

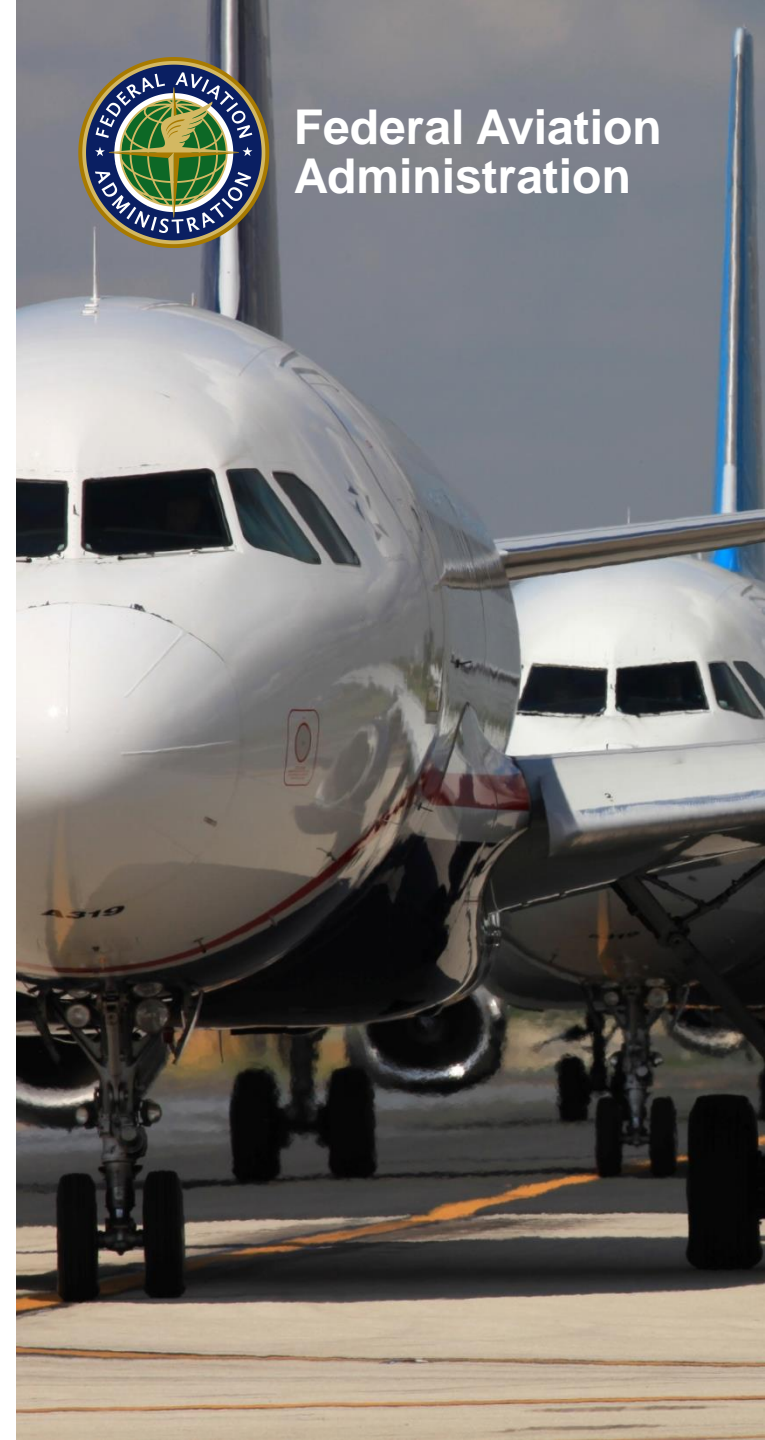
Battery & Fuel Cell Industry Working Group Updates

International Aircraft Systems Fire
Protection Working Group
Atlantic City, NJ
October 21 – 22, 2015

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Federal Aviation Administration
Fire Safety Branch
<http://www.fire.tc.faa.gov>



Federal Aviation
Administration



Industry Working Groups

- **Batteries**

- RTCA SC-225 – Rechargeable Lithium Batteries and Battery Systems
- RTCA SC-235 – Non-Rechargeable Lithium Batteries

- **Fuel Cells**

- EUROCAE/SAE WG80/AE-7AFC – Hydrogen Fuel Cells
- FAA Energy Supply Device ARC



Batteries – RTCA SC-225 (Rechargeable)

- **RTCA SC-225 was formed to provide certification guidance for lithium batteries and battery systems that are permanently installed in aircraft**
- **Group has been meeting regularly since March, 2011.**
- **Points of contact are:**
 - Chairperson: Richard Nguyen (Boeing)
 - Secretary: Stephen Diehl (Boeing)
 - DFO: Norm Pereira (FAA)



Batteries – RTCA SC-225 (Rechargeable)

- **Members of SC-225 include representatives from:**
 - Battery and cell manufacturers
 - Avionics manufacturers
 - Aircraft operators
 - Pilot and flight attendant associations
 - Regulatory and other government agencies
 - Other related industry associations



Batteries – RTCA SC-225 (Rechargeable)

- **RTCA/DO-311: “Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems”**
 - Published in March, 2008. Prepared by SC-211.
 - Intended for batteries being used as power sources for equipment devices, emergency lighting, and engine/APU starting.
- **RTCA/DO-347: “Certification Test Guidance for Small and Medium Sized Rechargeable Lithium Batteries and Battery Systems”**
 - Published in December, 2013. Prepared by SC-225.
 - Intended for small and medium sized batteries that are permanently installed on aircraft.
 - Defines test requirements based on battery size.

