RTCA Background on Standards for Lithium Batteries

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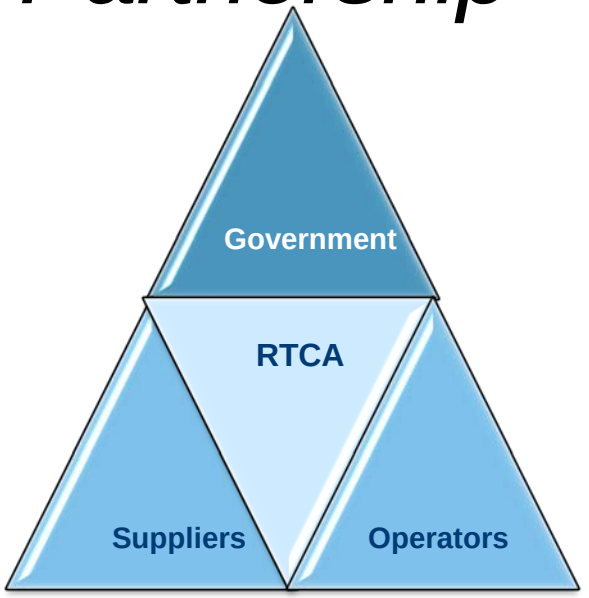
President

National Transportation Safety Board
April, 2013

RTCA:

Founded in 1935
Incorporated in 1991

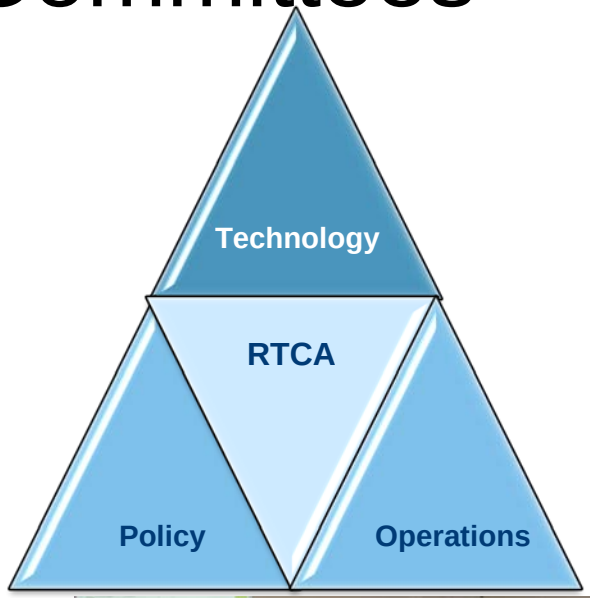
A Unique Public-Private Partnership



- Revenue Source:
  - Membership Dues
  - Document Sales
  - Training
- Over 400 Members
  - Academia
  - Airports
  - Aviation service providers, repair facilities
  - Government organizations (FAA, DOD, TSA, NASA)
  - Manufacturers (OEMs and after-market)
  - Operators – airlines, general aviation, cargo, DOD
  - Suppliers of automation, infrastructure & avionics
  - Labor – Pilots, Controllers, Dispatchers
  - R&D organizations

RTCA Operates U.S. Federal Advisory Committees

- Chartered by the FAA
- Deliver consensus-based, objective & independent recommendations to FAA
- Membership balanced representation
- Promote transparency, accountability
- Minimum Performance Standards
  - Expands marketplace of solutions
  - Provides anti-trust protection



All are Federal Advisory Committees

Special Committees

17 Active: 13 in Partnership with Europe

- Automatic Dependent Surveillance-B
- Aeronautical Information Systems
- Aeronautical System Security
- Air Traffic Data Communications
- Airport Security Access Control
- Airport Surface Wireless Comm
- Audio Systems Equip
- Enhanced Flight Vision Systems
- Environmental Testing
- GPS
- Inmarsat
- Lithium Batteries
- Mode-S Transponders
- Performance-Based Navigation
- Traffic Collision Avoidance Sys
- Aeronautical Databases
- Unmanned Aerial Systems

Oversight, Guidance, Integration Provided by Program Management Committee (PMC)

Minimum Aviation System Performance Standard (MASPS)

"… specifies characteristics that should be useful to designers, installers, manufacturers, service providers and users of systems intended for operational use within a defined airspace."

