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FIREDETEX

New Fire/Smoke Detection and Fire Extinguishing Systems for Aircraft Applications

EADS Airbus GmbH Payload Systems/Engineering Cargo Compartment/Fire Protection D-28183 Bremen Germany

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Thomas Grabow, EADS Airbus GmbH











Fire Detection: Background

- Today, all fire sensors in the fuselage are smoke detectors (ionisation- and photoelectric sensors)
- False alarm rate is high (due to dust, cargo condensation, ...)
 - This may lead to a/c turnbacks, emergency landings, evacuations, halon discharge, AOG, ...
- New Wide Body Aircraft with Lower Deck Facilities or Megaliners feature:
 - Double deck configuration (stairways, lifts, ...)
 - New kind of not permanently occupied area as crew rest, conference rooms, ...
- Detection of smouldering fires in electronic bays is not possible with todays systems
- New fire suppression requires new fire detection
 - Especially for a water mist system the detection system must be able to detect hot spots to minimise water consumption





Fire Detection: Goals

- Suppression system compatible fire and smoke detection for cargo compartments with drastically reduced false alarm rate
- Technology for "electrical wire overheat" detection
- Means for visualisation of status inside cargo compartment as additional tool for cockpit crew





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. Sensor
- Thermoelectrical Devices
- Piezoelectrical Devices
- Temperature Radiation Sensing
- Fibre-Optical Cables







Fire Suppression: Background (1)

- Since more than 30 years halons are used successfully for fire fighting
- Halons represent an excellent compromise between extinguishing efficiency and toxicity
- In all modern aircraft halons are used for fire fighting applications
 - Halon 1211 (CF₂CIBr):
 - Handheld Extinguishers
 - Halon 1301 (CF₃Br):
 - Cargo Compartment
 - Engine
 - Lavatory
 - APU





Fire Suppression: Background (2)

- Halons belong to the HCFCs which deplete the stratospheric ozone layer
- Developed countries have banned halon production and use in the Montreal Protocol since January 1994
- A suitable alternative is not available for aviation, due to special requirements as to:
 - Toxicity
 - Maintaining visibility
 - Necessary extinguishing mass/volume





Fire Suppression: Goals

- Environmentally friendly (non halon) fire extinguishing system on the basis of water mist and nitrogen
- Technology for on-board inert gas generation (OBIGGS) for cargo compartments





Installation of Halon Cargo Fire Extinguishers







Smoke Detector and Halon Nozzle Arrangement in Cargo Compartment







Fire Suppression: Technology

Water Mist System

2 possible system architectures:

- Total Flood System
 - **Complete cargo compartment is flooded with water mist after fire detection**

Zonal System

- Matrix layout of nozzles under ceiling or in sidewall allow suppression within limited zones of the cargo compartment
- Requires detection which can localise fire (point detection), e.g. optical fibre





Principle of Zonal Water Mist Fire Suppression

Water mist nozzles installed in matrix constellation

Detection system able to detect and localise hot spots

1 – n nozzles can be triggered to suppress a fire in zone x







Fire Suppression: Technology

Gas System

- On board nitrogen generating system (OBIGGS) for inerting of the cargo compartment
 - Bleed air can be separated by membrane technology into nitrogen enriched air (NEA) and oxygen enriched air (OEA), the nitrogen-enriched air is distributed into the cargo compartment











Fire Suppression: Technology

Combination of Water Mist and Gas System

- Combination of benefits of both technologies: 2-step fire suppression process
- Knock-down with water mist
 - + Short time = low mass
 - + Initially available
 - + Environmentally friendly
- Long time inerting with OBIGGS membrane system
 - Certain time necessary to build up suppression effective concentration
 - + Always available
 - + Environmentally friendly

















Expected Results

- Environmentally friendly (non halon) fire extinguishing system on the basis of water mist and nitrogen
- Technology for on-board inert gas generation (OBIGGS) for cargo compartments
- Suppression system compatible fire and smoke detection for cargo compartments with drastically reduced false alarm rate
- Technology for "electrical wire overheat" detection
- Means for visualisation of status inside cargo compartment