why the hysteria?

- FAA has published reports and posted videos publically.

- The media has promoted a level of hysteria about lithium batteries.
  http://abcnews.go.com/GMA/video/video-shows-lithium-battery-shipments-airplane-fires-27330626

- Airline pilots claim lithium batteries transported by air is the most pressing hazmat issue.

- Aircraft Manufacturer’s Advisories and Technical Papers.
WASHINGTON — Jul 17, 2015, 8:18 PM ET
By JOAN LOWY Associated Press

Boeing, one of the world’s two largest aircraft makers, warned its passenger airline customers on July 17, 2015, that flying bulk shipments of lithium-ion batteries can cause fires capable of destroying the planes. The guidance sent to airlines around the globe urged that they not carry the batteries as cargo "until safer methods of packaging and transport are established and implemented," Boeing spokesman Doug Alder told The Associated Press in an email. (FAA, via, File)

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Safety worries lead US airlines to ban battery shipments

BBC NEWS Technology

Lithium batteries can catch fire with disastrous consequences

United Airlines has become another of several major US airlines to announce it will no longer carry bulk shipments of lithium-ion batteries.

Delta Airlines stopped bulk shipments of the batteries in February.

Aviation officials believe lithium-ion batteries contributed to fires that destroyed two Boeing 747 cargo planes, killing all four crew members.

Federal Aviation Administration tests found overheating batteries could cause major fires.

In its tests, the FAA filled a cargo container with 5,000 lithium-ion batteries and a cartridge heater, which was added to simulate a single battery overheating.
Labelmaster recently published a blog on the Boeing advisory relative to lithium battery cargo shipment and indicated that there would likely be implications (e.g., airlines imposing additional restrictions).

Malaysia Airlines recently announced a temporary suspension on the transport of lithium batteries that went into effect on July 27, 2015.

The suspension applies to lithium metal batteries including when contained or packed with equipment on passenger and cargo aircraft. Lithium ion stand-alone batteries are prohibited on passenger aircraft and must be loaded into a Class C cargo compartment (lower deck only) when transported on cargo aircraft.

The suspension does not apply to lithium ion batteries contained or packed with equipment, lithium batteries shipped as AOG (Aircraft on Ground) spares, and lithium batteries shipped for urgent life saving devices where the words “Urgently required to Support Life-Saving Devices” are entered on the airway bill or shippers declaration. While the temporary suspension is unfortunate at least Malaysia Airlines has considered the implications to medical devices.

Link to the Malaysia Airlines Circular: 2616_001
Focus has resulted in continuous change

2013

• New packing instructions for lithium batteries PI 965-970.

2015

• International prohibition on lithium metal batteries aboard passenger aircraft;
  Revised packing instructions and qty limits.

2017

• Restrictions on overpacks;
• Additional airline loading and inspection requirements;
• Bulk shipments of lithium ion prohibited on passenger aircraft;
• New testing of cells and batteries;
• New prototype battery requirements;
• Packaging performance requirements;
• New handling label, new Class 9 label, no more document.
New handling label/mark and Class 9 label

Lithium battery mark

* Place for UN number(s)
** Place for telephone number for additional information
Who is responsible?

FAA, IFALPA, ICCAIA & NTSB Encourage More Regulation

- Lithium batteries should be fully regulated; exceptions afforded to small batteries should be eliminated
- Certain lithium batteries should not be authorized for transport on passenger aircraft
- Lithium batteries pose a greater risk because they can be a source of ignition and react so violently that they pose an unreasonable risk

Most recently ICAO has suggested that if an aircraft’s fire suppression system is not capable of controlling a fire the material must be prohibited for transport as cargo

Cargo liners can’t survive the pressure pulse created by the gases generated from a thermal event involving as few as 8 18650 cells
Recent US DOT Paper submitted to ICAO Meeting

The carriage of Lithium-ion cells and batteries in aircraft cargo compartments present three distinct hazards:

1) Lithium-ion cells and batteries can be an ignition source. A damaged, shorted, overheated or defective cell (from impurities, manufacturing defects, foreign object deposits etc.) can go into thermal runaway;

2) Lithium-ion cells and batteries can be a source of fuel for an existing fire.

3) Lithium-ion cells and batteries produce a pressure pulse when in thermal runaway. The gases produced, when contained, can result in an explosive mixture. This may increase the pressure within a cargo compartment, activate pressure relief features, and cause damage to the cargo liner and reduce the available suppressant agent.
Most recent Conclusion of FAA Testing

- If gasses from 8 18650 cells at 50% SOC or

- If gasses from 3 18650 cells at 100% SOC accumulate in a loaded 737 fwd. cargo compartment and ignite, the halon suppression system would be compromised.

8 cells at 50% SOC
2.6 cells at 100% SOC
.594 psi peak pressure
“Problem Statement” and “Goal” of ICAO Working Group

**Problem Statement:** A fire involving significant quantities of lithium batteries (UN 3090 and UN 3480) may exceed the fire suppression capability of the aircraft and could lead to a catastrophic failure of the airframe.

**Goal:** Develop performance-based standards based on the principle that hazardous effects will be contained within the package.

