Battery & Fuel Cell Industry Working Group Updates

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

Steve Summer
Federal Aviation Administration
Fire Safety Branch
http://www.fire.tc.faa.gov
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

<table>
<thead>
<tr>
<th>Battery Size</th>
<th>Single Cell Battery</th>
<th>Multi Cell Battery</th>
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</thead>
<tbody>
<tr>
<td>Very Small</td>
<td>&lt; 2 Wh</td>
<td>&lt; 2 Wh</td>
</tr>
<tr>
<td>Small</td>
<td>2 ≤ Wh &lt; 10</td>
<td>2 ≤ Wh &lt; 50</td>
</tr>
<tr>
<td>Medium</td>
<td>10 ≤ Wh &lt; 60</td>
<td>50 ≤ Wh &lt; 300</td>
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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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