Compliance with a MASPS is recommended as one means of assuring that the system and each subsystem will perform its intended function(s) satisfactorily under conditions normally encountered in routine aeronautical operations for the environments intended.

Example: Automatic Dependent Surveillance-B (ADS-B) Architecture for new satellite technology to replace radar

Minimum Operational Performance Standard (MOPS)

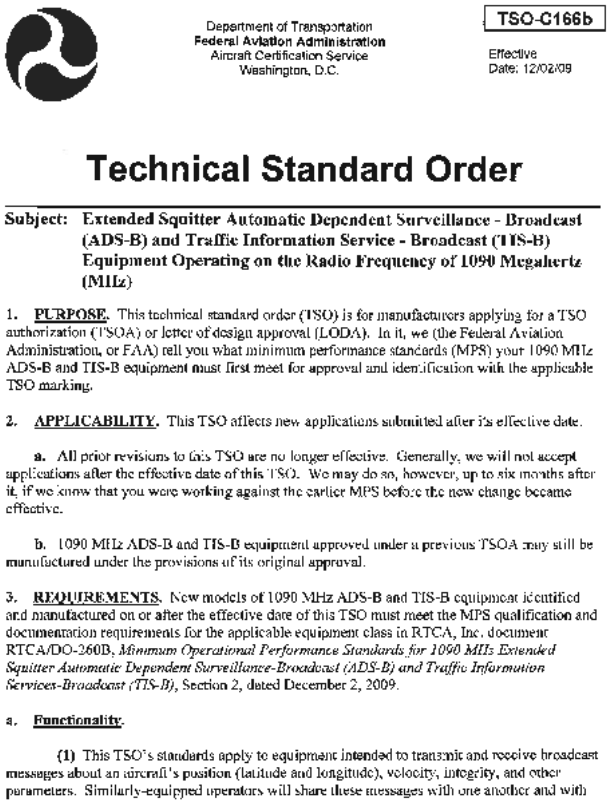
"… provides standards for specific equipment useful to designers, manufacturers, installers and users of the equipment…"

Compliance with MOPS is recommended as one means of assuring the equipment will perform its intended function(s) satisfactorily under all conditions normally encountered in routine aeronautical operations.

Example: Specific requirements for ADS-B aircraft avionics

FAA Reference to RTCA Documents

- Documents are recommendations
- FAA can implement with reference:
  - Regulation
  - Advisory Circular
  - Technical Standard Order
- RTCA DO-260B – FAA TSO-C166b
- Adherence to RTCA Standard is one means of compliance



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, D.C.

TSO-C166b

Effective
Date: 12/02/09

Technical Standard Order

Subject: Extended Squitter Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Service - Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)

1. **PURPOSE.** This technical standard order (TSO) is for manufacturers applying for a TSO authorization (TSOA) or letter of design approval (LODA). In it, we (the Federal Aviation Administration, or FAA) tell you what minimum performance standards (MPS) your 1090 MHz ADS-B and TIS-B equipment must first meet for approval and identification with the applicable TSO marking.

2. **APPLICABILITY.** This TSO affects new applications submitted after its effective date.

   a. All prior revisions to this TSO are no longer effective. Generally, we will not accept applications after the effective date of this TSO. We may do so, however, up to six months after it, if we know that you were working against the earlier MPS before the new change became effective.

   b. 1090 MHz ADS-B and TIS-B equipment approved under a previous TSOA may still be manufactured under the provisions of its original approval.

