European Commission

BOLTED JOINTS IN COMPOSITE AIRCRAFT STRUCTURES (BOJCAS)

University of Limerick (co-ordinator)(IRL), Airbus UK (UK), CIRA (I), DERA (UK), EADS Airbus (D), FOI (S), ISTRAM (GR), KTH (S), NLR (NL), SAAB (S), SMR (CH)

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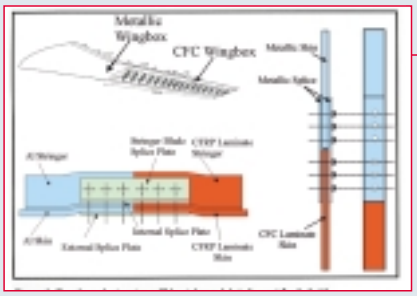


Benchmark structure 1: Skin-stringer joint element for hybrid metal/composite wing (courtesy Airbus UK)

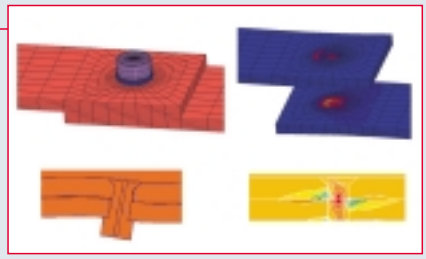
Project objectives

The objective of the project BOJCAS is to develop advanced numerical design methods for bolted joints in composite aircraft structures. This is a critical technology supporting the introduction of composites into the primary structure of large commercial aircraft. The methods to be developed have the potential to significantly reduce testing and hence the time and cost of development, as well as aircraft weight.

A set of representative benchmark structures have been designed by the industry partners. An example of such a structure is shown in the figure to the left. This is a metal-composite skin-stringer joint as proposed for use in a wing-box. The benchmark has been proposed by Airbus UK and originates from the design of the TANGO lateral wing-box (Contract No. G4RD-CT-2000-00241).

Development of numerical methods

These benchmark structures will be used to test and evaluate the numerical methods to be developed in the project. The numerical analysis is aimed at two levels: a global level and a local level. The two methods will have to be coupled for proper design of a composite structure. As an example, the figure to the right shows some of the detailed local analysis of a single lap joint, relating to the benchmark structures described above.



courtesy DERA and ULIM

The analyses shown have been performed by DERA (UK) and the University of Limerick (IRL) using existing tools. The project developments will include improved detailed analyses as well as the introduction of coupling of the local method to the global analysis.

Single-lap joint with single fastener-specimen test setup (courtesy DERA)

Experimental testing and numerical evaluation

Finally, an experimental test programme will be carried out not only on the benchmark structures, but also on smaller-scale joints. These tests will provide further data related to the phenomena studied in the project, as well as providing data for validation of the detailed models.

The figure on the left shows one of these test setups and results, relating to the benchmark structures and the detailed analyses described above. The specimens should provide additional information on the behaviour of bolted joints.