Date: 20 November 2020
RTCA Paper No. 325-20/SC235-025

Summary of the 12th Plenary
Special Committee 235 - Non-Rechargeable Lithium Batteries
Active Monitor Status Meeting

Meeting Summary:

The 12th Plenary Meeting of Special Committee 235 (SC-235) was held on November 10, 2020. 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
James Christo	NOAA
Claude Cresp	ELTA
Rodolfo Duran	Astronics DME
Leire SeguraMartinez de Ilarduya	Airbus
Nazih Khaouly	Federal Aviation Administration
Larry Masters	Gulfstream Aerospace Corporation
Brad Miller	Honeywell International
Thomas Pack	ACR Electronics
Paul Pfeifer	Textron
Mark Phaneuf	Air Line Pilots Association
Sergio Roberto	ANAC-Brazil
Fernando Menendez Rodriguez	European Aviation Safety Agency
Jim Russell	The Boeing Company
Fabricio de Oliveira Spigolon	Mitsubishi
Clayton Vondrasek	Garmin

Opening Plenary

- The 12th Plenary meeting of SC-235 was convened on November 10, 2020 at 12:00pm 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 #11 was reviewed and approved with one minor change. James Christo stated that he is no longer representing NASA and now supports NOAA. The meeting summary has been amended to reflect James' revised organization and posted on the RTCA Workspace.
- All documents and presentation material reviewed during Plenary #12 have been uploaded and is available on the RTCA Workspace at the following location:
  https://workspace.rtca.org/apps/org/workgroup/sc235_nonrechargeble_lithium_batteries/documents.php?folder_id=9572

Plenary #11 Action Item Review

There were three (3) action items assigned during Plenary #11. The status of each are reviewed below:

(1) Send request to SC-235 members to share test results summarizing OCV variation during temperature cycling. Cell / Battery chemistry tested should also be included.
Assigned to: Jeff Densmore
Status: **OPEN**

A request was submitted to all SC-235 members for the OCV variation data. A response was received from Radiant Power and reviewed during Plenary #12 as shown below.

Battery Chemistry	Thermal Cycling OCV Variation	MOPS	Section
CFx	0% avg OCV variation for 24 cells (worst case = 0.3% variation)	DO-227	2.3.3
LiMnO2	1.5% avg OCV variation for 45 cells (worst case = 1.7% variation)	DO-227	2.3.3
LiMnO2	1.0% avg OCV variation for 120 cells (worst case = 1.7% variation)	DO-227A	2.4.1.1.4
LiMnO2	0.9% avg OCV variation for 96 batteries (worst case = 1.2% variation)	DO-227A	2.4.2.1.4

Representatives from Honeywell and ACR Electronics also contributed stating that their test experience reflects meeting the 1% OCV variation requirements. It was noted that none of the data discussed represented test results for LiFeS2 cell chemistry. It was agreed that this action item remain open to allow other team members to share their test results. Additionally, it was requested that EASA contact the applicant for Deviation Request ETSO-C142a#5 and request that they share a summary of their test data as well.

(2) Provide a line-numbered PDF of DO-227A only to SC-235 committee members to assist in comment generation and review
Assigned to: Karan Hofmann
Status: **CLOSED**

A comment version of DO-227A including line numbers was uploaded into the SC-235 Workspace folder on 9 Oct 20.

(3) Consolidate discussion items from Plenary #10 and Plenary #11 into a comment spreadsheet for committee review and feedback. Additional comments will be included as received.
Assigned to: Jeff Densmore
Status: **CLOSED**

All discussion items from Plenary #10 and #11 were incorporated into a comment spreadsheet and uploaded into the SC-235 Workspace folder on 19 Oct 20. This spreadsheet was reviewed during Plenary #12.

DO-227A Comment Review

The committee reviewed the comments to DO-227A compiled in the "Monitor Comments" spreadsheet located in the SC-235 Workspace folder. Below is a summary of this review.

