Presentation of BOPACS (Boltless Assembling of Primary Aerospace Structures) **Project**

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Participants

Short name	Participant organisation name	Country
NLR	Nationaal Lucht- en Ruimtevaartlaboratorium NLR	NL
CEN	Cenaero ASBL, Centre de recherches en Aéronautique	BE
UCL	Université Catholique de Louvain, Institute of Mechanics, Materials, and Civil Engineering	BE
SAB	Société Anonyme Belge de Constructions Aéronautiques SABCA S.A.	BE
VZLU	VÝZKUMNÝ A ZKUŠEBNÍ LETECKÝ ÚSTAV, A.S.	CZ
DLR	Deutschen Zentrums für Luft- und Raumfahrt	D
USTUTT	Institut für Flugzeugbau, Universität Stuttgart	D
EADS	EADS Deutschland GmbH (European Aeronautic Defence and Space Company)	D
UPAT	Laboratory of Technology & Strength of Materials, University of Patras	GR
ZHAW	Zurich university of Applied Science	CH
BAB	Bombardier Aerospace - Belfast	UK
IFAM	Fraunhofer Institut für Fertigungstechnik und angewandte Materialforschung (IFAM)	D
AD	Airbus Operations GmbH	D
FID	FIDAMC	ES

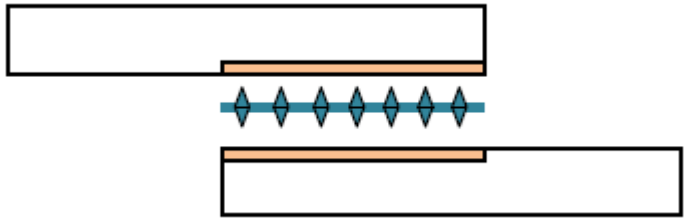
Project objectives

To meet airworthiness requirements for secondary bonded structures BOPACS (Boltless assembling Of Primary Aerospace Composite Structures) proposes a rigorous road map to certification by developing Means of Comply based on:

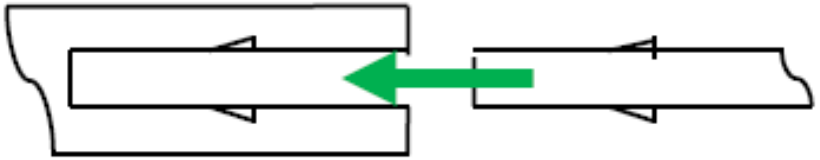
1. Thorough research, beyond the state of the art, into the crack growth / disbond extension mechanisms in adhesively bonded joints.

2. Design, analysis, testing and assessment of different categories of crack stopping design features, i.e. features that are capable of preventing cracks or disbonds from growing above a predefined acceptable size, with a joint still capable of carrying the limit load.

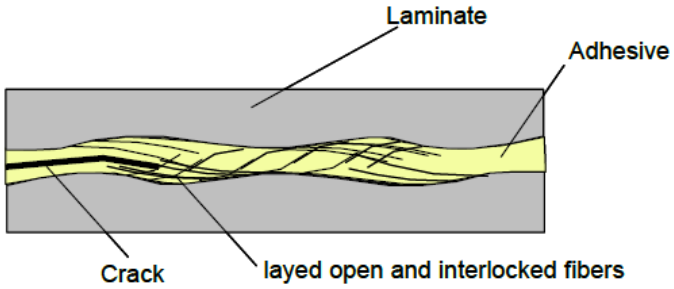
Some Crack Stopping Features



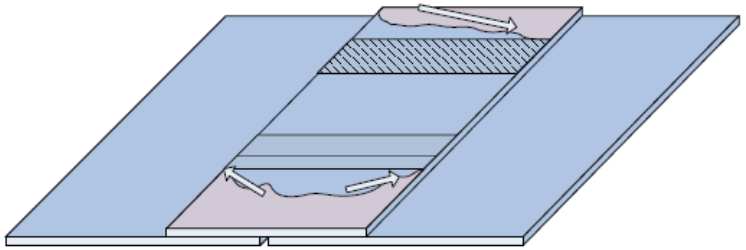
Metallic mesh with surface interfering features



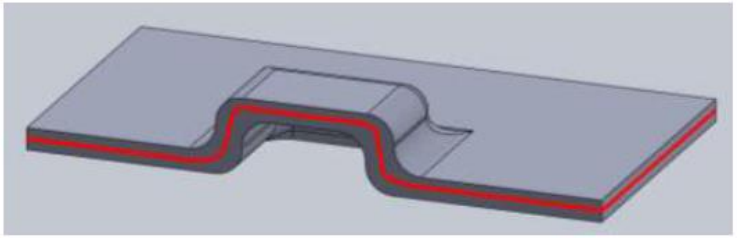
Principle of clipping surfaces in a double lap joint



