



CONVERGING

Developments from Industrial Pilots

Social industrial collaborative
environments integrating AI, Big Data
and Robotics for smart manufacturing

Automotive
Aeronautics
White goods
Additive manufacturing



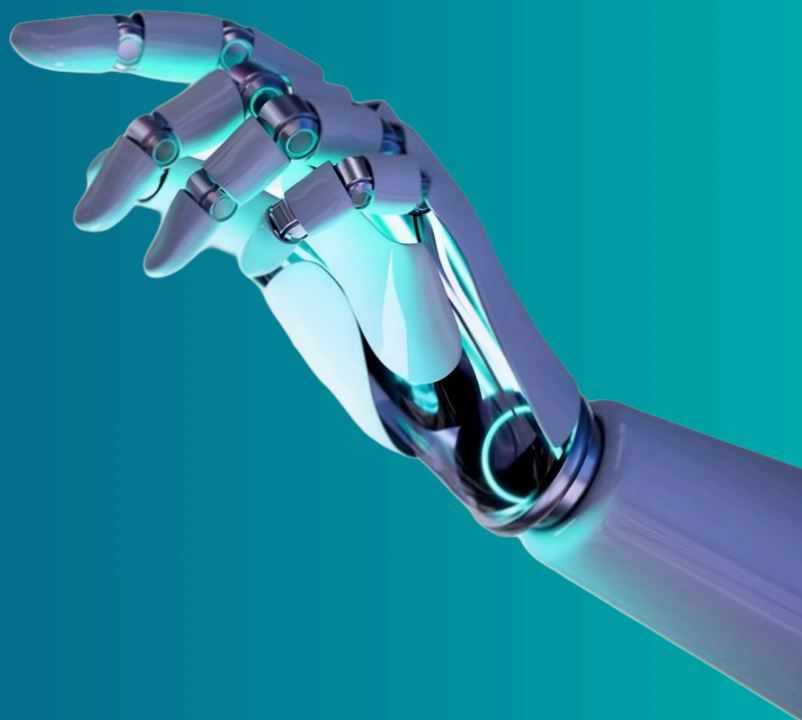
**Co-funded by
the European Union**

The CONVERGING project is co-funded by the European Union under the Horizon Europe Research and Innovation Programme, under Grant Agreement No. 101058521.

From industrial challenges to collaborative robotic solutions

CONVERGING focuses on four full-scale industrial pilots designed to operate in actual production environments across the automotive, white goods, aeronautics and additive manufacturing sectors.

Through these pilots, the project develops new robotic system applications and introduces additional safety and collaboration functionalities to existing systems. This is supported by the integration of smart mechatronic systems, distributed sensors and wearable devices, data communication infrastructure, and a digital pipeline incorporating virtual representations, simulation, knowledge modelling and digital twins for decision-making.



Automotive Pilot Line

Robotic Sanding and Polishing of Automotive Stamping Dies



The Industrial Challenge

Inspection, sanding and polishing of stamping dies are traditionally performed manually. These operations require highly experienced personnel, can be influenced by the operator's individual perception and are difficult to repeat consistently. Manual sanding also presents ergonomic and safety challenges and creates a strong dependence on experienced operators in a market where labour shortages are common.

