

Summary of the 23rd Plenary Special Committee 235 - Non-Rechargeable Lithium Batteries

Meeting Summary:

The 23rd Plenary Meeting of Special Committee 235 (SC-235) was held on June 28-29, 2022. 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.
Anuj Bhat	Panasonic Avionics Corporation
Camilo Camargo	ECA Aerospace
Antonio Chiesa	Transport Canada
Nazih Khaouly	Federal Aviation Administration
Thomas Maloney	Federal Aviation Administration
Frederic Menard	Oroliia
Fernando Menendez Rodriguez	EASA
Kathryn Mulhollen	U.S. Air Force
Richard Olson	Textron
Tom Pack	ACR Electronics
Paul Pfeifer	Textron
Ray Rodriguez	U.S. Air Force
Jim Russell	The Boeing Company (retired)
Leire Segura Martinez de Ilarduya	Airbus
Greg Smith	U.S. Air Force
Clayton Vondrasek	Garmin Ltd
Jeremy Zee	The Boeing Company

Opening Plenary

- The 23rd Plenary meeting of SC-235 was convened on June 28 and June 29, 2022 at 9:00am 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 Brandi Teel on behalf of 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 #22 was reviewed and approved as written.
- All documents and presentation material reviewed during Plenary #23 have been uploaded and are available on in the RTCA AerOpus documents folder.

Plenary #22 Action Item Review

The following action items were carried forward from Plenary #21 and assigned during Plenary #22, with an updated status shown.

- (1) (From Plenary #21) Need to Create a Small Working Group to review the Draft DO-227B document for consistency
Assigned to: Action identified, but not assigned
Status: **CLOSED**. John agreed to accept this action with the assistance of Jeff and Jim.
- (2) Capture in the minutes the request to extend the FRAC comment period from 30 days to 45 days to accommodate the summer holiday season
Assigned to: Jeff Densmore
Status: **CLOSED**. Captured in the minutes
- (3) Review and recommend what, if any, items from the "best practices" document should be included in the DO-227B requirements and/or test procedure sections
Assigned to: Working Group 2
Status: **CLOSED**. Recommendations presented and discussed during Plenary 23
- (4) Create a "RevA to RevB" matrix for inclusion into DO-227B as an appendix
Assigned to: John Trela and Jeff Densmore
Status: **OPEN**. template will be created for inclusion as an appendix with wording that states the intent of the table and that it will be completed upon resolution of FRAC comments

SC-235 Schedule Review

John Trela discussed the committee's progress towards updating and releasing DO-227B. He revisited the schedule discussed during Plenary #22 and identified minor updates since the last Plenary. He presented the following updated timeline representing achievable milestones:

- Upcoming RTCA PMC Meetings: Mar 17, 2022, Jun 23, 2022, Sep 15, 2022, and Dec 15, 2022
- Plenary #19: January 18th (Completed)
- Plenary #20: March 7th (Completed)
- Plenary #21: April 19th and 20th - Committee Review of Draft DO-227B (Completed)
- Plenary #22: May 18th and 19th Committee Review of Draft DO-227B (Completed)
- Plenary #23: June 28th and 29th Committee Review of Draft DO-227B
- Plenary #24: July 28th (Open FRAC)
- FRAC Process:
 - Submit Draft DO-227B to RTCA for FRAC Aug 1st
 - FRAC Start Aug 8th
 - FRAC comments due Sept 23rd
- Plenary #25: Week of Oct 10th – In Person (FRAC Resolution)
- Plenary #26: Week of Nov 14th – Complete FRAC Resolution and Approve DO-227B to PMC
- Release Process:
 - Document to RTCA December 1st
 - Target RTCA PMC Approval December 15th

The committee discussed this timeline and had doubts if this was achievable. Questions were raised if it was OK to make editorial changes to the document after plenary approval to release to FRAC. Karan stated that this was possible, provided it was clearly agreed by the committee that editorial changes will be accomplished. However, it was stated that corrections to “consistency” issues in the document may require an “emergency” Plenary to re-review and approve the document for FRAC. Finally, it was concluded that the document would not be FRAC-ready during this Plenary and that this would occur in July as noted above. As shown, the target continues to be PMC approval in December.

Draft DO-227B Review

The latest draft copy of DO-227B was uploaded into AerOpus the week prior to Plenary #23 to facilitate the committee's review of the document. For Reference, this document was titled “*DO-227B MOPS with changes June 23 2022.pdf*.” The committee spent two full days discussing the proposed changes to the document and addressing open topics identified within the working group meetings. Highlights of these discussions are summarized below.