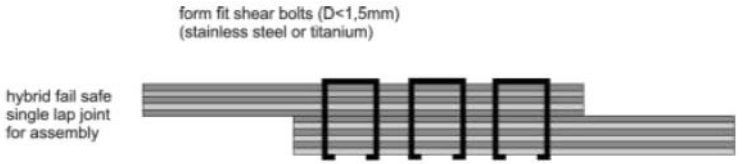
Adherent surface etching & stripping illustration



Adherent surface patterning concept

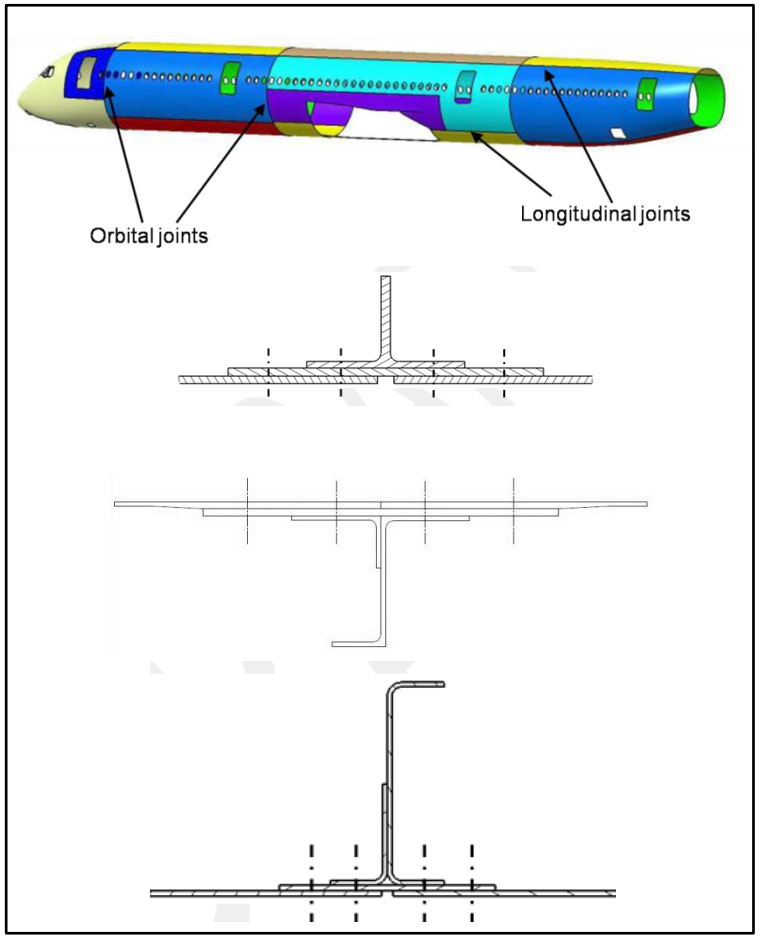


Corrugation principle

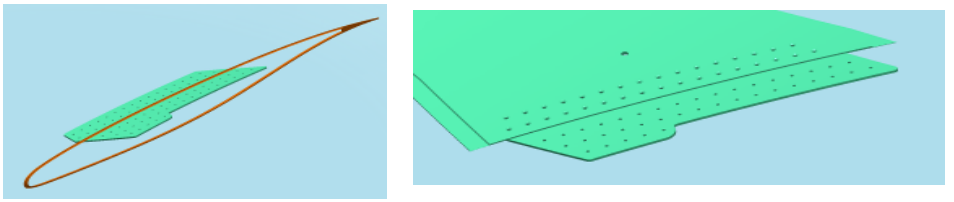


A hybrid bonded joint with staples

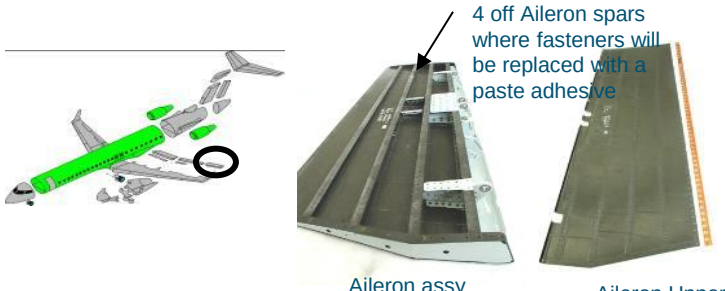
Some Applications



Skin panels assembly at stiffener and stringer locations (Courtesy of SABCA)



