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STS-16

Hypersonic Flight Technology Developments for Civil Air Transport in Europe

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Session Abstract

Keywords: *Hypersonic flight, stratospheric altitude, liquid hydrogen*

Since fifteen years, the European Commission has been funding projects devoted to civil high-speed air transport at stratospheric altitudes, with the final goal to reduce the duration of antipodal flights to 2-4 hours. These vehicles take off and land as conventional aircraft. They are equipped by propulsive systems using liquid hydrogen as fuel and are able to accelerate up to Mach 5-8 at typical cruise altitudes of 25-35km. Studies have demonstrated the technical and economic feasibility of hypersonic flight, also highlighting that various misconceptions or prejudices exist resulting in the formulation of particular paradoxes and paradigms.

Many technological aspects have been deepened, when developing complex systems as cruise vehicles and flight demonstrators, by exploiting latest developments in computational mechanics and applied mathematics, including experimental campaigns for validation: i) aerodynamics and aerothermodynamics; ii) air breathing propulsion (precooled turbojets, air turbo rockets, dual-mode ramjets/ scramjets); iii) air-hydrogen combustion; iv) NOx emission reduction and jet noise abatement; v) flight mechanics, trajectory optimization and GN&C; vi) avionics, on-board instrumentation, flight control system; vii) structural airframe, materials layout, thermal protection system, thermal control system, thermo-structural analysis.

The modelling approach has ranged from engineering tools used in preliminary stages of the projects to high-fidelity properly validated simulation tools for detailed design phase, requiring without doubt a multi-disciplinary approach that needs flight data for its validation.

This STS will present the status of technology developments in European research institutions, university and industries, showing some key achievements that are contributing to enhance the accuracy and fidelity of design tools to be used for future high-speed passenger aircraft.

Figure 1: *LAPCAT-II A2 cruiser (left) and LAPCAT-II MR2.4 vehicle (right)*

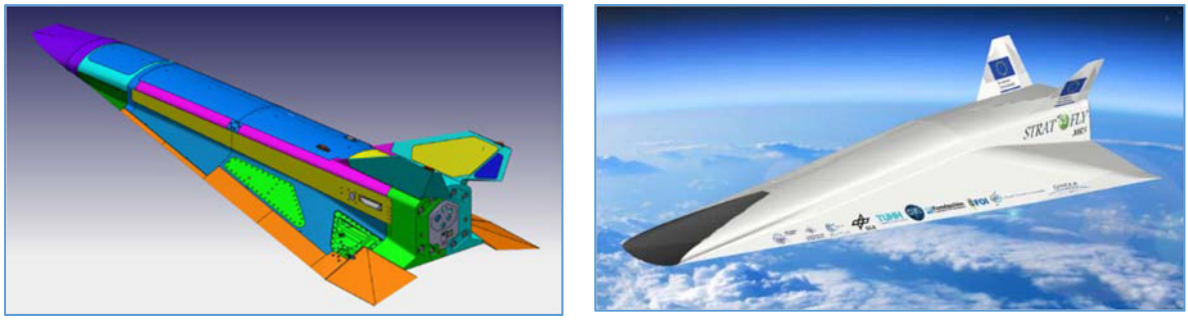

Figure 2: *HEXAFLY-INT EFTV glider (left) and STRATOFLY MR3 vehicle (right)*

List of paper titles and speakers of STS-16:

High-Speed Transportation: Challenges, Paradigms and Paradoxes
Johan Steelant, ESA-ESTEC, Noordwijk, The Netherlands, Johan.Steelant@esa.int

HEXAFLY-INT: Design of the Experimental Flight Test Vehicle
Sara Di Benedetto, CIRA, Capua, Italy, s.dibenedetto@cira.it

Main Challenges of the Concept of Operations of Future High-Speed Aircraft: The Case of STRATOFLY MR3
Nicole Viola, Politecnico di Torino, Turin, Italy, nicole.viola@polito.it

Combined cycle propulsion system design and challenges for STRATOFLY MR3 power plant
Bayindir H. Saracoglu, VKI - von Karman Institute for Fluid Dynamics, Rhode-Saint-Genese, Belgium, saracog@vki.ac.be

The SABRE Hypersonic Test Bed (HTB) – A European Hypersonic Flight Research Vehicle
Richard Varvill, Reaction Engines Ltd., Culham Science Centre, Abingdon, Oxon, U.K., Richard.Varvill@reactionengines.co.uk