



## Plan of Experiments – Primary Structures Materials – Final Requirements, Selection and Specification of Materials and Tests

M. Oliveira (CEiiA), J. Berthe (ONERA), G. Leplat (ONERA), C. Huchette (ONERA), A. Sanz Rodrigo (AD&S), R. Reis (Embraer)

Short abstract: Future Sky Safety is a Joint Research Programme (JRP) on Safety, initiated by EREA, the association of European Research Establishments in Aeronautics. The Programme contains two streams of activities: 1) coordination of the safety research programmes of the EREA institutes and 2) collaborative research projects on European safety priorities.

This deliverable is produced by the Project P7 “Mitigating the risk of fire, smoke and fumes”. The main objective of this deliverable is to plan the experiments of the proposed test program for characterization of primary aircraft structure composite material behavior, when exposed to fire and/or elevated temperatures.

<b>Programme Manager</b>	Michel Piers, NLR
<b>Operations Manager</b>	Lennaert Speijker, NLR
<b>Project Manager (P7)</b>	Eric Deletombe, ONERA
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## EXECUTIVE SUMMARY

All aeronautical structures are subject to damage as a result of fatigue, overloading conditions, material degradation through environmental effects, and unanticipated discrete events such as fire or elevated temperature environments usage. Damage compromises the ability of the structure to perform its primary functions, and hence safety. Therefore, to ensure the understanding of the influence of fire and temperature, a less studied factor on the performance standards on damage of aeronautical primary structures, analytical and experimental analyses will be performed to characterize the influence of fire and temperature on the mechanical properties of primary structure composite materials.



Figure 1 – Fuel Fire on a metallic aircraft structure

This report is framed within the context of the Future Sky Safety program, and has been specifically developed in Work Package (WP) 7.1 – “*Understanding and characterizing the fire behavior of primary structure composite materials*” of Project P7 – “*Mitigating Risks of Fire, Smoke and Fumes*”.

FSS Project P7 has in its focus the objective of increasing aircraft safety – meaning, reducing the number of fatalities – with respect to fire related issues (in-flight or post-crash). For this purpose research works – based on new approaches - will be undertaken on a reference material with the objective of increasing the knowledge, improving the physical understanding and means of characterization of the fire behavior of modern primary structures composite materials (and more specifically in the present WP7.1 work package Carbon Fibers Reinforced Polymers – CFRP). The reference material of interest is the Hexcel® HexPly® M21/35%/268/T700GC.

The compilation of this document represents the first step towards the development of D7.1 – “Primary Structures Materials – Final Requirements, Selection and Specification of Materials and Tests”. The scope of the work concerns on the one hand the effects of fire on materials (production of heat, toxic fumes and smokes), and on the other hand the effects of fire on structures (burn-through, strength) that can endanger the passengers’ life directly (exposure) or indirectly (evacuation). Enclosed in WP7.1, this document is a compilation of WP7.1 partners’ proposed test programs.

The test program is divided into two main parts:

- **Chemical and Physical Characterization of the Composite Material under temperature**
  - Physical Properties Testing,
  - Chemical Properties Testing,
  - Mechanical Properties Testing,
  - Thermo-mechanical Properties Testing.

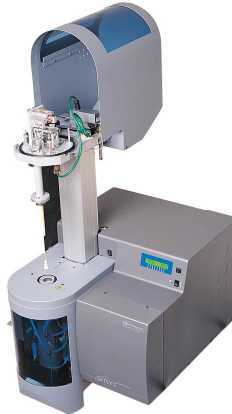


Figure 2 – Dilatometric measurement : SETSYS Evolution testing device from SETARAM

- **Characterization of the Composite Material under Fire**
  - Fire Behavior Testing,
  - Smoke & Fumes Properties Testing.



Figure 3 – Burnthrough test on an aircraft material panel

After the first batch of tests is performed, an updated plan of experiment will be provided together with the technical D7.4 deliverable (month 15) which will include the first batch of test results. In particular, Cranfield University's plan of experiment will be added to the present test description.