

Aircraft Fire

Fire Safety

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New combustion modes in aeronautical turbines

Combustion

Propulsion

Turboreactor

Turboengine

helicopter

Problematic

- Development of advanced combustion chambers
- Reduction of fuel consumption $\approx \text{CO}_2 \downarrow$ and fuel cost, of pollutant emission (NO_x, CO, Unburnt fuel particles, VOC..), of noise,...

Electric power generation

Auxiliary power unit (APU)

Fuel cell (generation of H₂ from kerosene)

FIRE SAFETY, EXPLOSION

FIRE PROTECTION

In cabin
and cargo

In engine

Fire safety researches in aeronautics

- Great differences in comparison with **building fires**
scenarios of fire development, detection, *flashover*, *back draft*,
materials, structure behaviour, ...
- Risk is weak
but not acceptable { **Prevention**: avoid fire triggering
 Protection: to minimize fire consequences

Why the fire risk is increasing?

- Full electrical plane (cable fires, ...)
- Increasing of electronic systems onboard (TV, electronic games, internet)
- The increase of composite materials and magnesium alloys
- The use of halon is soon forbidden (fire development in hidden zones)
- Post-crash fire

Fire prevention

- **Passive**: Non flammable and **non toxic** cabin material, hot surface insulation, double skin for **drainage**
- **Active**: forced ventilation, hot air leak detection

Evaporation and ignition



Flame stabilization processes



⇒ Hazardous flammable fluid quantity

Fire protection

- **Passive**: firewalls (composite?), cargo liners,...
- **Active**: Extinction systems (water mist, inerting systems), smoke detection and propagation

Detection / extinguishing / inerting systems in hidden areas

Conclusion

Aircraft fires are specific fires, where the risk is not acceptable

Main criteria: to satisfy the regulations and to manage a problem

Needs of

- **Experimental studies:** better understanding of tests results
- **Flow Modeling** (evaporation, ignition, flame stabilization, fire development, flame-material heat transfer)

High scientist potential, research networks already exist in Europe

Adaptation of the knowledge to specific aeronautics problem

A project was proposed at the two first calls of FP7