THE TENTH TRIENNIAL INTERNATIONAL AIRCRAFT FIRE AND CABIN SAFETY RESEARCH CONFERENCE

SAE A-22 AND AS6826 STATUS

October 2022

A-22 Powerplant Fire Protection and Flammability Testing Committee
Co-Chairs: John Ostic (Boeing) & Daniel Laborie (GE)
Secretary: Brian Stewart (Spirit AeroSystems)

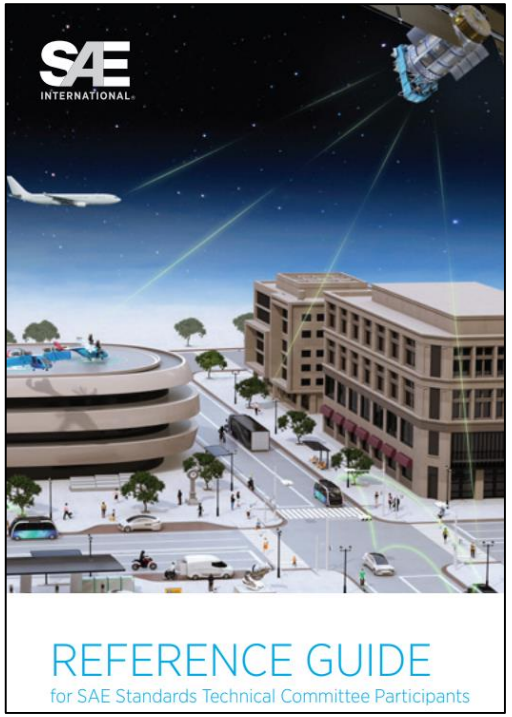
SAE INTERNATIONAL

Abstract

This presentation will brief the aircraft fire safety community on the current state of AS6826 Powerplant Fire Test Standard being developed by the SAE A-22 Fire Protection and Flammability Testing Committee. The A-22 was chartered by the FAA in 2018 to develop SAE standards or recommended practices to address the FAA Tasking Request pertaining to updating AC20-135. The SAE AS6826 Powerplant Fire Test Standard provides the applicant with fire test methodologies and pass / fail criteria that have been found to be acceptable means of compliance by the certification authorities to meet the applicable propulsion system component and powerplant installation fire protection requirements. In addition, as there are various guidelines for fire testing which have led to wide variations in fire test approaches and test pass/fail criteria, this document provides more prescriptive test methodologies and test pass/fail criteria standards for fire testing of various propulsion system components and powerplant installations.

SAE A-22: Background and Purpose

The SAE A-22 Fire Protection and Flammability Testing Committee was initially formed in March 2018 to support the update of FAA AC20-135. The committee is comprised of individuals from across the industry including aviation certification authorities. The committee is responsible for creating and maintaining technical standards pertaining to acceptable means of testing aircraft and propulsion system components and their installations (CFR/CS 23, 25, 27, 29, and 33). The committee works with regulatory authorities to ensure that the standards developed support certification requirements across the globe. While the initial task was to improve upon the existing AC20-135 powerplant installation fire test standard, the scope has grown to include harmonizing test methodologies, developing recommended practices, and maintaining other test standards.



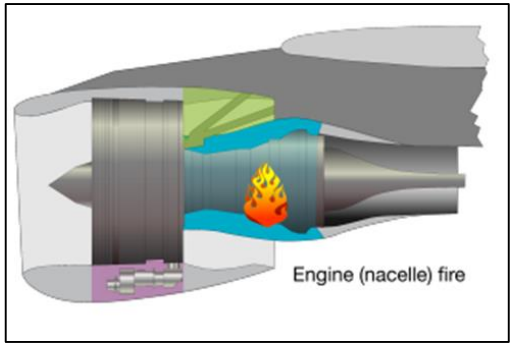


Image Courtesy of Airbus

SAE A-22 Committee Objectives and Initial Program of Work

The objectives of the committee are to:

