UK CAA's first International Lithium Battery Workshop to explore ways to reduce the risk to safety: Post workshop report

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Contents

Post workshop report

Introduction

On 13-14 June 2019, the UK Civil Aviation Authority (UK CAA) hosted its' first international lithium battery workshop to explore key issues faced in the safe transportation of lithium batteries.

The two-day workshop was attended by over seventy stakeholders (Appendix A) from manufacturing, testing, logistics, airline operators, government agencies and aviation regulators. The group discussed lithium batteries and the risk to flight safety and evaluated practical solutions that could see the reduction of non-compliant shipments in air transport.

The UK CAA's International Group hosted the workshop, with sponsorship from the UK Government's Department for Transport, Aviation Policy and Strategy, Aviation Strategy and Consumers Division. Keynote speeches and panel discussions included representatives of the International Civil Aviation Organisation (ICAO) and the International Air Transport Association (IATA).

The workshop identified practical actions that could:

1. help ensure lithium batteries meet the existing design and manufacturing standards; and
2. significantly reduce the number of non-compliant shipments in air transport

The workshop objectives were achieved through presentations followed by breakout sessions (Appendix B) to consider specific challenges within and outside of the aviation system, with the potential mitigations briefed to the group.

Appendix C shows a table of recommendations of how to mitigate the safety risk and by whom. The numbering of the recommendations provides a link to the workshop sessions and questions posed.

Background

There have been three major aircraft accidents where, whilst not proven to be the source of the fire, lithium battery cargo shipments were strongly implicated:

1. UPS DC-8-71F Philadelphia, February 2006
2. UPS 747-44AF Dubai, September 2010
3. Asiana Airlines B747-400F, July 2011

According to the accident investigation reports, the two UPS aircraft referred to above were carrying undeclared dangerous goods. In the case of the Dubai 747 accident, there were shipments of lithium batteries for which evidence of successful UN38.3 safety testing could not be provided by the shipper. These tests are mandatory for all modes of transport.

Global records of lithium battery fires in air transport are not available. However, since 2012 the UK CAA has received ten reports of fire/smoke events involving air cargo or air mail on the ground before or after carriage. These events all occurred in the UK and no mishandling was reported. More recently, the UK CAA has experienced an increase in the number of reports of undeclared and misdeclared lithium batteries (batteries shipped as equipment) discovered after flight to the UK, including multi-tonne shipments carried on both cargo and passenger aircraft.

Lithium batteries packed on their own, are only permitted for carriage onboard cargo aircraft where the crew may have more options to respond. This restriction cannot be applied when the goods are undeclared. Thus, there is a safety risk from undeclared or untested lithium batteries to all flights including passenger operations. There is also a significant hazard to the population at large should an aircraft accident occur in a densely populated area.

The International Civil Aviation Organization (ICAO) Annex 18 requires States establish inspection, surveillance and enforcement procedures for all entities subject to their dangerous goods regulations. Such entities include shippers, freight forwarders, designated postal operators, ground handling service providers and air operators (Appendix D).

Within many States including the UK there are millions of shippers as the population has easy access to mail services. In addition, exposure to undeclared dangerous goods has increased following the advent of e-commerce whereby goods are sold and distributed by an increased number of small and medium enterprises. Shippers are not typically required to hold any aviation approval; therefore, States cannot proactively identify all shippers, nor schedule oversight on all their dangerous goods activities. Instead, some States implement regulatory actions in response to occurrence reports received. This necessitates a strong reporting culture within a State as the report provides the necessary input prompting an investigation and response aimed at preventing recurrence.

Freight forwarders perform a critical function in the transport of air cargo by enabling individuals or corporations to get goods from the manufacturer or producer to a market, customer or final point of distribution. Responsible freight forwarders are well placed to advise their customers on the requirements for the safe transport of dangerous goods by air.

At present the only requirement within the Technical Instructions placed directly on a freight forwarder is to provide dangerous goods training to its personnel. The obligation placed on cargo acceptance staff of the air operator, to seek confirmation from

shippers about the contents of any item of cargo where there are suspicions that it may contain dangerous goods, with the aim of preventing undeclared dangerous goods from being loaded on an aircraft as general cargo, is not currently applied to the staff of freight forwarders.

Even where States are seeking to resolve issues within their territories, the problems could conceivably migrate. Lithium battery manufacturing bases are already moving from China to Vietnam, India and Malaysia. Thailand is expected to become an Electric Vehicle production hub soon and with that comes the potential for localised cell production. We therefore need systemic solutions that can be applied globally, or at least dynamically to the changing risk environment.

