



WORKING PAPER

**DANGEROUS GOODS PANEL (DGP)
MEETING OF THE WORKING GROUP OF THE WHOLE**

Abu Dhabi, United Arab Emirates, 7 to 11 November 2010

Agenda Item 5: Resolution, where possible, of the non-recurrent work items identified by the Air Navigation Commission or the panel

5.2: Review of provisions for dangerous goods relating to batteries

LITHIUM BATTERY SAFETY BULLETINS AND GUIDANCE MATERIAL

(Presented by the Secretary)

SUMMARY

This working paper draws the attention of the DGP-WG/10 to three safety bulletins on the risks in transporting lithium batteries.

Action by the DGP-WG is in paragraph 2.

1. INTRODUCTION

1.1 The attention of the working group is drawn to three recently issued safety bulletins on the risks in transporting lithium batteries.

1.2 It is noted that in the safety recommendations issued by the GCAA (Appendix B), mention is made of further guidance material being developed by the working group.

1.3 The Air Navigation Commission (ANC), in its review of the DGP/22 Report, requested the panel to continue to monitor world activities and to consider any new initiatives that would assist in greater compliance with the relevant provisions in the Technical Instructions. It supported any efforts by the panel to develop a comprehensive outreach programme, including training, to educate industry and the public on these matters.

2. ACTION BY THE DGP-WG

2.1 The working group is invited to develop guidance material for the safe transport of lithium batteries.

APPENDIX A

SAFETY ALERT FOR OPERATORS ISSUED BY THE UNITED STATES DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION



U.S. Department
of Transportation
**Federal Aviation
Administration**

SAFO

Safety Alert for Operators

SAFO 10017
DATE: 10/8/10

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest. Besides the specific action recommended in a SAFO, an alternative action may be as effective in addressing the safety issue named in the SAFO.

Subject: Risks in Transporting Lithium Batteries in Cargo by Aircraft

Purpose: To alert operators to the recent findings from the Federal Aviation Administration (FAA) William Hughes Technical Center testing results from April 2010 to September 2010. The Pipeline and Hazardous Materials Safety Administration (PHMSA), in coordination with the FAA, is considering the best course of action to address the risk posed by lithium batteries. In the interim, carriers should consider adopting the actions recommended at the end of this document.

Background: Lithium batteries are currently classified as Class 9 materials under the Hazardous Materials Regulations (HMR) (49 CFR 180 185). Nonetheless, most lithium batteries and devices are currently classified as excepted from the Class 9 provisions of the HMR. Because of this exception, they do not require a Notice to the Pilot in Command (NOTOC) to alert the crew of their presence on-board an aircraft.

Testing conducted by the FAA William J. Hughes Technical Center (FAA Tech Center) indicates that particular propagation characteristics are associated with lithium batteries. Overheating has the potential to create thermal runaway, a chain reaction leading to self-heating and release of a battery's stored energy. In a fire situation, the air temperature in a cargo compartment fire may be above the auto-ignition temperature of lithium. For this reason, batteries that are not involved in an initial fire may ignite and propagate, thus creating a risk of a catastrophic event. The existence and magnitude of the risk will depend on such factors as the total number and type of batteries on board an aircraft, the batteries' proximity to one another, and existing risk mitigation measures in place (including the type of fire suppression system on an aircraft, appropriate packaging and stowage of batteries, and compliance with existing requirements contained within both FAA and PHMSA regulations).

We note as well that United Parcel Service Flight 006 crashed in the United Arab Emirates on September 3, 2010. Investigation of the crash is still underway, and the cause of the crash has not been determined. We are aware, however, that the plane's cargo did include large quantities of lithium batteries and believe it prudent to advise operators of that fact.