- Develop and publish SAE Technical Reports for testing of fire protection systems, components, and structure
- Define test requirements for aircraft and propulsion systems
- Develop performance standards for certification testing of aircraft and propulsion systems
- Define the sensitivities and accuracy of equipment used to conduct fire and flammability testing
- Harmonize global testing methodologies

INITIAL PROGRAM OF WORK

Develop SAE standards or recommended practices to address the FAA Tasking Request to develop industry standards to update AC20-135, *Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards and Criteria*. The proposed standards will be used to demonstrate compliance with powerplant fire protection requirements. In addition, methods used to calibrate and set-up a new sonic burner as an optional replacement for existing fire test burners will be developed.

2016 Original Top 10 Industry Needs	
1	Post-Test Burning & Backside Ignition
2	Burner & Flame Temperature
3	Flame Calibration
4	Definitions: Fireproof, Fire-Resistant, Heat Flux
5	Test Pass/Fail Criteria including TSO hoses
6	Thermocouples (Size, Type, Number)
7	Environment and Operating Conditions
8	Panel Size
9	Materials
10	Harmonize with Other Specifications and References

SAE A-22 Committee Participants

Current SAE Roster Includes ~200 Participants from Industry and Regulatory Authorities

- **Consistent and Meaningful Support from FAA, EASA, TCCA, and ANAC**

Airplane Mfg.
Airbus
Boeing
Bombardier
Boom Supersonic
COMAC
Dassault
Embraer
Gulfstream
Heart
Mitsubishi
Textron/Cessna
Turkish Aerospace

Engine Mfg.
GE
Honeywell
Pratt & Whitney
Rolls-Royce
SAFRAN

Transport Canada

Helicopter Mfg.
Airbus
Bell/Textron
Sikorsky/Lockheed

Certification Authorities
Brazil (ANAC)
Canada (TCCA)
China (CAAC)
Europe (EASA)
Israel (CAAI)
United States (FAA)

ANAC

Component Mfg.
Air Liquide Tech
Akro Fire
Eaton
JPR Hutchinson
Meggitt
Luxfer MEL Tech.
Parker
Titeflex
Trelleborg
Triumph
Unison Industries

MRO Engineering
MHIRJ

Government Institutions
FAA Tech Center
Naval Air Systems Command (NAVAIR)
National Research Council (Canada)
ONERA (France)

Academia/Research
Concordia Univ. Montreal
Rescoll (Bordeaux Univ.)
University of Cincinnati
Wichita State University

Industry Consultants
Danker Associates
GE Aviation
Marlin Engineering
Nacelle Group
Waldron Aerosystems
Gordon & Gordon Engineering

Commodity Manufacturers
AIM Altitude
GKN
Safran Nacelles
Spirit AeroSystems
RTC/PW/UTC/Collins
ST Engineering
Zodiac Aerospace