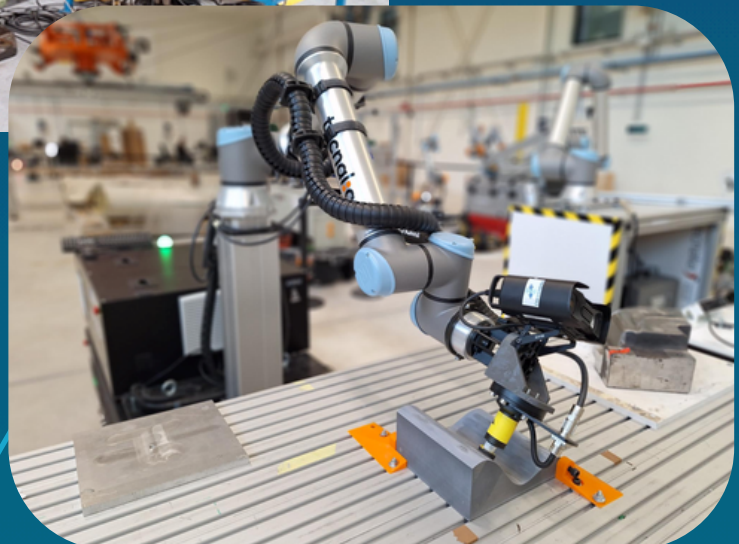
CONVERGING Solution

The technology developed within CONVERGING addresses these challenges through environmental scanning and 3D reconstruction, automated robot-trajectory planning and force-controlled sanding.

The technology can be adapted to different robots and mounted on autonomous mobile robots to provide greater mobility. This enables the sanding of large stamping dies and the successful removal of defects such as rust, seizing and scratches.

PILOT DEVELOPMENTS

- The static setup is fully operational in its new ROS2 version at FORD's facilities in Valencia, where it is actively being used to polish dies.
- Mobile setup of the pilot is shipped for the final Industrial pilot at Ford.
- The final pilot demonstrator includes a static robot polishing part of a stamping die and a mobile robot simultaneously polishing a large stamping die on the ground. The mobile robot then navigates through the factory to complete the polishing of the first die.



Aeronautics Pilot Line

Robot-Assisted Aircraft Fuel-Tank Inspection and Maintenance



The Industrial Challenge

Aircraft fuel-tank maintenance and inspection are highly demanding manual processes. During activities such as the conversion of a Boeing 767 from passenger to freighter and scheduled C checks, technicians may need to enter the fuel tanks to perform visual inspections, Foreign Object Debris removal and non-destructive testing.

The tanks have narrow spaces and confined entry points. Operators must work under difficult ergonomic conditions and follow strict ventilation and safety protocols, resulting in hazardous working conditions and additional preparation time.

CONVERGING Solution

Advanced robotic systems can navigate hazardous internal environments autonomously. Supported by remote human-robot communication tools, the approach reduces human exposure to toxic and confined areas while maintaining high precision in inspection and maintenance tasks.

PILOT DEVELOPMENTS

- The TFCC centre received an aircraft wing to serve as a dedicated testbed for robotic integration.
- The robot can navigate inside the wing to simulate non-destructive testing manoeuvres, perform visual inspections and remove Foreign Object Debris while generating a precise three-dimensional map of the structure.
- IAI is also providing a functional non-destructive testing system to create a fully operational testing environment. This setup enables rigorous validation of the data and results, supporting the transition from hazardous manual fuel-tank maintenance to a high-precision, robot-assisted process.



White Goods Pilot Line

Robot-Assisted Aircraft Fuel-Tank Inspection and Maintenance

The Industrial Challenge



Currently, the level of automation in critical assembly processes, such as cabling operations or the installation of sensitive and flexible components, remains limited due to product design constraints and high process complexity. As a result, fully automated solutions are often impractical or economically unfeasible.

