PROJECT

VULCAN

Vulnerability Analysis for Near Future Composite/Hybrid Air-Structures: Hardening via New Materials and Design Approaches Against Fire and Blast due to Accidents or Terrorist Attacks

Funding: European (6th RTD Framework Programme)

Duration: Oct 2006 - Feb 2011

Status: Complete with results

Total project cost: €4,916,529

EU contribution: €2,987,383

Call for proposal: FP6-2005-AERO-1

CORDIS RCN : 81489

Background & policy context:

The increase of air traffic is not accompanied by a similar percentage of increase in airborne accidents; however, the absolute number of fatalities due to accidents has increased. Moreover, despite the strict safety measures, terrorist acts cause the probability of internal or external incident of fire or blast to increase. More than ever, passenger airborne safety and consumer faith require hardening strategies, which should be incorporated in aircraft design.

Composite and hybrid metal/composite aero structures are nowadays considered as the only way to obtain a safe, light, environmentally friendly and cost-effective aircraft. This fact is reflected in the constantly increasing usage of such materials in the new generation of civil aircrafts. The improvement of current aircraft against blast and/or fire incidents remains an open issue; therefore the vulnerability of composite and hybrid structures under such loading is requiring more intense research than ever.

Objectives:

The objectives regarding blast are:

- development of algorithms, material models and failure criteria for high strain rate loading of composites and hybrid materials, and calibration of the numerical tools against experimental results;
- development of numerical tools for blast vulnerability analysis of composite and hybrid aeronautical structures;
- blast vulnerability map of composite and hybrid-scaled fuselage substructures for different charge locations and different explosive quantity;
- implicit and explicit blast hardening strategies of composite and hybrid aerostructures by design and by materials (including novel design approaches tailored to the new generation materials).

The objectives regarding fire are:

- development of algorithms, material models and failure criteria for fire behaviour: criteria for fire spread and fire burn-through;
- fire vulnerability map of in-flight fire spread and burn through conditions in composite and hybrid-scaled fuselage substructures for different types of flame intensity and location;
- implicit and explicit fire hardening measures for composite and hybrid aerostructures by design and by novel materials to reduce fire spread.

Methodology:

Numerical tools will be developed and validated against experimental findings in order to develop a vulnerability map of typical sub-structures. Vulnerable locations will be identified and reinforced in two ways:

- by introducing novel design approaches, and
- by using tailored novel composite and hybrid materials.

Implicit and explicit measures will be considered based on reinforcing design strategies and novel materials.

Finally, hardened sub-aero structures will be designed, manufactured and validated aiming at a tenfold increase in blast and fire resistance compared to those currently used with the minimum weight penalty.

Parent Programmes:

FP6-AEROSPACE - Aeronautics and Space - Priority Thematic Area 4 (PTA4)

Institute type: Public institution

Institute name: European Commission

Funding type: Public (EU)

Lead Organisation:

Integrated Aerospace Sciencees Corporation (Inasco)

Address:
Miaouli St., 22
MOSCHATO - ATHENS
Greece

Organisation Website:
http://www.inasco.com

EU Contribution: €0

Partner Organisations:

Laboratory Of Technology And Strength Of Materials - University Of Patras

Address:
Panepistimioupolis Rion
26500 PATRAS
Greece

Organisation Website:
http://www.mech.upatras.gr/~ltsm

EU Contribution: €0

University Of Sheffield

Address:
Western Bank, firth court
SHEFFIELD
S10 2TN
United Kingdom

Organisation Website:
http://www.sheffield.ac.uk/

EU Contribution: €0

Health And Safety Executive

Address:

