UP-DATE ON AIRBUS FIRE SAFETY RESEARCH AND DEVELOPMENT
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Introduction

A/C Size / Regulation Evolution

Max Pax

B747-100
A300 B4
B707-330
B747-400
B777-300
A340-300
B777-200
A380


100 200 300 400 500 600 700 800

12s horizontal test only
12s vertical test only
Vertical + horizontal Bunsen burner tests
Cargo liners burn through resistance
Seat cushions fire resistance
Lavatory fire protection
Cargo class D to C
HRR 100/100
HRR 65/65 + Smoke 200
Insulation materials

Amendments

14 32 59 60 66 74 93 61
Introduction

Airbus Fire Safety Specification

**Airbus Internal FST Requirements**

Airbus Directive (ABD 0031) contains fireworthiness design criteria for use inside the pressurized section of the fuselage.

More stringent requirements for smoke emission and toxic gases
F-S-T Requirements

**FAA/EASA**
- 60 s Flammability
- Heat Release
- Smoke emission

**Airbus**
Side wall panel
- 60 s Flammability
- Heat Release*)
- Smoke emission *)
- Toxicity

*) more stringent requirements

**Overhead Bin Door**
- 60 s Flammability
- Heat Release*)
- Smoke emission *)
- Toxicity
Introduction

Airbus Fire Safety Specification

- Tapes/Adhesives
- Wiring incl. brackets
- Air ducts incl. ducting, insulation and brackets
- Primary insulation
Introduction

• Tremendous improvements in aircraft safety have been introduced since the past 20 years
• Air transportation has become along the years, the safest means of mass transport ever

But

• Further efforts in fire safety research are required in order to keep reducing the risk of accidents
Areas of Current and Future Research

- Fuel System Safety
- Oxygen
- Hidden Areas / Burnthrough - Resistance
- Smoke/Fire Detection
- Halon Replacement
- Evolution on Materials - Fire Safety -
Evolution on Material Fire Safety

Cabin Interior 80 years ago
Evolution on Material Fire Safety

Cabin Interior today
Hidden Fire Research

Research Objectives

• Upgrade of materials in hidden areas to the level of fire resistance as proposed for insulation materials

• Develop new Fire Test Method based on “Radiant Panel Test”

Status

• Full scale and radiant panel test program in progress to evaluate the flame propagation behavior of state of the art materials
Hidden Fire Research Full Scale Test

Airbus Hidden Fire Test Set Up

Window Frame with Heating Element

Air Ducts with Heating Element
Fuselage Burnthrough Resistance

Research Objectives

• To prolong a safe environment of the passengers inside the cabin in the event of a post crash fire scenario

• To develop adequate materials and designs to improve burnthrough resistance

Status

• Various burnthrough configurations tested (e.g. burnthrough between decks)

• Much of upper part of A380 burnthrough protected by GLARE
## Fuselage Burnthrough Resistance

<table>
<thead>
<tr>
<th>Fuselage Materials</th>
<th>Burnthrough Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium, 1.8 mm</td>
<td>37</td>
</tr>
<tr>
<td>Aluminium, 1.8 mm</td>
<td>150</td>
</tr>
<tr>
<td>(incl. insulation + lining)</td>
<td></td>
</tr>
<tr>
<td>GLARE, 2.4 mm</td>
<td>no flame penetration</td>
</tr>
<tr>
<td>CFRP, 3.0 mm</td>
<td>no flame penetration</td>
</tr>
</tbody>
</table>
Fuselage Burnthrough Resistance

GLARE Burnthrough Test Pieces

- No burnthrough within 7 min
- Low Smoke
- Low Toxicity
Small Scale Burnthrough Test

Test method to evaluate burnthrough characteristics of materials / designs

Sample size: 600 x 600 mm

Suitable test method for pre-selection of materials and design
Full Scale Burnthrough Test
Smoke/Fire Detection Systems

Research Objectives

• Fire and smoke detection system with drastically reduced false alarm rate

• Multi - Criteria - Smoke Detection System

• Means for visualisation of status inside cargo compartment

Status

• Multi - Criteria – Smoke Detection System on A380

• Video camera aided fire and / or smoke indication developed
Smoke/Fire Detection Systems

Fire Detection Technology

Particle Sensing
• Photoelectric Sensor
• Laser Particle Sensor
• Light Attenuation Sensor
• Ionisation Sensor

Gas Sensing
• Semicond. Metal Oxide Sensor
• Infra Red Sensor
• Electrochemical Cell

Temperature Sensing
• Metallic Resistors
• Thermistors
• Silicon Semicond. Temp. Sensors
• Thermoelectrical Devices
• Piezoelectrical Devices
• Temperature Radiation Sensing
• Fibre-Optical Cables
Halon Replacement

Research Objectives

• Environment friendly (non-halon) fire extinguishing system that:
  - provides same level of safety
  - creates limited disbenefits / Halon
  - is fully compatible with the A/C environment

Status

• Halon replacements for cabin fire extinguishing purposes available
• Alternatives for cargo fire suppression system under study
Halon Replacement

Research on OBIGGS and Water Mist System
OBIGGS: On-Board Inert Gas Generating System

Gasgenerator

Water-Pressure Tank

Single Fluid Nozzles

Cargo Compartment

Inert Gas Nozzle

Bleed Air

Heat Exchanger

OBIGGS

OEA

NEA
Fuel System Safety

Research Objectives

• Prevention of ignition source within fuel tanks

• Demonstrating functionality of an On-Board Inert Gas Generating System (OBIGGS) on an Airbus A320 (OBIGGS developed by FAA)

• FAA / Airbus joint ground / flight test program

Status

• Ground / Flight tests have demonstrated the functionality of the system
Fuel System Safety

Airbus A320 OBIGGS Flight Test Installation

- Heat Exchanger
- Bleed Air
- Air Separation Modules
- Nitrogen Enriched Air Exit
OBIGGS Principle

- Cooling Inlet
- Heat Ex.
- Filter
- Waste OEA Flow
- Overboard Exit
- Monitoring, Control & Indication
- ASM = Air Separation Module
- OEA = Oxygen Enriched Air
- NEA = Nitrogen Enriched Air

Fuel Tank
Alternative Oxygen on Board

Research Objectives

• To reduce quantity of gaseous oxygen or chemical generators on-board

Status

• Solutions under investigation:
  - OBOGS “On-Top” to refill on-board oxygen cylinders
  - OBOGS “On-Line” to generate oxygen on demand

• Flight test program running at Air Liquide company

OBOGS: On-Board Oxygen Generating System
Alternative Oxygen on Board

Typical OBOGS Installation (On-Line Configuration)
Conclusions

• Prevention of incidents/accidents by anticipating and solving problems before they occur

• Continued efforts to improve fire safety required

• Manufacturers are committed to Fire Safety Research

• Balance of aircraft safety / economics and performance
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