DGP-WG/20-IP/5
20/10/20

DANGEROUS GOODS PANEL (DGP)
WORKING GROUP MEETING (DGP-WG/20)

Virtual Meeting, 19 to 23 October 2020

Agenda Item 3: Managing safety risks posed by the carriage of lithium batteries by air

3.1: Consider how lithium battery package standard under development by SAE G27 Committee (AS6413) can be incorporated into ICAO provisions (*Ref: Job Card DGP.003.02*)

3.2: Consider marking, labelling and documentation requirements for lithium battery packages meeting the SAE G27 Committee draft standard AS6413 (*Ref: Job Card DGP.003.02*)

STATUS OF SAE G-27 LITHIUM BATTERY PACKAGING PERFORMANCE STANDARD

(Presented by D. Ferguson)

SUMMARY

This information paper provides a presentation on the status of the SAE G-27 lithium battery packaging performance standard given to DGP-WG/20 by the co-chair of the committee.

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SAE INTERNATIONAL

STATUS OF SAE G-27 LITHIUM BATTERY PACKAGING PERFORMANCE COMMITTEE

Presented to DGP-WG/20
October, 2020

Doug Ferguson, Co-Chair G-27 Committee
Claude Chanson, Co-Chair G-27 Committee
Nicole Mattern, SAE Specialist G27 Committee

SAE G27 Committee

Why is committee formed and why a packaging standard?

The Council of the International Civil Aviation Organization (ICAO) established a prohibition on the transport of lithium batteries as cargo on passenger aircraft as a temporary measure until controls were put into place which establish an acceptable level of safety. A performance-based packaging standard was identified as one of the controls.

ICAO's intent to have a performance based packaging standard declared in late 2015; SAE International chosen to lead this effort as SAE standard.

"Performance based package standard for lithium batteries as cargo on aircraft" (AS6413)

This SAE Aerospace Standard (AS) specifies a minimum performance package standard that supports the safe shipment of lithium batteries as cargo on aircraft.

Standards Development Process

- SAE G27 committee currently has ~ 280 individuals
- Balloting process involves all stakeholders with opportunity to comment on proposed standard:
  - Ballot disapprovals must be resolved between the commentor and document author.
  - Comments from non-voting members must be reviewed and considered.
- Voting Member list (~46) has been updated to account for change in activity level of original members. On-going review and update list as required.

