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WORKING PAPER

DANGEROUS GOODS PANEL (DGP)

TWENTY-THIRD MEETING

Montréal, 11 to 21 October 2011

Agenda Item 5: Resolution, where possible, of the non-recurrent work items identified by the Air Navigation Commission or the panel:
Agenda Item 5.1: Review of provisions for the transport of lithium batteries

LITHIUM BATTERY STANDARDS

(Presented by J. McLaughlin)

SUMMARY

This paper proposes amending the Technical Instructions to ensure transport conditions for lithium battery shipments adhere to established principles in the air transportation of dangerous goods

Action by the DGP: The DGP is invited to consider the safety considerations discussed in paragraph 1of this working paper and to delete Section II of Packing Instructions 965 and 968 as presented in the appendix to this working paper. This amendment would eliminate the exception for small lithium ion and lithium metal batteries (i.e. such batteries not transported in or with equipment) and ensure that the essential elements of the Technical Instructions apply, i.e. 1) shippers would be required to be trained in the requirements for shipping lithium batteries; 2) operator acceptance checks for compliance prior to loading and stowage aboard an aircraft would be required; and 3) pilots would be notified of the presence, location and quantity of lithium batteries aboard the aircraft.

1. INTRODUCTION

1.1.1 The risk presented by lithium batteries in air transportation has been frequently discussed at DGP working groups and panel meetings. Additional shipping descriptions specific to each battery type, amendments to quantity limits, the introduction of specific handling labels, and improved emergency response guidance have come about as a result of these discussions. However, the Technical Instructions continue to allow many lithium batteries to be transported as general cargo and without the safety benefits that the dangerous goods transportation safety system requires even for other common

commodities such as paint and dry ice. Meanwhile, lithium batteries shipments are increasing in number, batteries are increasing in energy density, and research continues to inform regulators of the significant risk of lithium batteries in air transportation.

1.2 There are numerous safety implications for transporting a commodity classified as an item of dangerous goods as general cargo and therefore outside of dangerous goods transportation safety system. One consequence of the current regulatory approach is that the pilot has no information on the quantity, location, and types of lithium batteries —- including “bulk” battery shipments onboard the aircraft. This omission is entirely inconsistent with safety principles. Lithium battery fires (regardless of the source or cause) burn hotter, propagate faster, and are more difficult to suppress than other cargo fires. Pilots in command of an aircraft are responsible to make the determination of the first suitable airport for landing and all available information that could affect the time between a controllable and uncontrollable incident should be made available for use in this decision making process. Likewise, emergency responders are also unaware of the full threat they may confront once an aircraft has landed.

1.3 Training has long been viewed as the cornerstone to safety. All requirements have to be applied correctly to be effective. For most dangerous goods, shippers and operators must be trained commensurate with their responsibilities. Recordkeeping of this training ensures that the training is current and the trained personnel are used for the appropriate functions. Compliance and understanding of the requirements are essential to safety. In many States, operator training programs are approved and monitored. Although Packing Instruction 965 and Packing Instruction 968 require any person preparing or offering cells or batteries in accordance with these packing instructions to receive instruction commensurate with their responsibilities, this requirement is not equivalent to the level of training, confirmation of completion, and documentation prescribed in Part 1;4 of the Technical Instructions. However, for many lithium batteries, training is not required — therefore a key element of the regulations essential to safety is omitted for a commodity that poses a more substantive risk than many other dangerous goods subject to the full scope of the Technical Instructions.

1.4 For the lithium battery shipments that this paper addresses, each package is currently required to have only the lithium battery handling label. This label has a graphic of batteries and a fragile indicator and indicates that if damaged may catch fire so if damaged not to load the package. It also must include an emergency response telephone number. There are significant problems with this label. One problem is that emergency response personnel are trained to respond to hazard class labels and UN numbers marked on packages. A second problem is that air operators are not required to perform an acceptance check and inspection because the cells and batteries are excepted, as the DGP has previously decided. Air operator personnel are trained to handle a package with a hazard class label with caution. Any damage found during inspection and acceptance would indicate the package should not continue in transportation. But the very people that handle the package are not required to read the handling label and never inspect the package for damage. In the mechanized environment that packages go through in the new small package environment many cargo carriers operate, the acceptance check is the means to prevent incidents and the remainder of the handling until the consignee receives the package will be mechanized. Electronic systems common to many operators allow packages in the general cargo system to come into human contact as little as two times. A third problem is that the shippers required to know to apply the label are not required to have dangerous goods training. This reduces the likelihood of compliance.

1.5 A fire associated with lithium batteries does not necessarily suggest that a fire was caused by lithium batteries. What is known is that lithium batteries, when in the presence of typical cargo fires, will exacerbate the hazard. This also underscores the need for pilots to have awareness of the presence, location, and quantity of lithium batteries. The incident history must be seen as precursors to catastrophic

accidents and has prompted research by the Federal Aviation Administration (FAA). This research shows that a relatively small fire source is sufficient to heat lithium batteries to the point of thermal runaway and current fire suppression systems may not be effective in suppressing a cargo fire involving lithium batteries. The severity of a fire involving lithium batteries will depend on such factors as the total number and type of batteries on board an aircraft and the batteries' proximity to one another. Thus many packages of closely packed batteries, such as a palletized unit, pose a substantial hazard.