Generic butt strap joint for Airbus winglet-wing connection (courtesy of ZHAW)



Bonding of the aileron upper skin to the spars (Courtesy of Bombardier)

Airbus A350 Frame Clip Connection (courtesy of Airbus)

Methodology

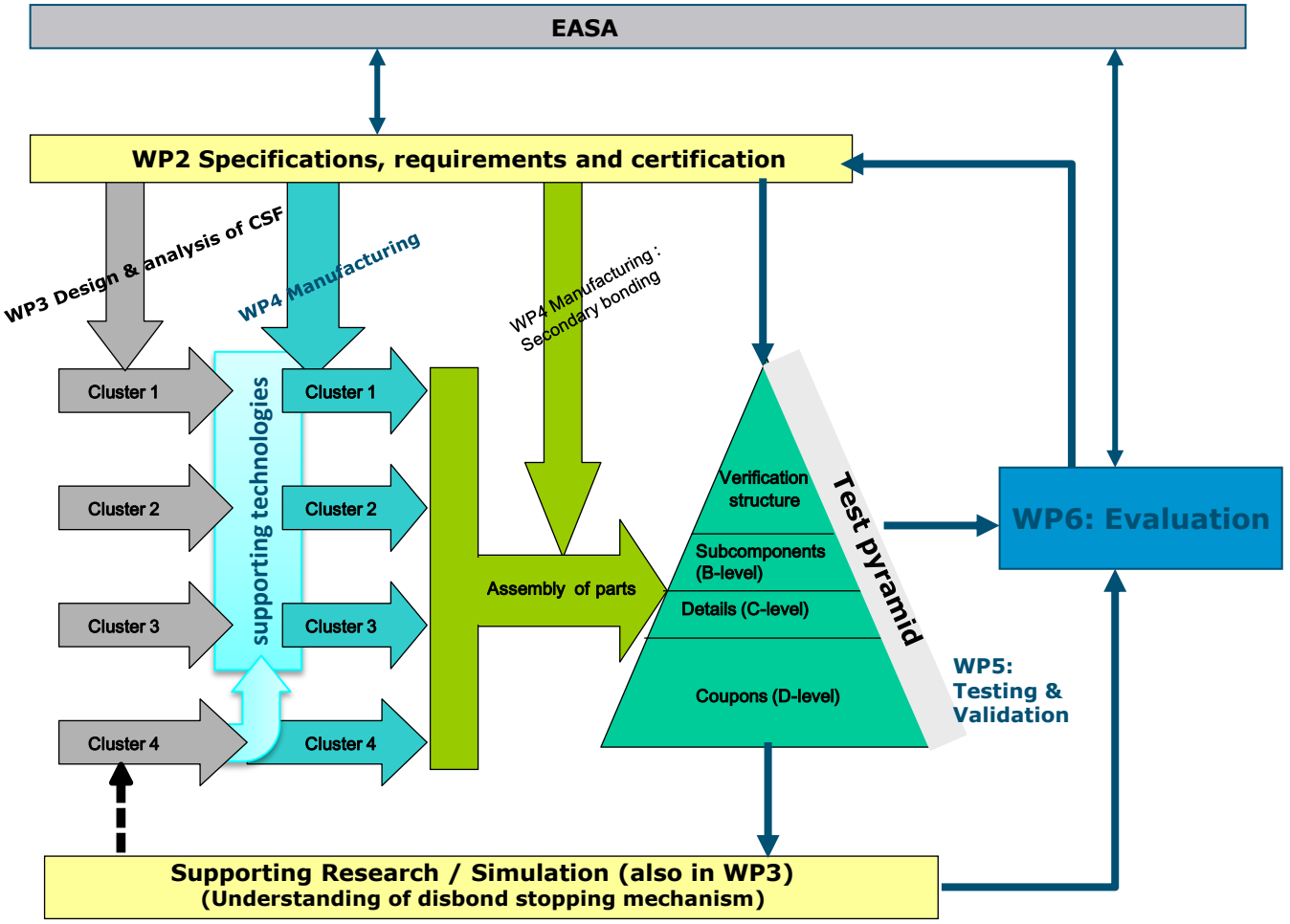
Generate and down selection of DSF's by the partners working together in 4 clusters:

Cluster 1:
Surface interfacing features

Cluster 2:
Surface and Geometry Modification

Cluster 3:
Mechanical through thickness Features

Cluster 4:
Adhesive bondline architecturing



General information

- FP7 funding of 4.5 Meuro
- Project started on September 2012 and will run until March 2016
- Project coordinator: Jan Halm (NLR)