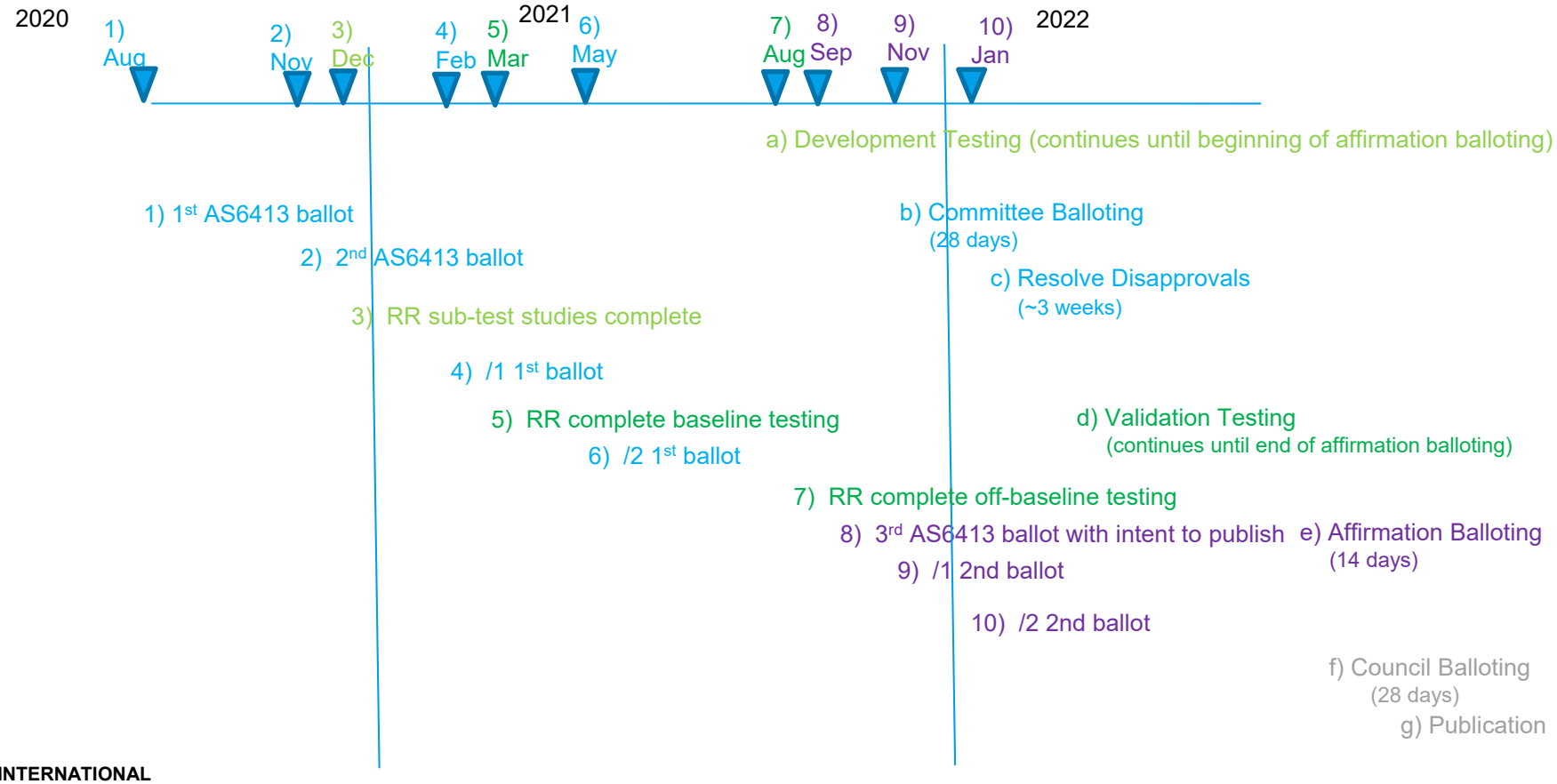
Standards Development Process

Since February, 2016:

- One telephone/Webex conference call of full G27 committee per month
- 10 face to face meetings of G-27 committee in US and Europe.
- External Fire Working Group (D. Ferguson)
- Initiation Cell Working Group (E. Canari)
- Round Robin Test Team Working Group (J. Russell, K. Shoib)

Virtual meetings using SAE Webex ~ every 4 months in 2020 due to Covid-19 health and travel concerns.

AS 6413 Projected Timeline
(As of July, 2020)



AS 6413 Draft Content

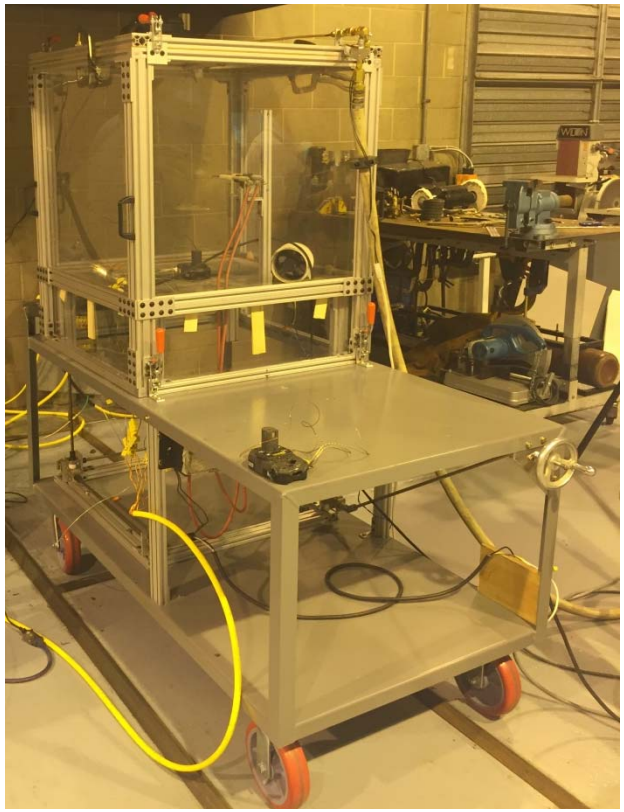
- This standard provides a test method to demonstrate and document the control of the potential hazards from Lithium metal batteries (UN 3090) and Lithium ion batteries (UN 3480) when transported as cargo on aircraft.
- It addresses the need to control the hazards which might arise from a failure of an individual cell by containing the hazards within the package.
- Controlling the consequences of a failure within the package is intended to prevent uncontrolled fire and pressure pulses that may compromise current fire suppression systems within the cargo compartment.
- The intent of this test is to severely abuse a single cell such that it is most likely to enter thermal runaway with the presumption that a single cell may enter thermal runaway during transport.

AS 6413 Draft Content

– **Baseline Test Method**

- The package will be placed in a transparent box with a [0.3] m^3 free volume that will contain gases generated from Thermal Runaway (TR). The box will have a rapid overpressure opening that will be sealed with a rupture foil. A spark ignition source will be energized continuously within the box volume, capable of igniting vapors reaching a flammable concentration within the box.