Standards Org.
NACE
SAE

FEDERAL AVIATION ADMINISTRATION

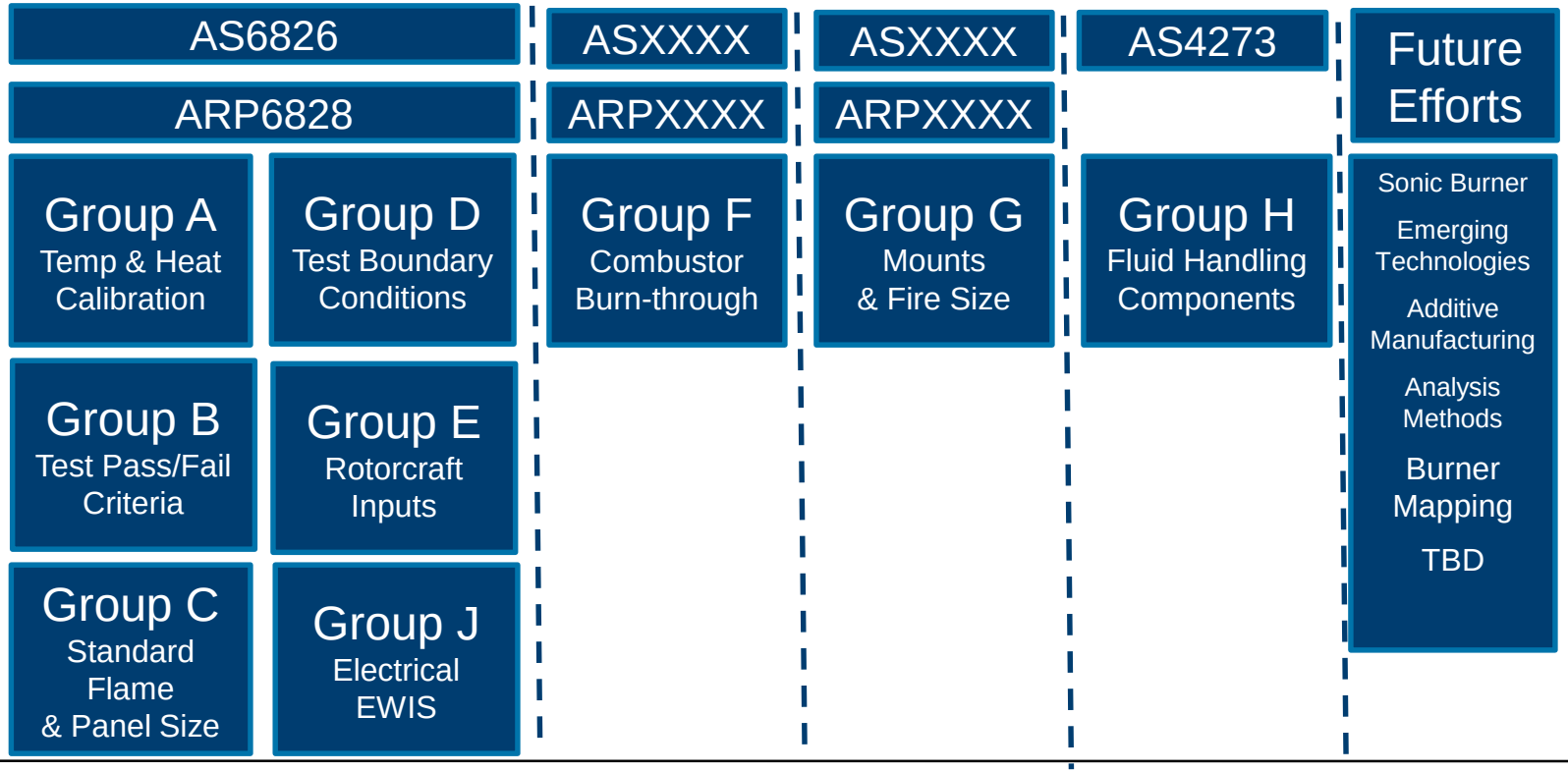
Testing Facilities
ACES
Accufleet
Aeroblaze
CTA
DGA
Element
Govmark
Lefae-Emitech
NIAR
NTS
Resonate

EASA

SAE A-22 Committee Groups and Documents

Committee is Currently Organized into Groups to Address Tasks Related to Several SAE Documents

- **AS 6826 – Powerplant Fire Test Standard**
- **ARP 6828 – Powerplant Installation Level Fire Safety Assessment**
- **AS 4273 – Fire Testing of Fluid Handling Components for Aircraft Engines and Installations**
- **ARP or AS XXXX - Combustor Burn-through Guidance**
- **ARP or AS XXXX - Protection of Engine Mounts, Flight Controls, and Other Structure**



SAE A-22 Group Responsibilities and Efforts

Group A
- Temperature Calibration
- Heat Flux Calibration
- TC and Instrumentation

Group B
- Post Test Burning
- Prescriptive Pass/Fail Criteria
- Industry Examples

Group C
- Standard Flame
- Panel Size
- Burner Position/Orientation

Group D
- Environmental Boundary and Operating Conditions

Group E
- Rotorcraft Input
- Harmonizing Flight Maneuver Loads During Fire Event

Group F
- Combustor Burn-Through Model
- Drafting MoCs for Hole Diameter & Shape, Case Pressure, etc.

