DOE's H2@Airports Virtual Workshop

Nov. 4 - 6, 2020

Joint SAE (AE-7AFC)/EUROCAE(WG-80) Hydrogen & Fuel Cells Working Group

Standardization Activities on Hydrogen & Fuel Cell Technologies for Airborne Applications

Chairman: Olivier Savin (Dassault Aviation)

Co-Chairman: Massoud Sadeghi (Dynamic Aerospace Services)

Secretary: Carlos Mourao (Embraer)

EUROCAE / SAE Working Group at a Glance

- SAE AE-7AFC and EUROCAE WG-80 jointly established in 2008
- Develop guidelines to support qualification and certification of Hydrogen and Fuel Cell Systems in various aircraft applications
- 80+ members, including ~20 active attendants
  - Airframers
  - System integrators
  - Component manufacturers
  - Gas/hydrogen equipment suppliers
  - Researchers and test centers
  - Certification agencies
- 3 face-to-face meetings per year
- Bi-weekly virtual meetings

Hydrogen in Aviation

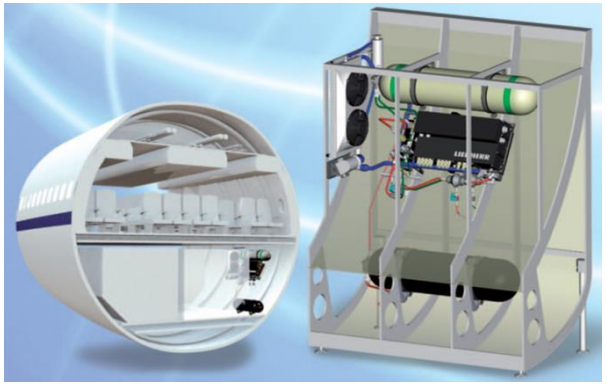
- Why use hydrogen as an energy carrier?
  - Zero-emissions locally (and globally if green hydrogen)
    - Water is the only byproduct (can be partly used on-board)
  - Benefits for electric flight
    - Gravimetric (high energy density)
    - Logistical (short refueling time)
    - Life-cycle costs (low operational cost, high availability)
  - May readily be produced locally
- Where using hydrogen and fuel cells in aviation ecosystem
  - Aircraft
    - Systems: APU, Galleys, RAT, etc.
    - EHPS: Main source and as range extender
  - Ground Support: airport vehicles, ground power units, battery charging, etc.
    - H2@Aviation, H2@Airport
- Experience with automotive/truck/train sectors transferable to aviation
  - Investments in drive systems, refueling
  - Understanding of safe handling and operations
  - Global H2 market is developing rapidly, including “green” hydrogen

Fuel Cell Safety Guidelines

* AIR6464/ED-219 “Aircraft Fuel Cell Safety Guidelines”
* First document released by AE-7AFC/WG-80 (2013)
* Definition of terms related to on-board fuel cell and hydrogen systems
* Provides technical guidance for safe integration of proton exchange membrane (PEM) fuel cell systems including:
  * Risk assessment and flammability considerations
  * Design for safety
  * Liquid and gaseous hydrogen storage system
  * Installation considerations (crashworthiness, handling, fueling,…)
* Reaffirmed in 2020

Fuel Cell System Performance Specifications

* AS6858/ED-245 “Installation of fuel cell systems on large civil aircraft”
* Based on initially released AIR6464/ED-219 it provides detailed technical requirements for design and installation (2017)
* Detailed specifications provided for three PEM fuel cell system applications fed by gaseous hydrogen:
  * Medical evacuation operation as power supply for e.g. medical equipment
  * Standalone galley power isolated from electrical aircraft system
  * Emergency power system in case of loss of electrical power from aircraft engines