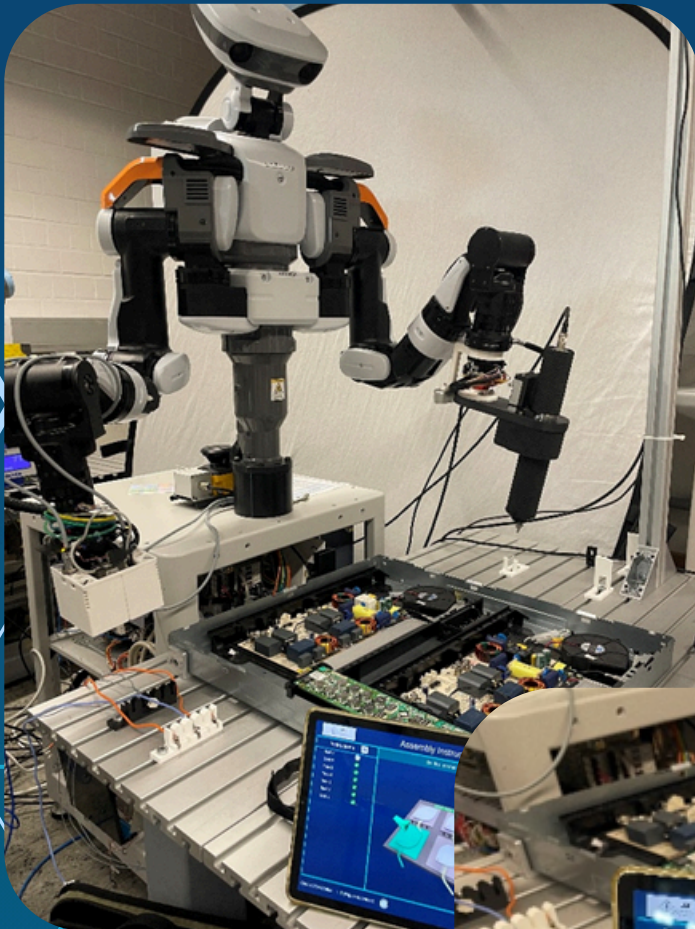
CONVERGING Solution

This pilot aims to develop flexible automation solutions that enable safe and efficient human-robot collaboration (HRC) in assembly tasks within home appliance manufacturing.

To address these challenges, the pilot focuses on introducing advanced HRC technologies that combine the strengths of both humans and robots. The objective is to automate repetitive, low-value, and ergonomically demanding tasks while maintaining human involvement for supervision, fine manipulation, and decision-making.

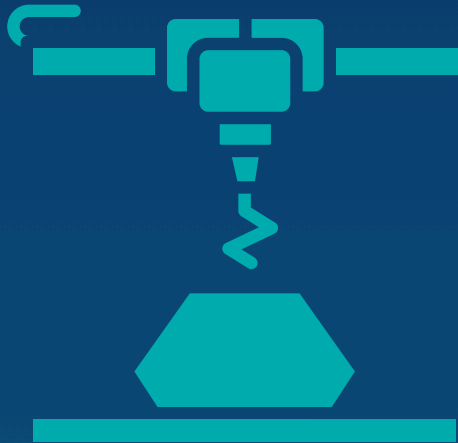
PILOT DEVELOPMENTS

- Address speed and productivity issues: increase robot speed, add laser fence to allow higher robot speed, add second workpiece to allow operator to work when waiting on robot.
- Integrate the screwdriver.
- Add a tablet display as alternative to projector / smart-watch.



Additive Manufacturing Pilot Line

Collaborative Robotic Post-Processing of Additively Manufactured Parts



In additive manufacturing, post-processing can be particularly challenging. Removing the supports required to produce complex geometries can result in accidental damage to the areas surrounding the supports, potentially compromising the functionality of the manufactured part.

The Industrial Challenge

Additive manufacturing parts are also not produced at a standard rate, which can create difficulties in balancing the workload of the production station.

CONVERGING Solution

CONVERGING applies robotic systems to support removal and surface-finishing operations in collaboration with human operators. Automated guided vehicles transfer time-dependent handling activities into data-driven handling processes, while AI-based planning supports the distribution of work according to the current load of the additive manufacturing station.

AI also enables the robot to reproduce human-arm movements, reach difficult areas and accelerate post-processing operations.

PILOT DEVELOPMENTS

The CONVERGING pilot redesigned the finishing station to distribute tasks between two robots and the operator, creating a more flexible and ergonomic human-robot workflow.

- A first robot identifies the finished part, while a collaborative manipulator picks it up and presents it directly to the operator, continuously adapting its position to support a more ergonomic working posture. Once the manual task is completed, the part is transferred to a mobile robot, which performs the surface-finishing process and transports it to the storage area.
- The integrated solution combines perception and operator tracking (PAM), real-time ergonomic assessment (UXE), AI-based digital-twin planning (AIDT), teaching by demonstration (TDM), augmented-reality interaction (MACI), production orchestration and dynamic task re-planning (AISC/DWR), safety monitoring (SAM), data traceability (DIM/DAR), and VR-based operator training (OTM). A COMAU medium-payload manipulator equipped for safe shared-space operation (MPCM) supports the physical handling of the parts.



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