

### 3.1 Publishable summary

#### Project details

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| <b>Project Title</b>                                                              | Innovative Repair Of Aerospace Structures With Curing Optimization And Life Cycle Monitoring Abilities                                                                                |
| <b>Project Logo</b>                                                               | <b>Coordinator's details</b>                                                                                                                                                          |
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| <b>Project web site</b>                                                           | <a href="http://www.iapetus.eu">www.iapetus.eu</a>                                                                                                                                    |

The aircraft industry is in dire need for reliable and cost efficient in-the-field repair technologies that will facilitate patch application and will reduce depot service time for aircrafts, contributing to reduction of the overall operational cost.

Composite patches are ideal for aircraft structural repair as they offer enhanced specific properties, case-tailored performance and excellent corrosion resistance. IAPETUS focuses on the use of improved composite repair systems offering (i) the introduction of new on-aircraft simplified curing technologies, (ii) enhanced fatigue and damage tolerance properties and (iii) integrated damage sensing. This can be performed via the incorporation of carbon nanotubes (CNTs) in the composite matrix of the repair patch. The use CNT modified repair concept will lead to improved performance in the blunting of stress concentrations in the parent surface and the inhibition of crack propagation, leading to enhanced fatigue resistance at the locus of the repair as well as for the patch itself. At the same time, the patch repair acquires additional functionalities. The CNT doped Carbon Composites can be tailored to reduce the galvanic corrosion in repaired Aluminium structures. As the patch becomes electrically and thermally conductive thermal energy can be infused in the patch either by direct resistance heating (using the patch itself as heating element via the application of electrical voltage) or by induction heating, to instigate a uniform matrix polymerization since the patch system appears improved thermal conductivity too. The electrically conductive percolated network can be employed to assess the damage within the patch and its interface with the repaired structure, as conductivity changes mirror the damage in the doubler/substrate system by tracing micro damage through breaches in the CNT network; thus, the structural efficiency monitoring at any stage in the service life of the aerostructure can be assessed non-destructively.

IAPETUS aims at revolutionizing aircraft repair processes with composite materials by using novel hybrid composites which are expected to fully exploit the unique properties of nano-scaled fillers in the matrix in order to step change the hot bond field repair by:

IAPETUS aims at revolutionizing aircraft repair processes with composite materials, (mainly the hot bond repair approach used in field repair) by using novel hybrid composites and adhesives. These materials are expected to fully exploit the unique properties of nano-scaled fillers in the matrix and adhesive systems in order to step change the hot bond field repair by:

- Introducing an innovative curing methodology for composite patch repair on aluminium substrate (induction heating) and composite patch repair on composite substrates (direct resistance heating) with the benefits of homogenous heating and curing and the minimization of the developed thermal stresses. In addition the introduction of an on line curing monitoring system will allow for a precise control of curing concluded to enhanced quality of the resulted repair.
- Providing direct inspection of the repair integrity and continuous health monitoring of the repaired site in service.
- Offering increased mechanical and bonding performance in the repair itself

**Project duration**

From 01 June 2009 to 31 December 2012