Discussion of Continued Research: The FAA Tech Center has continued its research into lithium battery fires and the packaging, processes, and systems that can mitigate lithium battery fires aboard aircraft.¹

¹ Past findings related to lithium battery research have been published in the following FAA Technical Center Reports:

Lithium metal batteries are highly flammable and capable of ignition. Ignition of lithium metal batteries can be caused when a battery short circuits, is overcharged, is heated to extreme temperatures, is mishandled, or is otherwise defective. Once a cell is induced into thermal runaway, either by internal failure or by external means such as heating or physical damage, it generates sufficient heat to cause adjacent cells to go into thermal runaway. The result of thermal runaway in a lithium metal cell is a more severe event as compared to a lithium-ion cell in thermal runaway. The lithium metal cell releases a flammable electrolyte mixed with molten lithium metal, accompanied by a large pressure pulse. The combination of flammable electrolyte and the molten lithium metal can result in an explosive mixture. Halon 1301, the suppression agent found in Class C cargo compartments, is ineffective in controlling a lithium metal cell fire.

The explosive potential of lithium metal cells can easily damage (and potentially perforate) cargo liners, or activate the pressure relief panels in a cargo compartment. Either of these circumstances can potentially lead to a loss of Halon 1301, allowing rapid fire spread within a cargo compartment to other flammable materials. For this reason, lithium metal cells are currently prohibited as bulk cargo shipments on passenger carrying aircraft.

FAA testing has shown that encased or enclosed lithium metal batteries may pose a safety risk. Two types of robust, readily available containers were tested at the FAA Tech Center: five gallon steel pails with crimp on gasketed lids, and 30 gallon steel drums with bolt closed ring seals and gasketed metal lids. For both types of container, as few as six loose CR2 lithium metal cells were sufficient to cause failure when induced into thermal runaway by an electric cartridge heater. The confined electrolyte and the molten lithium ignition source formed an explosive condition, forcefully separating the lid from the container. The explosive force in this test was likely high enough to cause physical damage to an aircraft's Class C cargo compartment.

A container specially designed to ship lithium metal batteries would need to demonstrate that it can withstand this explosive condition. There are currently no approved and tested containers that can sufficiently contain the known effects of accidental lithium metal battery ignition. Common metal shipping containers, pails and drums, are not designed to withstand a lithium metal cell fire.

Our test results have also demonstrated that lithium-ion cells are flammable and capable of self-ignition. Self-ignition of lithium-ion batteries can occur when a battery short circuits, is overcharged, is heated to extreme temperatures, is mishandled, or is otherwise defective. Like lithium metal batteries, lithium-ion batteries can be subject to thermal runaway. A battery in thermal runaway can reach temperatures above 1,100 degrees F, which exceeds the ignition temperature of most Class A materials, including paper and cardboard. These temperatures are also very close to the melting point of aluminum (1,220 degrees F). The fire suppression system in Class C compartments, Halon 1301, has been shown to be effective in suppressing fires generated by lithium-ion batteries, but does not eliminate the risk of transporting such batteries.

DOT/FAA/AR-06/38 – Flammability Assessment of Bulk-Packed, Rechargeable Lithium-Ion Cells in Transport Category Aircraft
<http://www.fire.tc.faa.gov/pdf/06-38.pdf>

DOT/FAA/AR-04/26—Flammability Assessment of Bulk-Packed, Nonrechargeable Lithium Primary Batteries in Transport Category Aircraft
<http://www.fire.tc.faa.gov/pdf/04-26.pdf>

DOT/FAA/AR-09/55 –Flammability Assessment of Lithium-Ion and Lithium-Ion Polymer Battery Cells Designed for Aircraft Power Usage
<http://www.fire.tc.faa.gov/pdf/09-55.pdf>

The complete results of the FAA Tech Center's study, reported in summary form here, will be made available to the public and for peer review in the near future. The study has not yet been peer-reviewed.

Additional Research: The FAA Tech Center will continue research on improved cell separator materials to stop or slow down thermal runaway propagation. In addition, the Tech Center will research packaging materials to adequately control the properties lithium batteries exhibit in a fire condition. These methods, results, and findings will be subject to peer review.

