Dangerous Goods Panel Working Group on Energy Storage Devices

DATE: November 22 and 25, 2022
TIME: 1530 – 1700 EST and 1330 – 1430 EST
LOCATION: Montreal, QC

I. Bowtie Diagram Review

The bowtie was introduced indicating two distinct threats lithium ion batteries packed with equipment and lithium batteries contained in equipment. A top event (thermal runaway), and safety barriers designed to prevent the occurrence of the thermal runaway event. The identified barriers are taken directly from the Technical Instructions and are given equal weight. Barriers are grouped into families. The working group discussions will further develop the bowtie, identify and validate the protective barriers and escalation factors.

The bowtie identifies the hazard, a top event and the consequence of the top event. Escalation factors, barriers (relating to top event prevention), and recovery controls (relating to top event consequence mitigation) are identified. For each control, assign a score against a barrier strength value. These values can then be applied to a risk index to identify the existing risk level. Outputs from the tool will become inputs into a report that includes a more detailed risk analysis of scenarios, incorporating data on transport volumes and aircraft capability to identify the effectiveness of various protective barriers.

II. Bowtie Amendments

Manufacturer Quality management systems identified as barrier to the following escalation factor: Changes that do not require a retest.

Design for use identified as barrier to the escalation factor “tests may not reflect abuse conditions”.

Effective protection that the device provides to the battery was removed as a barrier itself and included as a barrier to certain escalation factors. This is most applicable to new items originating from the manufacturer, recognizing that the manufacturer has an interest in ensuring products themselves are protected.

Procedures and training were identified as barriers to the escalation factor: Rough handling

Against misunderstanding of the phrase strong and rigid, there was discussion as to whether that is needed. The Technical Instructions indicate specific requirements in Part 4 and identify acceptable packagings in the packing instruction (boxes, drums, and jerricans). These indications may also be considered as barriers to rough handling leading to thermal runaway.

The escalation factor increased mass of batteries was questioned as it is widely accepted that batteries especially those in portable electronic devices are smaller with an increased volumetric energy density. The consequences of this include the same or more energy in smaller space, the opportunity to add more devices in a packaging while still respecting quantity limits. These

could be two separate escalation factors or a single escalation factor. Specific wording to be developed.

A lack of ability to control where packages are placed on board the aircraft was identified as an escalation factor. Requirements in Annex 6, Chapter 15 were identified as a barrier. Load planning software is used by various operators was also identified as a barrier. GEA indicated that requirements to place packages containing lithium batteries into specific cargo compartments would be disruptive to the network where packages and ULDs are loaded to facilitate movement through the system.

The group moved to consider the consequences of a thermal event. The UK CAA in their bowties sought to identify the worst case scenario no matter how remote e.g. consequences that result in harm to people or loss of the aircraft. The rationale being that a barrier effective at mitigating the worst consequences would also mitigate lesser consequences. Others suggest the group consider likely scenarios. The scenarios to consider include a thermal runway event that occurs during loading/unloading and prior to or after flight, and while in flight. The group identified a fire that compromises the fire protection features of the aircraft. Another severe consequence identified was a fire resulting in injuries to firefighters. This recognizes the potential of consequences of thermal runaway while the aircraft is on the ground. Notably, not all of the fire protection features are available while the aircraft is being loaded or unloaded. Identified fire protection features include detection, cargo compartment liners, ventilation, fire suppressant, and the ability to depressurize the compartment.

Devan provided the group with a preview of how the bowtie will form the basis of a more formal safety risk analysis and the risk assessment tool scoring method for controls. The safety risk analysis would follow a three step process:

1. Identify credible scenarios
2. Apply the risk assessment tool to each scenario
3. Assess the safety risk and determine the effectiveness of mitigation measures.

ACTION ITEMS:

Amend bowtie based on comments from working group and distribute

D. Ferguson will develop the right-side recovery measures to include fire detection and suppression features on aircraft.