Battery Size	Single Cell Battery	Multi Cell Battery
Very Small	< 2 Wh	< 2 Wh
Small	$2 \leq \text{Wh} < 10$	$2 \leq \text{Wh} < 50$
Medium	$10 \leq \text{Wh} < 60$	$50 \leq \text{Wh} < 300$



Batteries – RTCA SC-225 (Rechargeable)

- **Committee submitted DO-311A to the PMC in June, 2015**
 - This is an update to the current DO-311.
 - Integrates coverage for all sizes of batteries.
 - Incorporates the latest understanding of lithium battery technology, battery testing and installation guidance including special condition, means of compliance issue papers and recommendations from NTSB.



Batteries – RTCA SC-225 (Rechargeable)

- **PMC rejected initial document for use as a minimum operational performance standard for a TSO, citing format/editorial issues and requesting a review of the categorization of batteries and the incorporation of design requirements**
- **Group is currently working to address these issues with hopes to submit a revised final document in June or September 2016**



Batteries – AC 20-184

- **AC 20-184: “Guidance on Testing and Installation of Rechargeable Lithium Battery and Battery Systems on Aircraft”**
- **References back to DO-311 and DO-347 as well as DO-311A (once released) for specific test requirements of installed lithium batteries**
- **Recently signed and due to be released shortly**



Batteries – RTCA SC-235 (Non-Rechargeable)

- **FAA requested RTCA to form a committee to update DO-227, “Minimum Operation Performance Standards for Lithium Batteries” (Primary)**
- **Committee has been formed and is holding its first meeting on October 21 – 22, 2015**
- **The outcome of this committee will be an updated document that provides guidance for non-rechargeable lithium batteries that are permanently installed in aircraft.**



Fuel Cells – SAE AE-7AFC

- **Joint EUROCAE/SAE group was formed to provide design, integration and certification guidance for hydrogen supplied fuel cell systems on board transport category aircraft**
- **Group has been meeting regularly since December, 2008.**
- **Points of contact are:**
 - Co-Chairperson: Hans-Dieter Hansen (ZAL/Airbus)
 - Co-Chairperson: Joe Breit (Boeing)
 - Secretary: Tony Fallon (Parker Aerospace)



Fuel Cells – SAE AE-7AFC

- **Members of group include representatives from:**
 - Fuel cell manufacturers
 - Engine/power system manufacturers and integrators
 - Aircraft manufacturers
 - Regulatory and other government agencies
 - Other related industry associations (e.g. gas suppliers)



Fuel Cells – SAE AE-7AFC

- **Short-term:** Development of safety guidelines related to the issues around installation of fuel cells on board aircraft and storage in the airport environment; consolidation of existing power system requirements and review of fuel cell performance against baseline requirements.
- **Medium Term:** Review of fuel cell technology maturity related to aviation requirements; definition of future on board electrical applications, which could be supported by fuel cells.
- **Long-Term:** Development of detailed specifications for safety assessment and certification of fuel cells on board aircraft.



Fuel Cells – SAE AE-7AFC

- **SAE AIR-6464 – Aircraft Fuel Cell Safety Guidelines**
 - Provides comprehensive reference and background information pertaining to the installation of Proton Exchange Membrane (PEM) hydrogen fuel cells on-board aircraft for the purposes of supplying auxiliary power rather than using separate ground power systems.



Fuel Cells – SAE AE-7AFC

- **Currently working on a MASPS/AS Document to more generally cover installation of any PEM H₂ fuel cell system**
 - H₂ storage and distribution
 - Oxidant sources, storage and distribution
 - Fuel cell module
 - Balance of plant
 - Thermal management
 - Controller system
 - Sensors
 - Electrical power conditioning and storage



Fuel Cells – Energy Supply ARC

- **Aviation Rulemaking Committee formed by FAA to provide a forum for aviation community to provide recommendations to the FAA**
 - Determine appropriate airworthiness standards and guidance, identify hazards and determine design and operational principals to safeguard against these hazards
 - ARC covers all energy supply devices but is heavily focused on PEM and SOFC Hydrogen Fuel Cells
- **Points of Contact Are:**
 - Co-Chairperson: Massoud Sadeghi (FAA)
 - Co-Chairperson: Joe Breit (Boeing)

http://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/committee/browse/committeeID/457



Fuel Cells – Energy Supply ARC

- **25 Participants, from government and industry**
- **Approximately ½ of the participants are also members of the WG80/SAE AE-7 AFC**
- **Initial kickoff meeting was held 9/21-9/23**
- **Group split the effort into five tasks:**
 - Define types of fuel cell devices to be studied
 - Hazard analyses and mitigation
 - Rulemaking support
 - Cost/Benefit Analysis
 - Program management/Final reporting



Fuel Cells – Energy Supply ARC

- **Objective is to have a Final Recommendation Report completed by April 2017**
 - Explanation of hazards, mitigation strategies, applicable airworthiness standards, guidance and other information required to address safety issues associated with hydrogen fuel cell applications on board commercial aircraft



Questions?

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