Rulemaking: PHMSA issued a Notice of Proposed Rulemaking (NPRM) (75 FR 1302, January 11, 2010) with proposals to reduce the risks associated with the air transport of lithium batteries, and has submitted a final rule based on the NPRM to OMB for review. The Department of Transportation is concerned about the risk that lithium batteries pose to aviation safety in the event of an onboard fire. As a result of this concern, PHMSA and FAA are considering additional appropriate actions to address these safety risks.

The FAA and PHMSA have determined that carriers can now take prudent steps to reduce the risk that lithium batteries pose, which is why the FAA is issuing this safety alert.

Recommended Action: It is recommended that all air carriers institute additional procedures for safely transporting lithium batteries by aircraft:

- 1) Request customers to identify bulk shipments of currently excepted lithium batteries by information on airway bills and other documents provided by shippers offering shipments of lithium batteries.
- 2) Where feasible and appropriate, stow bulk shipments of lithium batteries in Class C cargo compartments or in locations where alternative fire suppression is available.
- 3) Evaluate the training, stowage, and communication protocols in your operation with respect to the transportation of lithium batteries in the event of an unrelated fire.
- 4) Pay special attention to ensuring careful handling and compliance with existing regulations covering the air transportation of Class 9 hazardous materials, including lithium batteries.

These recommendations are limited to lithium batteries transported in the cargo hold of an aircraft (including cargo holds that are not distinct from the flight deck), and do not apply to lithium batteries carried onboard by passengers and crewmembers, or otherwise stowed in the passenger cabin of the aircraft. These recommendations are not exclusive; we hope that carriers will use the information provided here and in our Tech Center study, together with any other available information, to consider other reasonable measures they believe appropriate to mitigate the risk of transporting lithium batteries by air.

Contact: Questions or comments concerning this SAFO should be directed to the FAA Office of Hazardous Materials, ADG-200 at 202-385-4897.

APPENDIX B

SAFETY RECOMMENDATIONS ISSUED BY THE GENERAL CIVIL AVIATION AUTHORITY OF THE UNITED ARAB EMIRATES



FROM
GCAA Regulations and Investigation Dept

DATE
20 October 2010

GCAA REFERENCE:
26030/50659/10

PURPOSE:
NOTIFICATION OF GCAA SAFETY RECOMMENDATIONS

SUBJECT:
PROMPT SAFETY RECOMMENDATIONS FOR THE TRANSPORTATION OF LITHIUM BATTERIES

TO
GCAA - DASI, DAS.
All Ground Handling Agents in the UAE
All UAE A.O.C. holders
All cargo operators transiting through the
UAE

BACKGROUND INFORMATION:

Following an accident involving a Boeing 747-400F on September 03rd 2010, 9 nm south of Dubai International Airport, the General Civil Aviation Authority has reviewed the initial accident findings of the investigators and determined that these immediate Safety Recommendations are to be distributed and adhered to by all UAE A.O.C. holders, freighter and passenger operators, ground handling companies, including all third party contractors directly and indirectly associated with the loading, storage and handling of freight either originating in, or in transit through the UAE.

The probable cause of the accident is not yet known; however, what has been established is that a fire on the main deck of the B747-400 was not extinguished following the standard operating procedures and that the crew acknowledged difficulties in handling the B747-400 during the emergency.

It is also been established from the cargo manifest that various consignments of lithium batteries and lithium-ion battery operated devices were included in the cargo onboard the B-747-400.

