Date: 14 October 2023
RTCA Paper No. 265-23/SC235-064

Summary of the 30th Plenary
Special Committee 235 - Non-Rechargeable Lithium Batteries

Meeting Summary:

The 30th Plenary Meeting of Special Committee 235 (SC-235) was held on September 25-26, 2023. The meeting was conducted as a Virtual Meeting with the following attendees participating via WebEx.

John Trela (Chairman)	The Boeing Company
Norman Pereira (Government Authorized Representative)	Federal Aviation Administration
Jeff Densmore (Secretary)	Radiant Power Corporation
Karan Hofmann (Program Director)	RTCA, Inc.
Antonio Chiesa	Transport Canada
Leire Segura Martinez de Ilarduya	Airbus
Tom Jaeger	American Airlines
Nazih Khaouly	Federal Aviation Administration
Thomas Maloney	Federal Aviation Administration
Sam McCrory	National Institute for Aviation Research
Frederic Menard	SED Beacons
Kathryn Mulhollen	U.S. Air Force
Paul Pfeifer	Textron
Fernando Menedez Rodriguez	EASA
Ray Rodriguez	U.S. Air Force
Jim Russell	The Boeing Company (retired)
Adrian Sfetcu	Bell Helicopter Textron, Inc
Greg Smith	U.S. Air Force
Mel St John	National Institute for Aviation Research
Thomas Taylor	The Boeing Company
Clayton Vondrasek	Garmin
Jeremy Zee	The Boeing Company

Opening Plenary

- The 30th Plenary meeting of SC-235 was convened on September 25, 2023 at 10:00am EDT by Chair John Trela (Boeing). Jeff Densmore (Radiant Power) was the SC-235 Recording Secretary.
- Norman Pereira was introduced as the Government Authorized Representative.
- An RTCA overview, including RTCA's Proprietary References Policy was read by Karan Hofmann, the Program Director.

- Welcoming remarks were made by John Trela. Each person in attendance was invited to introduce themselves.
- The meeting agenda was reviewed.
- The Meeting Summary for SC-235 Plenary #29 was reviewed and approved with minor edits to correct a typographical error. These edits have been incorporated and the updated meeting summary has been posted on AerOpus.
- All documents and presentation material reviewed during Plenary #30 have been uploaded and are available in the RTCA AerOpus documents folder for this meeting.

Plenary #29 Action Item Review

There were no open Action Items following Plenary #29

DO-227B Comment Resolution

At the conclusion of the previous Plenary meeting (#29) held in June, the committee was unable to reach consensus of several open issues with the Draft DO-227B. These included:

1. Battery external short circuit with protections disabled
2. Battery Cell Series Polarity Reversal Test Update
3. Gas Analysis

Several Working Group meetings were held to review these items. Due to the summer vacation season, little progress was made. The focus of Plenary #30 was to drive towards closure of these items.

<u>Battery Short Circuit with Protections Disabled Discussion</u>

John Trela guided the discussion on this topic with a review of the history of this requirement from DO-227 through DO-311, DO-347, and finally DO-227A / DO-311A. This prompted discussion regarding the distinguishing between fuses and fusible links "between" cells versus internal to the battery. John recommended that the committee adopt the same requirements as currently in DO-311A, which exempts fuses and fusible links between cells. There was support for this recommendation by several committee members.

There continues to be concern from the regulators that fuses can fail, particularly in a mode where they fail to open. It was also suggested that a reliability factor could be applied to battery fuses. The concept would be fuses that have a rate of "failure to open" worse 10^{-7} would have to be disabled (e.g. bypassed) for this test. Paul Pfeifer from Textron shared supporting data from the Nonelectronic Parts Reliability Data (NPRD) database showing that there are fuses that meet these criteria. It was also suggested that MIL-HDBK-217 could also be used as a standard for determining these ratings. This prompted some follow-on questions including:

- Does the 10-7 failure rate apply to each fuse or all fuses?
- Can Fuse Manufacturer's reliability data be used in place of values found in the above reference databases?

The meeting ended again without consensus on this topic, however, the committee does seem to be converging on a resolution.

Battery Cell Series Polarity Reversal Test Update

The committee reviewed a comment from EASA regarding the Battery Cell Series Polarity Reversal Test. The comment focused on battery configurations that include series strings of parallel cells. Per the current written procedure, a single cell within the battery should be completely discharged before discharging the battery. For the parallel cell configuration, discharging a single cell would require isolating it from the other parallel cells. The comment asked if this was what the committee intended or should all cells that are in parallel be discharged.

It was agreed that this configuration was not considered during the creation of the original requirements and that the intent should be to discharge all parallel cells. The wording for this test was revised and agreed upon during the Plenary meeting.

Gas Analysis

The contentious subject of gas collection was once again discussed. The current draft of DO-227B contains several new gases to be collected and concentrations measured.

Carbonyl Fluoride (CF_2O): The concern regarding this gas is that it decomposes very quickly and that it is difficult to measure. Because CF_2O decomposes to HF, it was suggested that its concentration could be scaled to predict the concentration of CF_2O. It was not clear how this could accurately be calculated. In the end it was agreed by the committee to move this gas to Appendix A list of "other gases" to be considered.

Acrolein (C_3H_4O): The concern regarding this gas is that it is difficult to measure. Additionally, it can be cross contaminated with other gases leading to potentially inaccurate readings.

There is a high degree of concern within the committee that alterations to the existing gas collection requirements will increase the complexity of the TR test, limit the ability to perform these tests to a select few providers, and/or drive the requirement to acquire high capital equipment to perform. It was suggested that the list of gases in the Thermal Runaway test remain unchanged from DO-227A and that any additional gases be included in the Appendix A list instead.

The committee did not reach consensus on this topic during the Plenary.

Terms of Reference (TOR):
Given the delays in reaching consensus and the need for a second Final Review and Comment (FRAC) process, the committee discussed updating the TOR to reflect revised timing of completion. The committee discussed and AGREED to update the TOR for a FRAC completion date of June 2024. The TOR will be updated accordingly and presented to the PMC on December 14, 2023

Action Item Summary
There were no new actions generated during Plenary #30:

Working Group Meetings
It was agreed that Working Group meetings should be held on 11 October and 17 October to finalize the remaining open items and prepare the document for approval to proceed to FRAC at the next Plenary.

Next Plenary
Plenary #31 was scheduled for October 23, 2023 at 10am (EDT). The plan for this meeting is to approve DO-227B for a second FRAC.

-S-
Jeff Densmore
Secretary

CERTIFIED as a true and accurate summary of the meeting.

-S-
John Trela
Chairman