**ZAero - Zero defect manufacturing of composite parts in the aerospace industry**

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**ABSTRACT**

ZAero project is an European project. The aims of this project is the inline control of the defects that may occur during the manufacturing of a stiffened panel.

The aims of this project is the inline control of the defects than may happen along the manufacturing of a stiffened surface panel. The ZAero control system consists in sensors integrated in the lay-up machine and sensors used during the resin infusion and curing processes. These sensors will detect defects out of the acceptance threshold giving a response. This response may be a rework as in the case of defects produced during lamination stage or the variation of curing parameters in the infusion and resin curing stage due to the process monitoring.

Three demonstrators will be manufactured. The degree of complexity will be increased in each demonstrator. The control system through sensors will make a quality control and when a defect that is outside the range of acceptance a response will occur.

The ZAero system provides an inline and automatic system for defect detection during the manufacturing of a stiffened surface panel by sensors.

The system detects deviations in real time, analyzing their impact in the final part in terms of mechanical performances, proposing rework operations to solve them if it were needed thanks to the Decision Support Tool.

The Part Flow Simulation Model analyses the status of each tooling / station involved in the manufacturing process to feed the Decision Support Tool in order to get the optimal response avoiding bottle necks in case of deviations.

### Visualization of part flow simulation

#### LAY-UP PROCESS

- **LScan** → laser profile scanner to acquire 3D profiles
- **LScan** → laser triangulation for height measurements of DFP lay-up

#### INFUSION AND CURING PROCESSES

- **Electrical Time Domain Reflectometry (E-TDR) sensor:**
  - Flow front, Cure degree & Tg
- **Electrical resistance:**
  - Temperature

### MATERIALS AND TECHNOLOGY

Two different technologies of automated lay-up which have similar needs for inspection will used.

- **Dry Fiber Placement (DFP)**
- **Uni-axial material**
- **Automated Dry Material Placement (ADMP)**
- **Multi-axial material**

### MANUFACTURING TRIALS

- **DEMONSTRATOR 1**
  - Focused on testing lay-up monitoring.
  - Defects will be induced during the manufacturing to assess the detect detection capabilities of the inline sensor systems.
  - A prototype system for inline quality control will be manufactured.

- **DEMONSTRATOR 2**
  - Lay-up inspection and curing monitoring.
  - Demo with double curvature in order to identify potential lay-up defects as excessively wide gaps, overlaps, twisted yarns or other defects. Dimensions: 1700x1700mm.
  - An intermediate version of the inline quality support will be manufactured.

- **DEMONSTRATOR 3**
  - Demo 3 is like Demo 2 with three stringers.
  - A full version of the inline quality support will be manufactured.

### PROJECT PLAN

- The duration of the project is 36 months (October 2016 to October 2019).
- 1st Demonstration will be planned to month 12 (October 2017).
- 2nd Demonstration will be planned to month 24 (October 2018).
- 3rd Demonstration will be planned to month 36 (October 2019).

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