End Item Thermal Runaway Containment – End Item Orientation:

The committee discussed the orientation of the test articles as it related to the Thermal Runaway testing. It has been reported by some members that observed thermal runaway outcomes have differed based on the orientation of the end item. Thus, the committee discussed how best to capture requirements for orientation considerations. Many options were considered which tried to balance the required number of TR tests (presently two) and the equipment's installation

orientation. After a lengthy debate, the committee agreed to the following wording: *“Test at least once in each intended orientation and limit installation to only the tested orientations. A minimum of two TR tests shall be performed.”*

End Item Thermal Runaway Containment – Evidence of Thermal Runaway:

Another requirement of the TR Containment test discussed was the criteria for evidence of a thermal runaway. The working group had included an expanded explanation of Thermal Runaway markers in the “Reportable” section in paragraph 2.4.3.2.2. The intent of these additions was to clarify the original bulleted lists of TR markers. However, the committee felt that the additions were too detailed and restrictive. In the end, it was agreed that the original wording be retained without the additional details.

Also debated during this discussion was the related procedural step regarding the trigger cell heater. Currently, the document states that *“Power to the trigger cell heater shall not be turned off until the cell has experienced a thermal runaway (as shown by a peak in cell temperature above 400°C or other unambiguous marker event in the case of cells which have lower temperature peaks).”* As it relates to the “TR markers” discussion above, it was suggested and agreed that statement within the parentheses be removed. The new wording will read as follows: *“Power to the trigger cell heater shall not be turned off until the cell has experienced a thermal runaway.”*

Open Circuit Voltage (OCV):

The subject of OCV was discussed again during this Plenary. Starting with Table 2-3, Table 2-4, and Table 2-5, it was agreed that Footnote #1 should be consistent for all three tables and should read: *“1. Decrease in open circuit voltage shall be less than or equal to 2 % as measured per test procedure.”* This change is consistent with and reinforces the committee’s agreement on the Open Circuit Voltage requirements reached during Plenary #16 and documented within those meeting minutes.

It was also requested that the document be reviewed to ensure that OCV is included in all of the “Reportable” sections for the applicable tests.

Finally, there was a suggestion to add a new OCV requirement on the cumulative variation over the entire environmental test sequence. The current requirements do not include a cumulative variation criterion and a compliant offering could vary as much as 2% for each test. There are five cell environmental tests, six battery environmental tests, and two end item environmental tests. Thus, cumulative variation could be as high as 10%, 12%, and 4% for cells, batteries, and end-items, respectively. After discussing, it was agreed to not include this new requirement and proceed to FRAC as written.

End-Item Test Evaluation Criteria – Table 2-5:

The proposed changes to Table 2-5 were reviewed and accepted.

Cell Humidity Test:

The working group had suggested a change to the Cell Humidity test profile to match the battery profile. There was no compelling reason for this change and the committee agreed to retain the existing cell profile in DO-227A.

Battery External Short Circuit with Active External Protection Disabled:

The requirements for this test were discussed at great length. As currently written, this test requires that a 5 milli-ohm short circuit be applied across the battery with all protective devices disabled except for fuses and fusible links between cells or over-current protective devices located inside the cells. The FAA and TCCA expressed their opinion that fuses should not be excluded and should be disabled unless they are inaccessible. Others on the committee questioned the reason for not excluding. It was stated that there was a concern that a fuse could fail in a “shorted” condition and not disabling them could mask this potential failure mode. This topic was discussed throughout the remainder of the meeting without consensus being reached. It was agreed to continue discussions during the upcoming working group meetings.

The committee did not have time to review the proposed changes to the Thermal Runaway Containment Test section that incorporated “best practices” recommendations. This will continue to be discussed during working group meetings, with the final recommendation to be presented at the next Plenary.

Action Item Summary

There were no new actions generated during Plenary #23:

Working Group Meetings

Weekly Working Group meetings will continue on Monday’s and Wednesday’s to continue review of the draft DO-227B. Additionally, John and Jeff agreed to begin a “consistency” review of the document.

Next Plenary

Plenary #24 has been scheduled as a Virtual Meeting on 28 July 2022. A detailed agenda and WebEx meeting information will be issued closer to this meeting date. The intent of the next Plenary is to approve DO-227B for FRAC.

-S-
Jeff Densmore
Secretary

CERTIFIED as a true and accurate summary of the meeting.

-S-
John Trela
Chairman