

Technology/Process: **Automation and Rationalization of Ultrasound Inspection**
 Responsible: **Exova**
 Partners: **SAAB**
 Work package: **4.6 - "Mechanization/Robotization of Inspection"**



Description of Technology/Process:

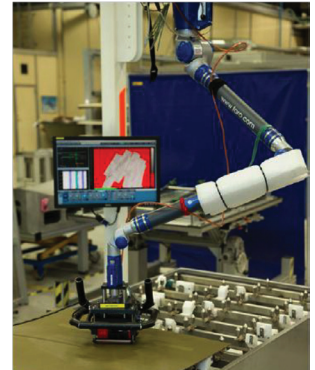
Three leading automation processes have been benchmarked and their technologies were assessed on three Saab composite articles: Areva offers robust robotic solutions to a diverse variety of geometries. Tooling and arrays are in-house. Tecnatom develops in-house software to attain maximum repeatability. Re-inspection is facilitated. Techno Diffusion Inc. applies SAUL algorithm to account for part-to-part variability in tests performed in immersion. Re-inspection is avoided.

Before:

At Saab non-destructive testing (NDT), inspection is performed under manual and semi-automatic procedures on three composite components focused on this work package.

Illustration:

Semi-automatic inspection performed by a wheel probe array mounted to a FARO arm.



Keywords:

Automation, robotic arms, gantry systems, rototranslation, repeatability, re-inspection, phased arrays, c-frame, cargo door, door demonstrator

Benefits:

- Areva provides the fastest installation times in the industry. Their in-house manufactured array solutions are very versatile to complex geometries.
- Tecnatom offers a user-friendly interface to design inspection trajectories. Algorithms are programmed to follow the contours of any geometry. Re-inspection is facilitated and minimized.
- Compensation from the beam direction by SAUL. Inspection time was calculated in 22 minutes. Probes needing a water column are used.

Work performed:

Robotization techniques have been assessed on three different composite articles.

Areva

C-frame. Tailored in-house arrays for inner and outer radii devised. Standard arrays for other surfaces. Bulk Cargo Door. Tailored in-house arrays for radii. Standard arrays for other surfaces. Contact probes. Door demonstrator. Tailored in-house arrays for inner frames & radii. Standard arrays for other surfaces. Usage of Areva grippers, alternatively Robotiq. Gripper 10k euros. Probes 20k - 40k euros. Contact probes mounted with loaded springs / force torque sensor to follow the surface.

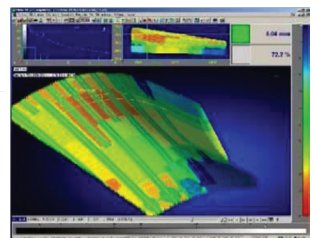
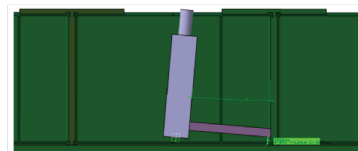
Tecnatom

Repeatability in inspections is attained by SUMIAD, GENTRAY and INSPECT-VIEW aided by the rototranslation option. Position sensors can sense the inspection. Door demonstrator. Common phased arrays were considered in the design. A specialized computer simulation considering automation methods tailored to the part composite would cost 35k euros.

Techno Diffusion Inc.

Door demonstrator. SAUL method was tested on the prototype. Varying thicknesses and wave front angles up to 10° of deviation were cleared up. SAUL proved reduced background noise.

Speed was estimated at 150 mm/sec and overlap of 20% was allowed. By integrating SAUL into non-contact probes automated in a robotic system, the fastest process of all researched methods is achieved. Hardware + Software acquisition + 64 element probe + SAUL = ca 138k euros.



Future developments & exploitation:

- Strive to reduce manual inspections after robotized inspections should be studied with Areva.
- Inspection by immersion designed by Techno Diffusion demands feasible solutions to submerge the door demonstrator under water in short time. Solutions to get rid of bubbles and facilitate water flow are needed.

- Evaluation from their technology on real CAD models and further certification of the array solutions is the next step in the project.

Technology readiness level is considered to be TRL3 for Areva and Tecnatom and TRL5 for Techno Diffusion.