With regards to other ongoing activities related to this workshop:

- The SAE G-27 Lithium Battery packaging performance standard commissioned by ICAO is intended to develop a test method to demonstrate that hazards which might arise from a failure of an individual cell could be safely contained within the package.
- The Sabatair project within the EU is to propose and evaluate novel and tailored packaging solutions and other operational measures aimed at the safe transport of both lithium metal and lithium ion batteries on board an aircraft - passenger and cargo alike.

The deliverables from these activities should enhance the safety of compliant shipments but will not address the safety threat from untested batteries or undeclared shipments, whether these be caused through omissions due to ignorance of the transport requirements, or deliberate violations of the national regulations that apply them.

ICAO Annex 6 will soon require the air operator to conduct a specific safety risk assessment on the range of items placed within cargo compartments[1]. The safety of the supply chain must be considered, and the safety risk management approach requires mitigations to be implemented where required. This presents a significant challenge to air operators because shippers and forwarders are the customers of airlines, not their service providers. Further, as cargo is often consolidated[2], and consolidations may themselves be consolidated prior to being ultimately offered for air transport, it can be difficult for the air operator to apply effective controls at source. A consolidation may be received by the air operator palletised and covered in shrink-wrapping which hides any visual indications that dangerous goods may be present.

[1] Subject to adoption by ICAO Council during Q1 2020.

[2] Consignments from several shippers or forwarders ultimately booked for air transport by a single freight forwarder under a single master air waybill.

Our mission

The aviation industry cannot address this issue alone and needs the support of the battery manufacturing, testing and logistics industries; plus, other regulators and standard setting bodies.

Addressing untested or undeclared dangerous goods is truly to our mutual benefit:

- Compliant manufacturers do not want counterfeit (and probably untested) products entering the market place. Non-compliant shipments have already resulted in increased regulation, complexity, time and ultimately cost which affects those which comply.
- Testing laboratories would benefit from increased demand for testing.
- Non-compliant shipments expose freight forwarders to enforcement from regulators, reputational loss and reduced access to air cargo services.
- Some air operators have conducted robust safety risk assessments and as a result have implemented significant controls over the acceptance of shipments. As these increasingly take effect the risk may be increasingly transferred to air operators with less robust controls or to road and sea transport operations.
- Regulators and rule makers can benefit from working more closely together as untested products present a hazard to the end consumer as well as during transport. Experience has shown that a shipper who is circumventing transport safety requirements will likely seek to evade import duty as well, not least as they will need to conceal the true nature of the goods consistently with all the documents associated with the consignment. With different sources of intelligence and legal powers, regulators are stronger together than when working in isolation.

Key next steps

The United Kingdom has submitted Working Paper A40-WP/287 entitled 'Carriage of Undeclared / Misdeclared High-Hazard Dangerous Goods by Aircraft' for discussion at the 40th Session of the ICAO Assembly, to be held in Montreal 24 Sep - 4 Oct 2019. Amongst other things, the paper invites the Assembly to request ICAO to continue to prioritise the work programme aimed at reducing the risks associated with shipment of lithium batteries by air, and to adopt a cross-domain approach.

The recommendations of the workshop are being considered within the UK CAA's overall strategy to mitigate the risk from undeclared or untested lithium batteries within cargo and mail. **We recommend that all other stakeholders do the same**.

We will continue to seek opportunities to engage and collaborate with other stakeholders.

Known related future events

IATA is convening its annual Lithium Batteries Workshop in Amsterdam on 29-30 October 2019. It is understood that one session will bring the cargo operations; cargo security and facilitation; and lithium battery groups together with a panel session to explore some of the issues around misdeclared and undeclared shipments. The UK CAA's Dangerous Goods Policy Specialist will be a panelist during this discussion.