1.6 Information papers will be submitted to provide the DGP with published research conducted by the FAA that characterize the unique risks and hazards that lithium batteries present in air transportation.

1.7 Currently, Packing Instructions 965 and 968 are applied to lithium ion and lithium metal batteries, respectively. Section II of those packing instructions provides for complete relief from all other provisions of the Technical Instructions when certain conditions defined in those sections are met. While these conditions limit the quantity of batteries per package, no limit is placed on the number of packages that may be consolidated within an overpack, palletized, transported in a single unit load device, or placed in a single aircraft cargo compartment. In addition, because such batteries are not declared as dangerous goods, operators are limited in the information received — for example, no dangerous goods declaration is required and no notification to the pilot in command is necessary. While the relief afforded may make sense for an individual battery or small numbers of such batteries, the lack of any limit beyond the individual package quantity allows for large quantities of batteries to be consolidated therefore increasing the risk in a fire situation — whether or not the fire is initiated by the batteries themselves or by an outside source.

2. ACTION BY THE DGP

2.1 The DGP is invited to consider the safety considerations discussed in paragraph 1of this working paper and to delete Section II of Packing Instructions 965 and 968 as presented in the appendix to this working paper. This amendment would eliminate the exception for small lithium ion and lithium metal batteries (i.e. such batteries not transported in or with equipment) and ensure that the essential elements of the Technical Instructions apply, i.e. 1) shippers would be required to be trained in the requirements for shipping lithium batteries; 2) operator acceptance checks for compliance prior to loading and stowage aboard an aircraft would be required; and 3) pilots would be notified of the presence, location and quantity of lithium batteries aboard the aircraft.

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APPENDIX

Part 4
PACKING INSTRUCTIONS

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Packing Instruction 965

Passenger and cargo aircraft for UN 3480

This entry applies to lithium ion or lithium polymer batteries.

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~~SECTION II~~

~~Lithium ion cells and batteries offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.~~

~~Lithium ion cells and batteries may be offered for transport if they meet the following:~~

~~1) for lithium ion cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;~~
~~2) for lithium ion batteries, the Watt-hour rating is not more than 100 Wh;~~
~~— the Watt-hour rating must be marked on the outside of the battery case except for those batteries manufactured before 1 January 2009;~~
~~3) each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3.~~

~~*Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.*~~

~~General requirements~~

~~Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).~~

~~*Contents*~~	~~*Package quantity (Section II)*~~	
	~~*Passenger*~~	~~*Cargo*~~
~~Lithium ion cells and batteries~~	~~10 kg G~~	~~10 kg G~~

~~ADDITIONAL PACKING REQUIREMENTS~~

~~— Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong outer packaging.~~
~~— Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.~~
~~— Each package must be capable of withstanding a 1.2 m drop test in any orientation without:~~
~~— damage to cells or batteries contained therein;~~
~~— shifting of the contents so as to allow battery to battery (or cell to cell) contact;~~
~~— release of contents.~~
~~— Each package must be labelled with a lithium battery handling label (Figure 5-31).~~
~~— Each consignment must be accompanied with a document with an indication that:~~
~~— the package contains lithium ion cells or batteries;~~
~~— the package must be handled with care and that a flammability hazard exists if the package is damaged;~~
~~— special procedures must be followed in the event the package is damaged, to include inspection and repacking if necessary;~~
~~— a telephone number for additional information; and~~
~~— the words "lithium ion batteries", "not restricted" and "PI965" must be placed on the air waybill, when an air waybill is used.~~
~~— Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.~~

OUTER PACKAGINGS

Boxes *Drums* *Jerricans*

Strong outer packagings

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Packing Instruction 968

Passenger and cargo aircraft for UN 3090

This entry applies to lithium metal or lithium alloy batteries in Class 9 (Section I) and lithium metal or lithium alloy batteries subject to specific requirements of these Instructions (Section II).

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SECTION II

Lithium metal or lithium alloy cells and batteries offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

Lithium metal or lithium alloy cells and batteries may be offered for transport if they meet the following:

1) for a lithium metal cell, the lithium content is not more than 1 g;
2) for a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g;
3) each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3.

Note. — Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.

General requirements

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).

Contents	*Package quantity (Section II)*	
	Passenger	*Cargo*
Lithium metal cells and batteries	2.5 kg G	2.5 kg G

ADDITIONAL PACKING REQUIREMENTS

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong outer packaging.
- Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
  - damage to cells or batteries contained therein;
  - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  - release of contents.
- Each package must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document with an indication that:
  - the package contains lithium metal cells or batteries;
  - the package must be handled with care and that a flammability hazard exists if the package is damaged;
  - special procedures must be followed in the event the package is damaged, to include inspection and repacking if necessary;
  - a telephone number for additional information; and
  - the words "lithium metal batteries", "not restricted" and "PI968" must be placed on the air waybill, when an air waybill is used.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

~~**OUTER PACKAGINGS**~~

~~*Boxes*~~ ~~*Drums*~~ ~~*Jerricans*~~

~~Strong outer packagings~~

— END —