Table 2-1 and 2-2: Relative Humidity / Temperature Test Profile

This comment stated that Table 2-1 and 2-2 do not agree with the written requirements included in 2.4.1.2.1 and 2.4.2.1.7, respectively. They do not include stabilization times. (Reference ETSO.Dev.C142a#2). Per the review during Plenary #10, it was concurred that the Cell and Battery Tables should be revised to match the written description / requirements. This is considered clarification and not a requirement change. **ACTION** - J Russell to suggest updated tables for review during Plenary #13

Figure 2-6 and 2-16: Relative Humidity / Temperature Test Profile

Figure 2-6 and 2-16 do not agree with the written requirements included in 2.4.1.1.6 and 2.4.2.1.7, respectively. It does not include stabilization times. (ETSO.Dev.C142a#2). Per the review during Plenary #10, it was concurred that the Cell and Battery Graphics should be revised to match the written description / requirements. This was considered clarification and not a requirement change. **ACTION** - J Russell to suggest updated figures for review during Plenary #13

End Item Test Sequence

The third paragraph under section 2.4.3 does not agree with Figure 2-27. The figure illustrates that the five end item tests are not performed in sequence while section 2.4.3 implies that Vibe and Shock should be performed prior to Thermal Management, Thermal Runaway, and Load Profile. (ETSO.Dev.C142a#3).

There was a lengthy discussion regarding this comment. During Plenary #10, the committee discussed this item and concluded that the intent of this section was to perform Vibe and Shock on the batteries within end-items prior to performing Thermal Management, Thermal Runaway, and Load Profile (if applicable). During Plenary #12, there was a dissenting opinion siting original FRAC comment resolution. A review of those comments indicates that Figure 2-27 was amended to show a "non-sequential" requirement. During the subsequent conversation did not yield consensus on this issue. Most of the committee continues to believe Vibe and Shock testing should be performed prior to the safety tests. However, some committee members disagree. The two paths forward are (1) change Paragraph 2.4.3 to reflect a "non-sequential" test flow or (2) change Figure 2-27 to reflect Vibe and Shock testing to be performed prior to the safety testing.

Regardless of the path, it is unlikely this change will be considered an "errata" or "editorial" change to the document. It was agreed to table the discussion.

Cell Discharge Current Test

Test Procedure step (d) of Paragraph 2.4.1.2.1states to discharge the test cell using a DC Power Supply set at a constant current with a voltage limit of 3 volts (ETSO.Dev.C142a#4). The committee agreed to change "a voltage limit of 3 volts" to "a voltage limit set to the cell's nominal voltage".

Cell and Battery Test Evaluation Criteria for Temperature Cycling

Table 2-3 and 2-4 state that the OCV variation before and after Temperature Cycling Test should be less than 2%. (ETSO.Dev.C142a#5). The suggested change was to change the variation requirement to 5% and accomplish via a new footnote in both tables. The committee agreed to leave this item open until the next Plenary in hopes of collecting additional data. **ACTION** – EASA request Deviation Applicant to provide OCV Variation Summary test data to support this change. **ACTION** – Extend request to other SC235 members for OCV summary data.

At the conclusion of Plenary #12, committee members were again encouraged to submit other discussion items for review at the next Plenary meeting.

Action Item Summary

There were three (3) actions assigned during this Plenary as summarized below:

(1) Update Table 2-1 and Table 2-2 to match the written description / requirements to be presented during Plenary #13.
Assigned to: Jim Russell

(2) Update Figure 2-6 and Figure 2-16 to match the written description / requirements to be presented during Plenary #13.
Assigned to: Jim Russell

(3) EASA request Deviation ETSO.Dev.C142a#5 Applicant to provide OCV Variation Summary test data to support continued discussion of the requested OCV Variation change
Assigned to: Fernando Menendez Rodriguez

(4) Extend request to other SC-235 members for OCV summary data.
Assigned to: Karan Hofmann

Next Plenary

Plenary #13 has been scheduled as a Virtual Meeting on January 11, 2021. A detailed agenda and WebEx meeting information will be issued closer to this meeting date.

-S-
Jeff Densmore
Secretary

CERTIFIED as a true and accurate summary of the meeting.

-S-
John Trela
Chairman