PRIMARY COMPOSITE STRUCTURES REPAIR: CHALLENGES AND INNOVATIVE SOLUTIONS

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Abstract: Despite the high damage tolerance of the composite solution for Airbus Aircraft, some large damages can occur leading to industrial and scientific challenges for developing an optimal solution [1]. "In field" repair of composite primary principal structures is a very strategic issue for the aeronautical industry. Whatever the material (metallic or composite), the Structural Repair Manual (SRM) does not cover all repairs. As far as a composite solution is concerned, the fuselage and wing cannot be dismantled (and even if it could be, it would not be in accordance with schedule and cost for airline companies). Structural damage needs a "case by case" solution including design, calculation phases, damaged zone removal, patch construction, set-up and finishing. To respond to the needs of a "case by case" solution, a partnership (between ICA and CES, since 2002) led to an original concept called Multi-Instrumented Technological Evaluator toolbox (MITE toolbox). This toolbox allows a test/calculation dialogue adapted to the particular case of composite structures from the design standpoint of composite structural parts.

It deals with a set of complementary sets of "tools" and "methodologies". MITE toolbox involves three parts of equivalent importance: experimental, numerical and structural set-ups.

The objective of this toolbox is to address the response of limited size specimens (MITE) under complex loading and at the same time containing the scales representative of the industrial structure. The MITE can be designed for a case by case situation to study particular issues introduced by a design features within a structure. This approach is cheaper than a direct assessment of a real industrial part, and definitively well adapted to the situation of a repair zone (companion of the "building block approach"). We can choose the location of the zone of interest and the nature of the solicitation optimizing the MITE loading path. Several examples of advanced repair technological evaluators will be presented. These examples have provided a useful input to an increasingly important subject addressed by SAE CACRC (Commercial Aircraft Composite Repair Committee) in 2016 [2]. References:

1. Collombet, F., Grunevald, Y.H., Crouzeix, L., Douchin, B., Zitoune, R., Davila, Y., Cerisier, A., Thévenin, R. Chapter 10 Repairing composites, In book Advances in Composites Manufacturing and Process Design, Chap. 10, p.197-227. Ed.© 2015 Elsevier Ltd. 2015 ISBN: 978-1-78242-307-2.

2. Collombet, F. et al. Advanced Methodology to Evaluate Design of Large Bonded Composite Repair, invited lecture by Dr. Simon Waite, Senior Expert - Structures and Materials of European Aviation Safety Agency, AMS CACRC Commercial Aircraft Composite Repair Committee EASA, Cologne (Germany), 19th-23rd Sept. 2016.