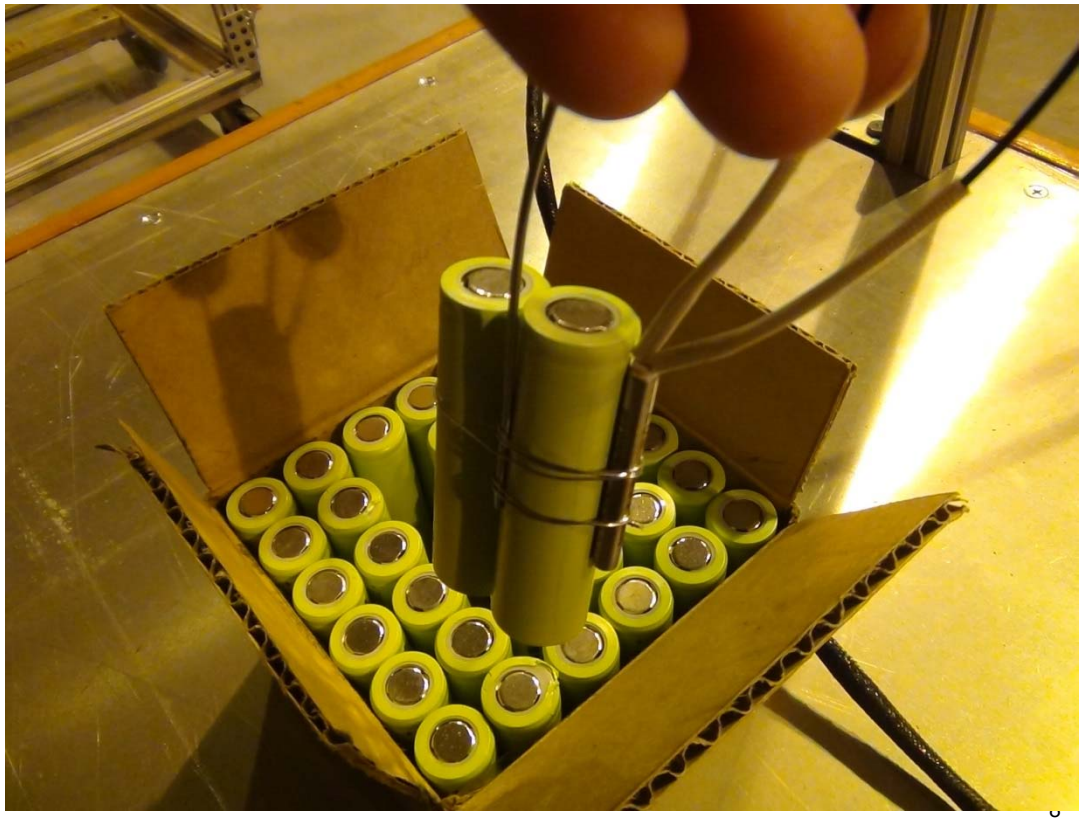
- Rationale for volume size is explained within draft standard



AS 6413 Draft Content

- For testing individual cells, Use a heat source (e.g. tape, cartridge) to create a temperature rise at 5 to 20 °C (9 to 36 °F) per minute as measured at an external point on the cell that is most representative of the cells internal temperature.

- If reducing SOC for shipment is part of package preparation to meet the performance requirements, a margin of safety is to be applied. Cells to be tested at the SOC of cells or batteries when tested in the package shall be at an SOC of 110% of maximum SOC allowed as presented for transport up to a max of 100%.



AS 6413 Draft Content

- If there is clear external evidence of cell thermal runaway, power to the heat source will be stopped.
- If clear evidence of cell thermal runaway has not occurred, monitor the cell temperature as measured at an external point on the cell that is most representative of the cells internal temperature and hold at 200°C (392°F) for 1 hour then remove power to the heat source.
- The unit under test will be monitored for 5 hours after removal of power to the heat source.

For testing batteries, the goal is to use the same methodology applied to a single cell within the battery, but there may be more than one single method for triggering TR, depending on the battery type and construction.

AS 6413 Draft Content

- Verification of “non-hazardous flame” and a “non hazardous particle” achieved visually or with witness panels
  - Visually: no flame or fragments
  - Witness panel: cheese cloth placed less than 25 mm away from package does not ignite
- Surface of package shall not be sufficient to ignite adjacent materials.
  - Temperature of thermocouple placed on package surface adjacent to the initiation cell shall not increase by more than 150 C for more than 3 minutes during the remaining 5 hours after the heater for the initiation cell is turned off.
  - Average increase in temperature of each thermocouple on each face of package shall not be greater than 100C during the remaining 5 hours after the heater for the initiation cell is turned off.
- Non-hazardous quantity of flammable vapor released outside package
  - No ignition of vapor collected within test chamber

AS 6413 Draft Content

Information requirements for traceability

- A similar approach has been proposed as in the UN model regulation: the description of a Summary Report Sheet, readily available for the transport stakeholders, and a detailed Test Report content (possibly containing restricted access information).

- Summary Report Sheet with a subset of the necessary data for documenting and validating the successful conduct and completion of the test:

  List of identification and traceability information (Name of the test laboratory and contact information for the testing Laboratory, the package qualification owner, the part number and description of the cells/batteries and the the packaging, the tests results summary, the State of Charge tested, etc..)

- Test Report with the detailed laboratory information for traceability (data recording, video recording, test set up and result detailed description, etc…)

QUESTIONS?

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