Group G
- Fire Protection of Engine Mounts, Flight Controls, and Other Structure
- Aligning Fire Protection and Certification Standards to 25.865

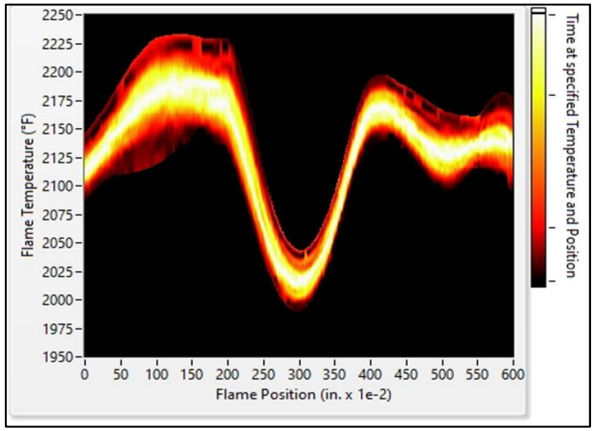
Group J
- Electrical/EWIS Regulations
- Fire Testing of Electrical Components

AS6826 Powerplant Fire Test Standard: 2022 Significant Accomplishments

- Progressed throughout Covid-19 era via regular monthly virtual all-committee meetings and sub-group meetings
- Transitioned through changes in our regulatory (FAA) focal, one A-22 chairperson, and our SAE administrator
- Increased coordination between committee and regulatory authorities to provide guidance and feedback
- Increased coordination between regulatory authorities to facilitate harmonization
- Developed detailed plans for water calorimeter setup
- Completed industry testing of TCs size, type, and aging cycles to evaluate impact on temperature measurements
- Combined initial sub-group (A-D) documents into a single document in preparation for balloting
- Added sub-groups to address needs related to rotorcraft, electrical, combustor burn-through, engine mounts, etc.

AS6826 Powerplant Fire Test Standard: Significant Changes

- Copper Tube Water Calorimeter as Instrument to Verify Heat Flux
  - Setup Details Defined
- Added Post Test Heat Flux Verification
  - 4500 BTU/Hr Clean, 4100 BTU/Hr Dirty
- Average Flame Temperature Calculation
- Define Thermocouple
  - Type, Size
- Use of Sonic Burner Allowed
  - Calibrated Using Same Methods as Legacy