3. **REQUIREMENTS.** New models of 1090 MHz ADS-B and TIS-B equipment identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements for the applicable equipment class in RTCA, Inc. document RTCA/DO-260B, *Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B)*, Section 2, dated December 2, 2009.

   a. **Functionality.**

      (1) This TSO's standards apply to equipment intended to transmit and receive broadcast messages about an aircraft's position (latitude and longitude), velocity, integrity, and other parameters. Similarly-equipped operators will share these messages with one another and with

STANDARDS FOR LITHIUM BATTERIES

History of Standards for Batteries

- Standards for nickel-cadmium, nickel-metal hydride & lead acid batteries 07/04
- Issues and questions arose during testing of batteries
  - Storage life, altitude testing, rapid discharge, etc.
- Lithium technology considered mature enough to establish standards in 2006
- Request from FAA to establish SC-211, scope:
  - Update nickel-cadmium lead acid standards
  - Develop standards for rechargeable lithium batteries
- First meeting of SC-211 - 8/06, completed standard 3/08
- Committee referenced other standards organizations
  - ANSI/ASQC, IEC, ISO, UL, EUROCAE
  - 14 Code of FAR, Part 23, Part 25, Part 27, Part 29, Part 21

SC-211, Nickel-Cadmium, Lead Acid and Rechargeable Lithium Batteries

- Proper integration of rechargeable lithium battery systems into aviation-related equipment requires cooperation among the battery supplier, aircraft designer, the avionics equipment designer, and the FAA
- Outcome → DO-311, Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems

Broad Stakeholder Participation

Co-Chair William Johnson, Naval Air Systems Command
Co-Chair Hector Silberman, The Boeing Company

1. A123Systems, Inc.
2. ACME Aerospace
3. Aero Quality Sales
4. Aeroflex
5. American Airlines, Inc.
6. Appareo Systems, LLC
7. Astronics AES
8. Aviation Application Engineer
9. Aviation Management Associates
10. Bitrode Corporation
11. Cessna Aircraft Company
12. Concorde Battery Corporation
13. Continental Airlines, Inc.
14. Crane Aerospace & Electronics
15. Davidson Engineering Resources, Inc.
16. EaglePicher Technologies
17. EaglePicher Technologies LLC
18. EaglePicher Technologies, LLC
19. East Penn Manufacturing Co., Inc.
20. EIC Laboratories
21. Electro Energy, Inc.
22. EnerSys
23. Energy/Hawker GmbH Ltd.
24. Federal Aviation Administration
25. Federal Express Corporation
26. George Mason University
27. GS Yuasa Corporation
28. Gulfstream Aerospace Corporation
29. Honda Aircraft Company, Inc.
30. Lithium Technology Corporation
31. Lux Aviation Engineering
32. Marathon/Norco Aerospace Inc.
33. Modular Enery Devices
34. Quallion
35. RTCA, Inc.
36. Saft America, Inc.
37. Securaplane Technologies
38. Sparrow-Tech Inc.
39. Thales Avionics, Inc.
40. The Boeing Company
41. U. S. Air Force
42. U. S. Army
43. UK – Civil Aviation Authority
44. United Lithium Systems
45. Wiley Rein LLP

DO-311 MOPS in Regulatory Material

- Accepted and invoked by FAA TSO-C-179**a**
  - "Permanently Installed Rechargeable Lithium Cells, Batteries and Battery Systems."
    - TSO-179 issued 12/2/2009
    - **TSO-C179a, issued 04/19/2011**
    - Last Updated 11/20/2012

" Requirements. New models of permanently installed rechargeable lithium cells, batteries and battery systems manufactured on or after the effective date of this TSO must meet the minimum operating performance standards (MPS) tests based on the intended application defined in the TSO installation manual, in Sections 2 and 3 of RTCA/DO-311, MOPS for Rechargeable Lithium Battery Systems dated March 13. 2008. Refer to Table 4-1 of DI-311 for test schedule." 04/19/2011