APPENDIX A

Workshop stakeholders

The following organisations participated in the workshop on 13-14 June 2019:

Airbridgecargo Airlines
Air Sea Containers Ltd
Amazon
Belgian Civil Aviation Authority
British Airline Pilots Association BALPA
British Airways
Cathay Pacific Airlines
CargoLogicAir
CargoLux Airlines
Dangerous Goods Safety Group (UK) Ltd
DHL Express
eBay
Freight Transport Association FTA
Hapag-Lloyd
HMRC Her Majesty's Revenue and Customs
Hong Kong Civil Aviation Department
IAG Cargo
Intel Ireland Limited
International Air Transport Association IATA
International Civil Aviation Organisation ICAO
International Federation of Airline Pilots' Associations IFALPA
Office for Product Safety & Standards
Rapiscan Systems Recharge
Redline Assured Security Royal Mail Group
Saft Batteries
The Dangerous Goods Office Ltd
Underwriters Laboratories Inc
United Airlines
UK Border Force
UK Civil Aviation Authority
UK Department for Transport
US Department of Transportation
US Federal Aviation Administration FAA
US Postal Service
Vehicle Certification Agency
Virgin Atlantic Airways

APPENDIX B

Workshop breakout sessions

Session 1: Enhancing Awareness of Testing & Shipping Requirements

Presentations were made on the requirements for UN38.3 testing and quality-controlled manufacturing (which apply to all modes of transport) and the packaging, marks, labels and documents required for air shipment.

Question 1: How can product designers, manufacturers and distributors be made more aware of UN Manual of Tests and Criteria, Part III, Subsection 38.3 test requirements and dangerous goods shipping requirements?

- How could awareness be heightened of the need for UN38.3 tests and who should do this?
- How do product designers identify the standards applicable to their intended products?
- Should the UN38.3 transport testing requirements be referenced within product design standards (e.g. ISO/EN) and how would this be achieved?
- How can shippers be informed of the requirements for dangerous goods training / instruction for air transport and who should do this?
- How could these objectives be met globally?

Session 2: Supply Prevention of Counterfeit / Poor Quality Lithium Batteries

Presentations were made on an air operator's safety risk assessment on the threat from undeclared or misdeclared lithium batteries and the controls implemented as mitigations; techniques for the detection of lithium batteries within cargo and air mail through visual x-ray screening; and detection of lithium batteries by automated security screening systems.

Question 2: How can counterfeit, poorly manufactured or untested batteries be prevented from entering the supply chain, or be intercepted at the earliest opportunity?

- What actions should be taken by:
  - Manufacturer trade associations?
  - Trading standards bodies?

    - Freight forwarders (a person or organisation who offers the service of arranging the transport or cargo by air)?
    - Designated Postal Operators?
    - Air cargo general sales agents (a sales representative for an airline in a specific country or region)?
    - Air operators (and their cargo acceptance agents)?
    - National aviation regulators and other international agencies e.g. ICAO, IATA, FIATA etc?
- How could these objectives be met globally?
- Who should be responsible for co-ordinating?

Session 3: Leveraging Data to Identify Potential Shipments of Undeclared / Misdeclared Dangerous Goods

Presentations were made on:

- Provisions to aid recognition of undeclared dangerous goods within the ICAO Instructions Technical
- Natural language processing and machine learning systems
- Pre-Loading Advanced Cargo Information (PLACI)
- UK Customs Handling of Import and Export Freight (CHIEF) system
- IATA Air cargo and mail data standards
- Hapag-Lloyd/IBM 'Watchdog' software and maritime Cargo Incident Notification System

Question 3: How can freight forwarders, air operators and their agents leverage existing data to identify potential shipments of undeclared or misdeclared dangerous goods?

- What data / criteria would indicate suspect shipments?
- Which stakeholder(s) should develop the software to interface with existing air cargo/mail data systems and analyse the data?
- What legislative restrictions are there on the collection and sharing of data, such as data-protection and anti-trust regulations?
- Is it for each entity to develop or should there be a global solution?
- Who should finance the development of the software?

Based on the presentations it was demonstrated that there is scope to use consignment data to identify suspected shipments of undeclared lithium batteries, for example:

- The 'general description' of goods on the air waybill could be checked against the list of dangerous goods and list of hidden dangerous goods with the ICAO Technical Instructions, generic product terms etc. using natural language processing and fuzzy matching[3].
- Package volumetric mass density could be used to identify comparatively dense items of dangerous goods (e.g. batteries) when described as other non-dangerous goods with a lower volumetric mass density, e.g. clothing.
- Verification of shipper/forwarder addresses against national company registration data such as www.companieshouse.co.uk
- Historical non-conformity data could be used to prompt additional scrutiny over future shipments, until confidence is restored.
- Some tariff Import codes have a direct correlation to dangerous goods status, for example the UK system has codes which directly relate to lithium ion batteries.
- False positive rates could be minimised using multiple data points and optimising splitting points for quantitative data such as package mass density (the tolerance with which a probabilistic assessment is to be made).