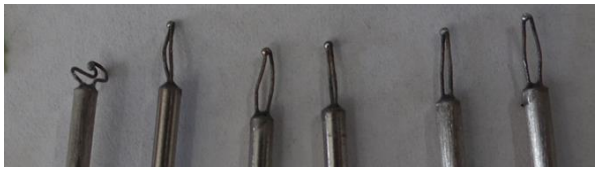


Photo Courtesy of ACES

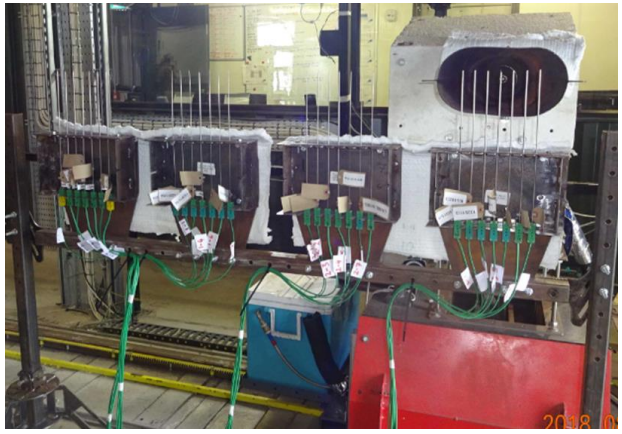
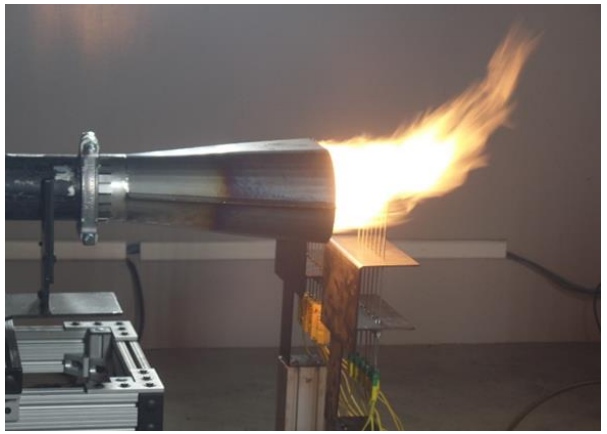


Photo Courtesy of Resonate

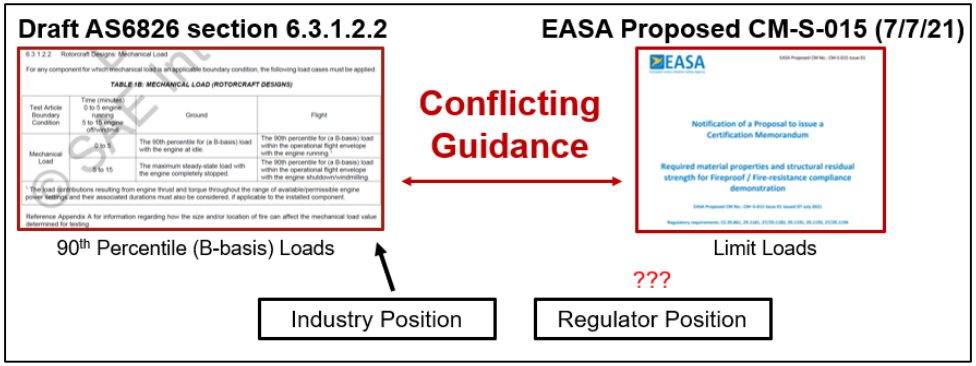


Photos Courtesy of Aeroblaze Labs

AS6826 Powerplant Fire Test Standard: Significant Changes

- Pass-Fail Criteria Defined to Allow Pass/Fail Determination at Time of Test
- Detailed Guidance for Defining Test Boundary Conditions
  - Loads (in-work)
- Post Test Residual Burning
  - Acceptance Criteria (Duration, Size)
  - Component Functionality
  - Maintaining Boundary Conditions
- No Flammable Fluid Leakage