DO-311 Scope

- General
- Safety
- Quality Control
- Storage, Shipping, Disposal
- Design Requirements
- Test Considerations
- Electrical Qualification Requirements & Test Procedures
- Environmental Qualification Requirements & Test Procedures
- Quality Assurance Requirements

DO-311 Content

- Provides guidance on…
  - Design
  - Certification
  - Production
  - Use
- Applications as power sources for:
  - Equipment devices
  - Emergency lighting
  - Engine or APU starting when required
- Applies to:
  - Chemical composition
  - Cell size
  - Cell construction
  - Cell interconnection methods within batteries
  - Venting provisions
  - Ops & storage environments
  - Packaging, handling, test, storage and disposal
- …installed separately or in avionics equipment

Copies of RTCA standard DO-311
may be obtained from RTCA, Inc. at
http://rtca.membershipsoftware.org/store_product.asp?prodid=1097

or by contacting RTCA at
202-833-9339.

BACKUP

Rechargeable Lithium Batteries – Small & Medium

- SC-225
  - Chair: Boeing
  - 56 Companies participating
- Committee established March 2011
- Certification guidance for small to medium size rechargeable lithium batteries and battery systems that are permanently installed on aircraft
- Anticipated completion in October 2013

Rationale for SC-225

- Standards for non-rechargeable large exist
- Certification guidance for small & medium does not exist.
- The aviation industry is seeing increased use of these small and medium sized rechargeable Lithium batteries in Avionics and Cabin Systems equipment.
- Certification guidance will enable a more efficient and standardized certification approach across the industry.

RTCA Standards re: Batteries

- DO-311, MOPS for Rechargeable Lithium Battery Systems
- DO-293A, MOPS for Nickel-Cadmium, Nickel Metal-Hydride, and Lead Acid Batteries
- DO-227, MOPS for Lithium Batteries
- DO-188, Emergency Locator Transmitter (ELT) Batteries Guidance and Recommendations
- DO-160G, Environmental Conditions and Test Procedures for Airborne Equipment

SC-225 Member Companies

- A123Systems Inc.
- ACME Aerospace
- Aeroflex Plainview
- Air Line Pilots Association
- Airbus Americas, Inc.
- Airbus Industries
- American Airlines, Inc.
- ANAC-Brazil
- Association of Flight Attendants
- Astronics AES
- BAE Systems Controls
- Bell Helicopter Textron Canada
- Beyond the Edge
- Bitrode Corporation
- CARERI
- Cessna Aircraft Company
- Concorde Battery Corporation
- Crane Aerospace & Electronics
- Day-Ray Products, Inc.
- DME Corporation
- EaglePicher Technologies LLC
- EIC Laboratories
- EMBRAER
- EnerSys
- European Aviation Safety Agency
- Federal Aviation Administration
- FedEx Express
- Gogo LLC
- GS Yuasa Corporation
- Gulfstream Aerospace Corporation
- Honda Aircraft Company, Inc.
- International Communications Group
- Intertek Testing Services NA
- JSR Micro Inc.
- L-3 Communications
- Marathon/Norco Aerospace Inc.
- Mid-Continental Instruments
- Mobile Power Solutions
- NASA
- National Fire Protection Association
- NSWG Carderock
- Overlook Consulting, Inc.
- Panacis
- Panasonic Avionics Corporation
- PRBA - The Rechargeable Battery Association
- RTCA, Inc.
- Saft America, Inc.
- Securaplane Technologies
- Teledyne Controls Division
- TES Electronic Solutions
- The Boeing Company
- Thompson Aerospace
- Transport Canada
- U.S. Army
- Universal Avionics Systems Corp.

Updating Standards, Creating New Standards

- Requests from FAA or industry
- Drivers:
  - Experience using standard or operating equipment
  - Forecasted change in airspace environment (NextGen)
  - New, improved technology
  - International activity
- Threshold to start activity
  - Minimum of 3 companies
  - FAA intention to reference
  - Critical mass of participants