Based on the above, and through consultation with other civil aviation safety entities concerning empirical data from previous in-flight fires involving lithium batteries and/or lithium-ion battery operated devices in the cargo, the following four Prompt Safety Recommendations are released:

SUPPORTING INFORMATION:

As a reminder to all Operators/Ground Handling Agents, the following information is provided:

- Identified and declared Dangerous Goods must be accepted from a GCAA Dangerous Goods Certified Freight Forwarding agency (Ref. State Variations, ICAO TI AE 2 and IATA DGR AEG-02).
- The declared Dangerous goods must be handled in accordance with GCAA CARs Part VI Chapter 2 – "Transport of Dangerous Goods by Air".
- The USA Federal Aviation Administration's Safety Alert for Operators (SAFO) number 10017, dated 8th October 2010. The FAA SAFO is attached, or alternatively it is available here:

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo/all_safo/media/2010/SAFO10017.pdf

The GCAA R&I realizes that it is crucial for all UAE Ground Handling Agents and AOC holders operating to/from/via the UAE to enhance their procedures for assuring safer and securer transportation of lithium batteries by air, hence the following is recommended:

In view of this, all involved are also advised to:

- Increase the level of surveillance during loading to include the identification and reporting of any damaged packages, pallets or cargo containers, in particular, reporting any signs or indications of smoke or fire damage, or possible fire event initiation.
- It is imperative for all personnel of the operators or ground handlers that the reporting of any damage or suspected damaged is part of a comprehensive 'no blame culture', in line with accepted SMS practices.
- Educate all those who carry out activities related to Class 9 hazardous materials, including lithium batteries on the best practice to identify Lithium Batteries in particular in "Items/ shipments carried by Passengers, in Cargo, in Courier and in Mail modes" in/to/via UAE so that they are conversant with these new recommendations.
- Perform a risk assessment of their own practices for transporting lithium batteries.

Adhere, understand and cooperate in this regard, which will be highly appreciated. This will go a long way in improving transport of Dangerous Goods and batteries containing Lithium in particular, within the UAE towards achieving safer and securer operational standards.

Further information: A Dangerous Goods Panel – Working Group meeting will convene in Abu Dhabi, UAE, during November 2010. On the basis of the outcome of this working group meeting further guidance material will be available regarding the transport of dangerous goods by air, including lithium batteries.

SAFETY RECOMMENDATIONS:

Safety Recommendation 1 (SR20/10):

- Customers are requested to identify bulk shipments of currently excepted lithium batteries by information on airway bills and other documents provided by shippers offering shipments of lithium batteries.

Safety Recommendation 2 (SR21/10):

- Where feasible and appropriate, stow bulk shipments of lithium batteries in Class C cargo compartments or in locations where alternative fire suppression is available.

Safety Recommendation 3 (SR22/10):

- Evaluate the training, stowage, and communication protocols in your operation with respect to the transportation of lithium batteries in the event of an unrelated fire.

Safety Recommendation 4 (SR23/10):

- Pay special attention to ensuring careful handling and compliance with existing regulations covering the air transportation of Class 9 hazardous materials, including lithium batteries.

Kind regards,


Ismail Abdul Wahid
Chief Regulation and Investigation



APPENDIX C

EASA SAFETY BULLETIN

CC: XA; XM; XC; OL; EV
21.10.2010

EASA SIB No: 2010-30



EASA Safety Information Bulletin

SIB No.: 2010-30
Issued: 20 October 2010

Subject: Risks in Transporting Lithium Batteries in Cargo by Aircraft

Ref. Publications: Federal Aviation Administration (FAA) Safety Alert for Operators (SAFO) 10017, dated 08 October 2010.

Description: The FAA Flight Standards Service published the above-referenced advisory document (which is attached as pages 2 through 4 of this bulletin) to alert operators to the recent findings that identify a certain risk posed by lithium batteries, when carried as cargo onboard an aircraft.

Appendix A to this working paper (DGP-WG/10-WP/41)

After reviewing the information, EASA supports the recommended actions contained in FAA SAFO 10017. This SIB is published to ensure that all owners and operators of aircraft, registered in European Union Member States or associated countries, are made aware of these important recommendations regarding the transportation of lithium batteries by aircraft.

Applicability: All aeroplanes and helicopters where Lithium batteries can be carried onboard as cargo.

Contact: For further information contact the Airworthiness Directives, Safety Management & Research Section, Certification Directorate, EASA.
E-mail: ADs@easa.europa.eu.

This is information only. Recommendations are not mandatory.