The above analysis functions could be embedded within online cargo reservations at a transactional level or batched in advance of loading but after reservations have been made. Whilst an air operator could embark upon establishing this form of data analysis on their own, a global solution would be better achieved by IATA and the UPU embedding this within existing air cargo/mail electronic data processing systems. This would address the Master Air Waybill, but forwarders earlier in the supply chain would also need to embed similar capabilities to their systems to capture non-compliance earlier on and before cargo is consolidated as the Master Air Waybill would not then contain valuable data on the nature of individual consignments. The look-up tables and methodology should therefore be made available in an open source format unless there are concerns that this would help miscreant shippers avoid detection (e.g. a table listing parameters for the typical volumetric mass density for a range of products may be sensitive).

A forwarder that demonstrates effective processes for the detection of dangerous goods could conceivably be rewarded with by airlines providing them with streamlined booking processes, resulting in reduced shipment time and potential commercial advantage.

[3] Fuzzy matching is a method that provides an improved ability to process word-based matching queries to find matching phrases or sentences from a database. When an exact match is not found for a sentence or phrase, fuzzy matching attempts to find a match which, although not a 100 percent match, is above the threshold matching percentage set by the application

The same data analysis functions could be embedded within electronic customs clearance systems to enable States to identify and target non-compliant dangerous goods shipments. But this is a sub-optimal solution as it is reactive (clearance often occurs during or after flights) and is only of use if States have the resources to respond to the intelligence.

Data analysis systems could also be provided in the public domain to enable shippers that intend to comply to check whether their goods may be dangerous goods. Analogous to this is the French DGAC Airbag website for passengers to check dangerous goods prohibitions and restrictions.

Session 4 Facilitated Discussion: How can the various Regulators and other Agencies collaborate more effectively on investigation and enforcement?

Prior this session there a presentation on the role of the UK Office for Product Safety and Standards which was established to make regulation work so that it protects people and enables businesses to understand their obligations.

APPENDIX C

Table of recommendations

Ref	Recommendation	Who
1.1	Establish centralised online repositories for manufacturers to make available the UN38.3 test summary together with declarations of manufacturing in a quality-controlled environment (ICAO Technical Instructions 2;9.3).	UL[4], TÜV[5], RECHARGE[6], PRBA[7], etc.
1.2	Reshape consumer demand by promoting the benefits of buying lithium batteries for which the safety status can be readily verified, for example by checking a certification mark reference online or by reading a Quick Response (QR) code using a mobile phone.	UL, TÜV SUD, RECHARGE, PRBA, etc.
1.3	Establish national regulations requiring the importer to ensure that batteries are of a type which has passed UN38.3 testing and were manufactured in a quality-controlled environment (similar regulations already apply within many States for explosives). This would enable enforcement within the State of destination (in addition to action against the shipper in the State of Origin) and reduce the level of unsafe batteries entering the marketplace.	States
1.4	Use websites, social media, etc. to promulgate safety promotion material to manufacturers, shippers, freight forwarders and e-commerce platforms, e.g. the related videos on the UK CAA's YouTube Channel and IATA's free Lithium Battery Guidance Document	All Stakeholders ICAO/IATA should seek assistance from freight forwarding international associations, e.g. FIATA[8], WCA[9]

[4] UL is a global safety certification company which maintains offices in 46 countries.

[5] TÜV SUD is a global inspection/certification services group.

[6] RECHARGE is a non-profit association representing the interests of the lithium battery industry in Europe.

[7] PRBA serves as the voice of the Rechargeable Power Industry, representing its members on legislative, regulatory and standards issues at the state, federal and international level.

[8] International Federation of Freight Forwarders Associations (FIATA) is a non-governmental organisation representing approximately 40,000 forwarding and logistics firms.

[9] WCA is the largest network of independent freight forwarders, with over five thousand member offices in 190 countries.