**Unresolved:** Does packaging need to protect from external heat/fire?
• The cell or battery pack is placed in packaging that will be presented for transportation
• For Li ion cells/batteries, the specified shipping SOC is set per manufacturer’s specifications
• The testing is identical to that run at the cell or battery pack level
• Pass/Fail Criteria (see following slide)
Package Pass/Fail Criteria

- **Pass**
  - Package integrity maintained
  - Package has not ruptured or released any debris or fragmentation outside of packaging
  - No external flames observed
  - Smoke venting is permitted
  - Exterior sidewall temperatures of package cannot exceed 100° C in any location

- **Fail**
  - Package has not maintained structural integrity
  - Package has ruptured or released debris or fragmentation outside of packaging
  - External flames observed
  - Ignition of vented gases
  - Exterior sidewall temperatures exceed 100° C
Battery Pack / Cell Testing

Li ion Battery Packs Shipped at > 30% SOC and Li Metal Battery Packs

- For Li ion battery, the battery is prepared at the specified shipping SOC per the manufacturer
- Cell temperature and cell voltage are monitored
- If heater is used to induce thermal runaway on the cell, a pre-test is run to determine what size heater is required to achieve a ramp rate of 5±2°C/min. Alternatively, a closed-loop temperature controller may be used to achieve the ramp.
- If heater is used, cell heater is activated until either thermal runaway is achieved or the cell reaches 200°C, which is held for 20 minutes
- The battery pack is considered to pass if there is no disassembly or fire outside the battery pack
Shipping Li ion Cells and Batteries
\[\leq 30\% \text{ SOC}\]

Li ion cells and batteries are excepted from testing provided that are shipped at \[\leq 30\% \text{ SOC}\]
What problems arise from additional regulations?

- More onerous and not well substantiated regulations result in an increase in non-compliant shipments and may incentivize unscrupulous companies to cheat.

- Shippers have difficulty keeping pace, training employees and changing operational controls especially downstream distributors.

- Carriers and freight forwarders frustrate cargo and impose additional restrictions.

- Additional cost associated with marking, labelling, packaging, training and developing changes.
Supply Chains are Impacted!

Imposing additional regulations and restrictions have ripple effects on supply chains.

Underlying consequences for vital products - how the public will react?

Restrictions without appropriate consideration of implications outside of aviation safety can have serious and adverse impacts to public safety and health.

Lithium batteries are used in medical devices, weather monitoring and warning systems, criminal and terrorist surveillance systems, disaster relief products, emergency response and security equipment among other applications.

A regulation reducing a target risk for one area of focus may increase other risks, ultimately resulting in greater loss of life, harm to the environment and to economies.
Generally if all shippers followed the battery design, testing and packaging requirements in place we wouldn’t likely have incidents.

However, shippers represent persons with varying levels of experience and commitment to compliance and safety.

Not all shipments are new batteries coming directly from a reputable manufacturer. For instance, consumers may ship batteries that have been subject to abuse.

Some hobbyists ship batteries that have been reconfigured and pose a higher risk of an incident.

Certain battery designs and chemistries represent varying degrees of hazard. A $2.00 flashlight battery won’t have the same safety features as a medical device battery.
The focus is misguided

Compliant shippers are typically victims in the aftermath of airline incidents when politicians and regulators rush to impose new regulations.

This frequently results in the expenditure of significant resources while non-compliant shippers continue to ignore the law.

Recently IATA members called on governments to criminalize the act of shipping undeclared dangerous goods. James Woodrow, head of IATA’s Cargo Committee and chief of Cathay Pacific Cargo, told the industry it must unite to stop non-declared dangerous goods being sent by air.

International organizations and regulatory agencies must focus on reducing undeclared and non-compliant lithium battery shipments to successfully reduce the overall risk to the public.
Politicians – not helping making us safer
Proposals will result in unrecognized harm

“ICAO standards “are laughable,”
“Whatever the Chinese want to put into a crummy cardboard box and stick into an airplane and not label, that’s fine with ICAO,” “It’s only a matter of time until we lose another plane,” Rep. Peter DeFazio (D-OR) said April 14 during a hearing before the House Hazardous Materials Subcommittee. “We’ve lost a couple of cargo planes. It could be a passenger plane; it could be a cargo plane.”

https://www.youtube.com/watch?feature=player_embedded&v=Zoc47G5eJfw

House Dem wants to ban lithium batteries from flights
The top ranking Democrat on the House Transportation Committee said Friday that lithium batteries should be banned from passenger and cargo flights. Rep. Peter DeFazio (D-Ore.) said in a letter to Transportation Secretary Anthony Foxx that a string of recent accidents that have been tied to problems with lithium batteries prove they are unsafe to transport on airplanes, even if they are just carrying cargo packages instead of passengers.
How do we prevent incidents?

Outreach, Education and Enforcement

• Non-compliance with hazmat regulations is significant problem
• Enforcement by government agencies is lacking
• Regulators need to step up and enforce regulations
• Better training of enforcement staff and problem solving approach
• Industry and Government Partnerships (e.g. DGAC, PRBA, ICAO, IATA and Battery Associations) with particular focus on shippers in China and Far East working cooperatively on outreach materials and educating shippers
• Improve communication between shippers, freight forwarders and airlines
Common errors
Shipments for disposal or recycling
What should battery shippers do?

1. Review operations and impacts to current procedures

2. Develop or update training programs

3. Revise procedures and operations including revising internal documentation, standard operation procedures, battery documents and package markings

4. Be active in reviewing and commenting on pending rule changes
We’re Here to Help!

www.labelmaster.com/lithium-battery-shipping
Thank you for your time!

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