2 Southwark Bridge
LONDON
United Kingdom

EU Contribution: €0

Nederlands Organisation For Applied Scientific Research

Address:
Schoemakerstraat 97
6060 DELFT
Netherlands

Organisation Website:
http://www.tno.nl

EU Contribution: €0

Institut Fur Vebundwerkstoffe Gmbh

Address:
Erwin-Schrodinger Strasse; Geb.58
KAISERSLAUTERN
Germany

Organisation Website:
http://www.ivw.uni-kl.de

EU Contribution: €0

Fundacion Inasmet

Address:
Paseo Mikeletegi , Parque Tecnologico Miramon 2
20009 SAN SEBASTIAN
Spain

Organisation Website:
http://www.inasmet.es

EU Contribution: €0

Associacao Para A Valorizacao E Promocao Da Oferta De Empresas Nacionais Para O Sector Aeronautico - (Pemas)

Address:
DEP - Campus de Azurem
GUIMARAES
Portugal

Organisation Website:
http://www.pema.pt

EU Contribution: €0

Royal Military Academy - Patrimony

Address:
Renaissancelaan 30
BRUSSELS
Belgium

Organisation Website:
http://www.rma.ac.be

EU Contribution: €0

Politchnika Warszawska (Warsaw University Of Technology)

Address:
Pl. Politechniki 1
Warsaw
Poland

Organisation Website:
http://www.pw.edu.pl

EU Contribution: €0

Hellenic Aerospace Industry

Address:
TANAGRA
23 SCHIMATARI
Greece

Organisation Website:
http://www.haicorp.com

EU Contribution: €0

Israel Aerospace Industries Ltd.

Address:
Ben Gurion International Airport
Lod 70100
Israel

Organisation Website:
http://www.iai.co.il

EU Contribution: €0

Piep - Polo De Inovacao Em Engenharia De Polimeros

Address:
Universidadee do Minho, Campus de Azurem
GUIMARAES
Portugal

Organisation Website:
http://www.piep.pt

EU Contribution: €0

Sener Ingenieria Y Sistemas

Address:
AVENIDA ZUGAZARTE 56
48930 GETXO
Spain

Organisation Website:
http://www.sener.es

EU Contribution: €0

Swerea Sicomp Ab

Address:
PITEA
Sweden

Organisation Website:
http://www.ifpsicomp.se

EU Contribution: €0

Bae Systems (Operations) Limited

Address:
Warwick House, Farnborough Aerospace Centre
FARNBOROUGH, HAMPSHIRE
GU14 6YU
United Kingdom

Organisation Website:
http://www.baesystems.com

EU Contribution: €0

Rolls Royce Plc

Address:
65 Buckingham gate
LONDON
SW1E 6AT
United Kingdom

Organisation Website:
http://www.rolls-royce.com

EU Contribution: €0

Key Results:

One of the major innovations of VULCAN is the development of novel hardening methodologies for aircraft structures against blast and fire incidents. These methodologies will be based upon the adoption on novel materials (and material technologies) and the application of new design approaches which are expected to significantly enhance aircraft safety and security. Going one stage further, the experience gained through the envisaged test campaign will be consolidated in proposing new standards for the study of blast and fire incidents and thus provide the roadmap for an integrated approach to the issue of civil aircraft survivability.

This project is directly addressing the subject of passenger survivability: VULCAN will identify research, and specify and introduce strategic approaches which will bring major benefits to the safety of the passengers, thus minimising the number of fatal losses, even in the case of onboard terrorist actions.The outcome of VULCAN will provide methodologies readily applicable to aircraft design and the anticipated benefits will reflect the realisation of safer airborne structures within the next five to seven years.

In this way VULCAN is expected to contribute to the sustainable development of a sector that has suffered serious blows in the last few years and thus enables the European air transport sector to reinforce its current global position and continue to increase, offering employment and better customer service.

Documents:
01-INASCO-VULCAN_seminar-Introduction(3).pdf (Project presentation)

STRIA Roadmaps: Vehicle design and manufacturing

Transport mode: Air transport

Transport sectors: Passenger transport, Freight transport

Transport policies: Safety/Security

Geo-spatial type: Network corridors