Ref	Recommendation	Who
1.5	Seek to align ISO[10]/CENELEC[11] standards with UN38.3 requirements or establish cross references. 'BS EN 60086-4: 2015 primary batteries' (lithium metal) broadly aligns to the UN38.3 standard and refers to ICAO/IATA shipping requirements. However, BS EN standards for lithium ion batteries have been withdrawn.	ICAO, IATA, UL, TÜV, RECHARGE, PRBA
1.6	Engage with test laboratories to ensure that advice or consultancy on product testing encompasses both transport and product safety testing standards.	UL, TÜV, RECHARGE, PRBA
1.7	Seek opportunities to inform designers and manufacturers through presentations and engagement at lithium battery trade shows, universities, etc.	UL, TÜV, RECHARGE, PRBA, IATA, States
1.8	Ensure that enforcement procedures include measures aimed at preventing the recurrence of undeclared dangerous goods as required under Annex 18, Chapter 12, such as warning letters, audits or ultimately enforcement.	States ICAO Universal Safety Oversight Audit Programme (USOAP)
2.1	Address the dangerous goods responsibilities of freight forwarders through the emerging specific working group of the Flight Operations Panel on the Safe Carriage of Goods (WG- SCG), ensuring that this has appropriate representation from freight forwarding trade associations and the Universal Postal Union in addition to experts from States, IATA, etc.	ICAO
2.2	Task the WG-SCG to work with the AvSec Panel in identifying opportunities for the detection and removal of undeclared lithium batteries through or in conjunction with security screening processes without detriment to their primary function (preventing acts of unlawful interference) including via existing visual x-ray screen techniques and by automated x-ray detection capabilities.	ICAO
2.3	Ensure that all States have reviewed and approved Designated Postal Operator dangerous goods training programmes, controls over the introduction of dangerous	States ICAO (USOAP)

[10] The International Organization for Standardization is an international standard-setting body composed of representatives from various national standards organizations.

[11] CENELEC is the European Committee for Electrotechnical Standardization and is responsible for standardization in the electrotechnical engineering field.

Ref	Recommendation	Who
	goods into air mail and (where applicable) the introduction of lithium batteries contained within equipment.	UPU
2.4	Provide support to States in implementing their dangerous goods oversight and enforcement responsibilities when significant gaps are identified through USOAP.	ICAO (with appropriate partners)
2.5	Establish a means of sharing data concerning shipper/forwarder non-compliance between air operators without breaching anti-trust regulations.	IATA
2.6	Ensure that air operator compliance monitoring programmes include audits of general sales agents (GSA12) worldwide to verify that that information concerning dangerous goods is readily available and that personnel are trained commensurate with their dangerous goods responsibilities.	Air Operators States
2.7	Verify that cargo acceptance agents adhere to the operator's process for reporting undeclared/misdeclared dangerous goods and that the level of reporting is credible based on the nature of goods transported (will vary from region to region).	Air Operators States
2.8	Consider: a) additional controls over customer freight forwarders such as pre-contract audits to verify there is an effective dangerous goods training programme and that controls aimed at detecting undeclared dangerous goods are effective; b) tasking General Sales Agents or Freight Forwarders with seeking a lithium battery test report for each shipment where there is a direct relationship between the shipper and airline (albeit it would be difficult to cascade this expectation to forwarders of consolidations occurring earlier in the logistics chain); and c) supplemental x-ray screening for the purposes of identifying undeclared lithium batteries at the locations of highest risk.	Air Operators
3.1	Evaluate the opportunity to analyse existing cargo/air mail data for the purposes of detecting suspected hidden lithium batteries (and potentially other high-hazard dangerous goods).	IATA (pre-load) States (pre-arrival)

Ref	Recommendation	Who
3.2	Publicise details of concluded legal actions taken against miscreant shippers and forwarders as a deterrent to others.	States
3.3	The ICAO Technical Instructions include recommendations that air operators are alert to the presence of hidden dangerous goods, e.g. consideration of the description of goods on the air waybill. Human interfaces are increasingly being replaced by electronic systems, so this ICAO recommendation should be amended to encompass electronic data processing.	UK CAA through ICAO Dangerous Goods Panel
4.1	NAAs to engage with all State regulators that have an interest in transport safety, security, customs and trading standards to identify synergies and therefore opportunities for collaboration using their respective complimentary enforcement powers. Consideration should be given to: • Intelligence sharing including at a minimum, referrals of undeclared dangerous goods or poor quality declared batteries discovered during inspections conducted for non-dangerous goods purposes such as to detect evasion of import duty. • Shared data analysis tools • Collaborative enforcement, e.g. CAA can seize air cargo in transit whereas trading standards can seize all unsafe goods from a shipper and thus prevent further shipments. • Workforce cross-training • Memorandum of Understanding/Agency Agreements to formally outline collaborative measures.	States

APPENDIX D

Annex 18 Oversight – Logistic Supply Chain