Photo Courtesy of Eaton Aerospace



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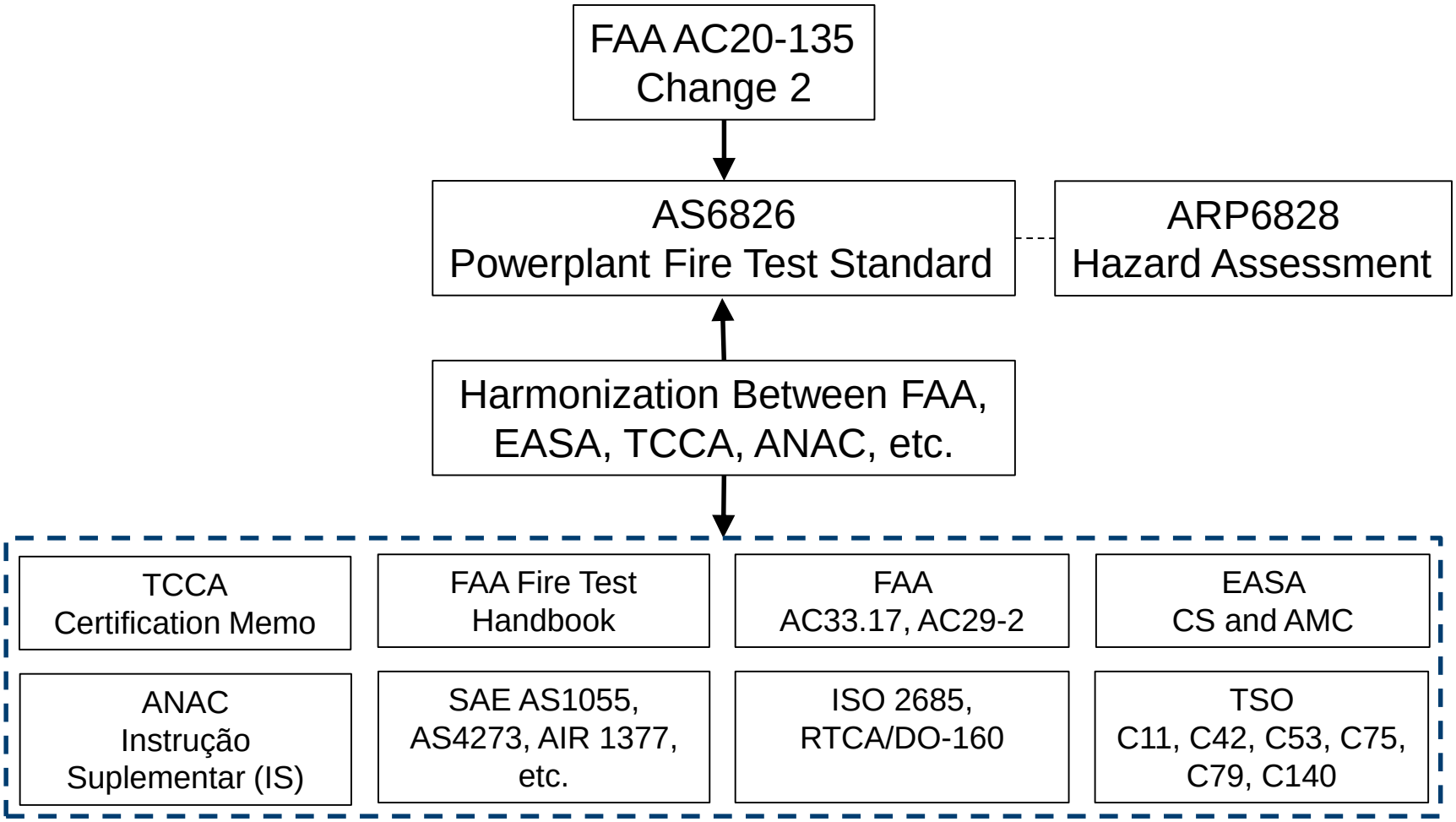
AS6826 Fire Test Standard Implementation: AC20-135 and Other Updates



Note, the new AS6826 fire test standard is intended to provide acceptable means of compliance to be recognized by FAA AC20-135 (for example, similar to AC20-155A for Lightning Protection)

SAE A-22 Fire Test Document – Roadmap & General Timelines

Are we there yet? Almost…

AS 6826

- **AS6826 Initial Release Balloting: *November 2022***
- **AS6826 document publication: *June 2023***
- **FAA AC20-135 and RA Document Revisions to Reflect AS6826: *2023 – 2024***

AS 4273

- **AS4273: *June 2023***
- **Revise or Stabilize Document**

ARP 6828

- **ARP 6828 Completion: October 2022 - March 2023**
- **ARP 6828 Balloting: *June 2023***
- **ARP 6828 Document Publication: *December 2023***

ARP XXXX

- **xxx**
- **xxx**
- **xxx**

…Plus Future Efforts – Sonic Burner, Burner Mapping, Emerging Technologies…