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CREATING THE FUTURE

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

AUTHORS: A.R. Rodriguez, J. Cuenca, R. Ruiz, A. Calero

ABSTRACT

ZAero project is an European project. The aims of this project is the inline control of the defects that will be produced along the manufacturing of a stiffened surface panel.

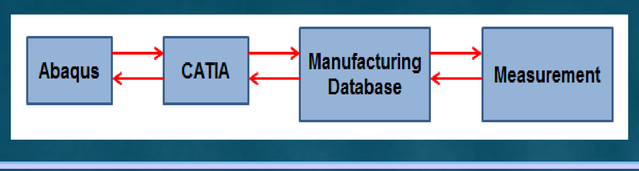
The ZAero control system consists on sensors integrated in the lay-up machine and sensors used during the infusion and resin curing processes. These sensors will detect defects that are outside the acceptance range and a response will occur. This response may be a rework as in the case of defects produced in the lamination stage or the variation of parameters produced in the infusion and resin curing stage due to the process monitoring.

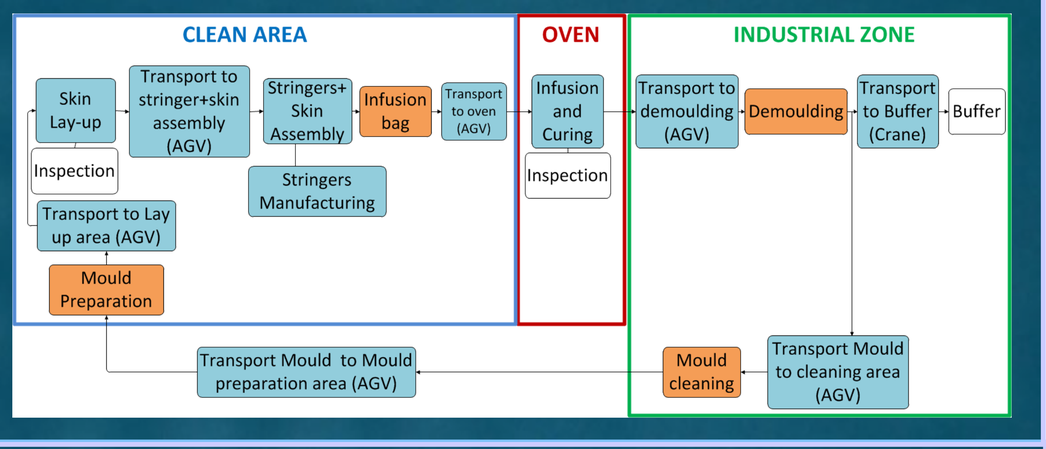
Three demonstrators will be manufactured. The degree of complexity will be increased in each demonstrator. The control system through sensors will make a quality control and when a defect that is outside the range of acceptance a response will occur.

ZAERO CONTROL SYSTEM

The ZAero system provides an inline and automatic system to detect defects during the manufacturing of stiffened surface panel by sensors.

The inline inspection that will perform the control system is shown in the following figure.

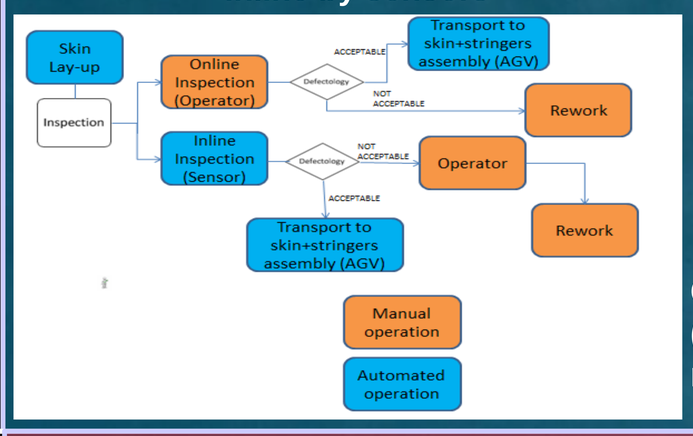




LAY-UP PROCESS

Lay-up process → Every layer is automatically inspected inline by sensors → Sensor

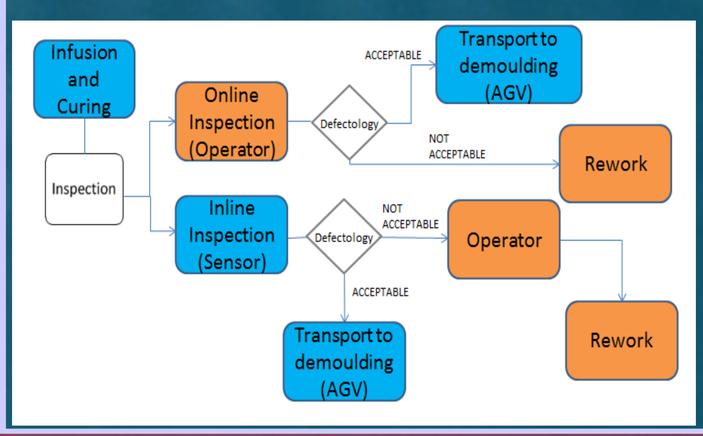
- **Fscan → laser profile scanner to acquire 3D profiles**
- **Lscan → Reflection model to measure fibre orientation**



Current working method (orange) and ZAero method (blue)

INFUSION AND CURING PROCESSES

Infusion and curing processes → Sensor → Electrical Time Domain Reflectometry (E-TDR) sensor



Current working method (orange) and ZAero method (blue)

MATERIALS AND TECHNOLOGY

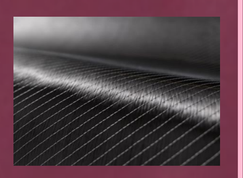
Two different technologies of automated lay-up which have similar needs for inspection will used.

Dry Fiber Placement (DFP) →

→ **Uniaxial material**

Automated Dry Material Placement (ADMP) →

→ **Multiaxial material**



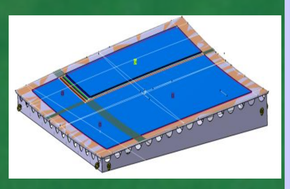
MANUFACTURING TRIALS

DEMONSTRATOR 1

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

DEMONSTRATOR 2

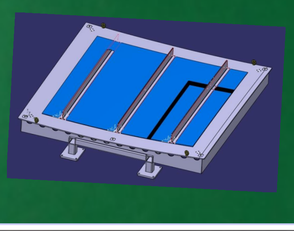
- Lay-up inspection and curing monitoring.
- Demo with double curvature in order to identify potenctial lay-up defects as excessively wide gaps, overlaps, twisted yarns or other defetcs. Dimensions: 1700x1700mm.



- 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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