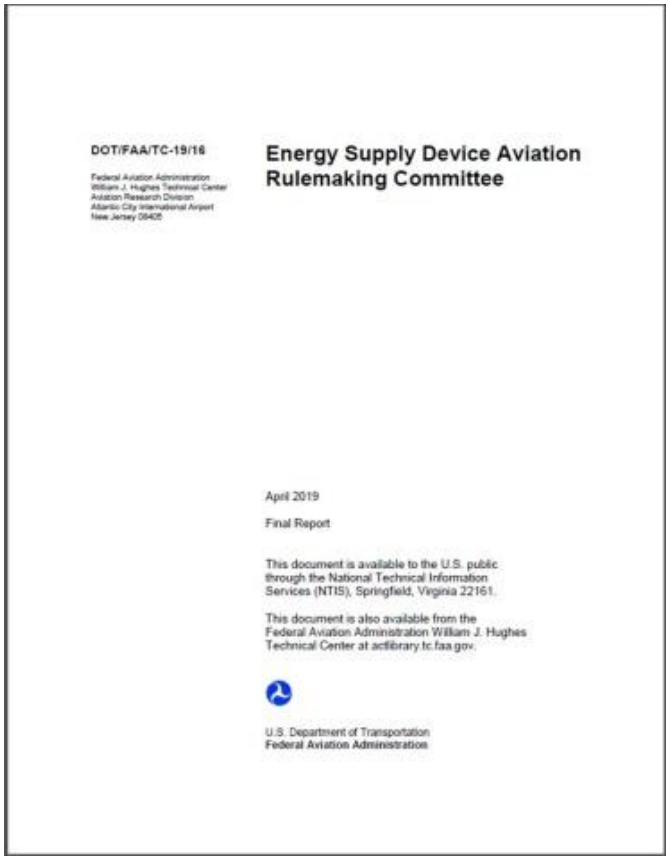


Considerations for Hydrogen Fuel Cells in Airborne Applications

* AIR7765/ER-20 - A comprehensive document for 'decision-makers' on hydrogen, its applications and its benefits for aircraft (issued in 11/2019)
  * Why and how to use hydrogen and fuel cells in aviation
* Covers:
  * Introduction to hydrogen (properties, production, storage)
  * Current hydrogen usage (mobile and stationary)
  * Hazards and mitigations
  * Benefits for airborne applications


FAA's Aviation Rulemaking Committee

- WG members invited to support FAA's Energy Supply Device ARC (issued 04/15/2015), including industry, standardization and governmental bodies
- Recommendations w.r.t. airworthiness and operational rules / standards and guidance:
  - Proposed new requirement in a performance based and prescriptive form
  - Identified need for change of existing requirements and indicated need for guidance
- Main focus on Fuel Cell Systems,
  but other ESD are addressed
- Report finished and published by the FAA on 04/2019



DOT/FAA/TC-19/16

Federal Aviation Administration
William J. Hughes Technical Center
Aviation Research Division
Atlantic City International Airport
New Jersey 08405

Energy Supply Device Aviation Rulemaking Committee

April 2019

Final Report

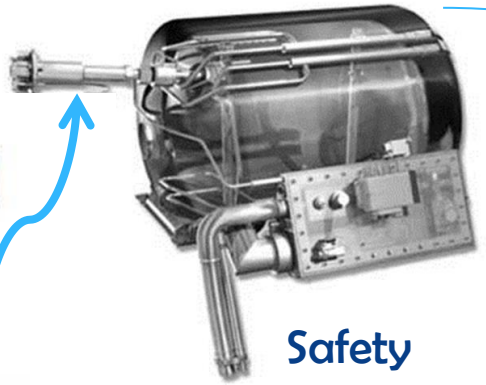
This document is available to the U.S. public through the National Technical Information Services (NTIS), Springfield, Virginia 22161.

This document is also available from the Federal Aviation Administration William J. Hughes Technical Center at actlibrary.tc.faa.gov.

U.S. Department of Transportation
Federal Aviation Administration

Liquid Hydrogen Storage for Aviation

* AS6679/ED-XXX (WIP 2019-2021)
* Describes LH2 general properties and system definition
* Specifies critical requirements for the safe use of liquid hydrogen (LH2) on-board aircraft and on ground in terms of:



Operation : storage and distribution

Maintenance

Safety

Installation

Qualification

Certification

Conclusions

* Our joint international WG on Hydrogen/Fuel Cells is very active on highly relevant standardization topic
* WG is establishing grounds for safe and airworthy use of hydrogen and fuel cells for airborne applications
* Includes representatives from major stakeholders in the aerospace industry: gathers hydrogen/fuel cells experts from all over the world
* Join us and contribute to the sustainable future of aviation !

THANK YOU