ODIN

WELCOME TO THE 2nd ODIN NEWSLETTER!

October 2021

In this issue

DISCOVER ODIN

The challenge

While robots have proven their flexibility and efficiency in mass production and are recognized as the future production resource, their adoption in lower volume, the diverse environment is heavily constrained. The main reason for this is the high integration and deployment complexity that overshadows the performance benefits of this technology.

If robots are to become well accepted across the whole spectra of production industries, real evidence is needed that they can operate in an open, modular and scalable way.

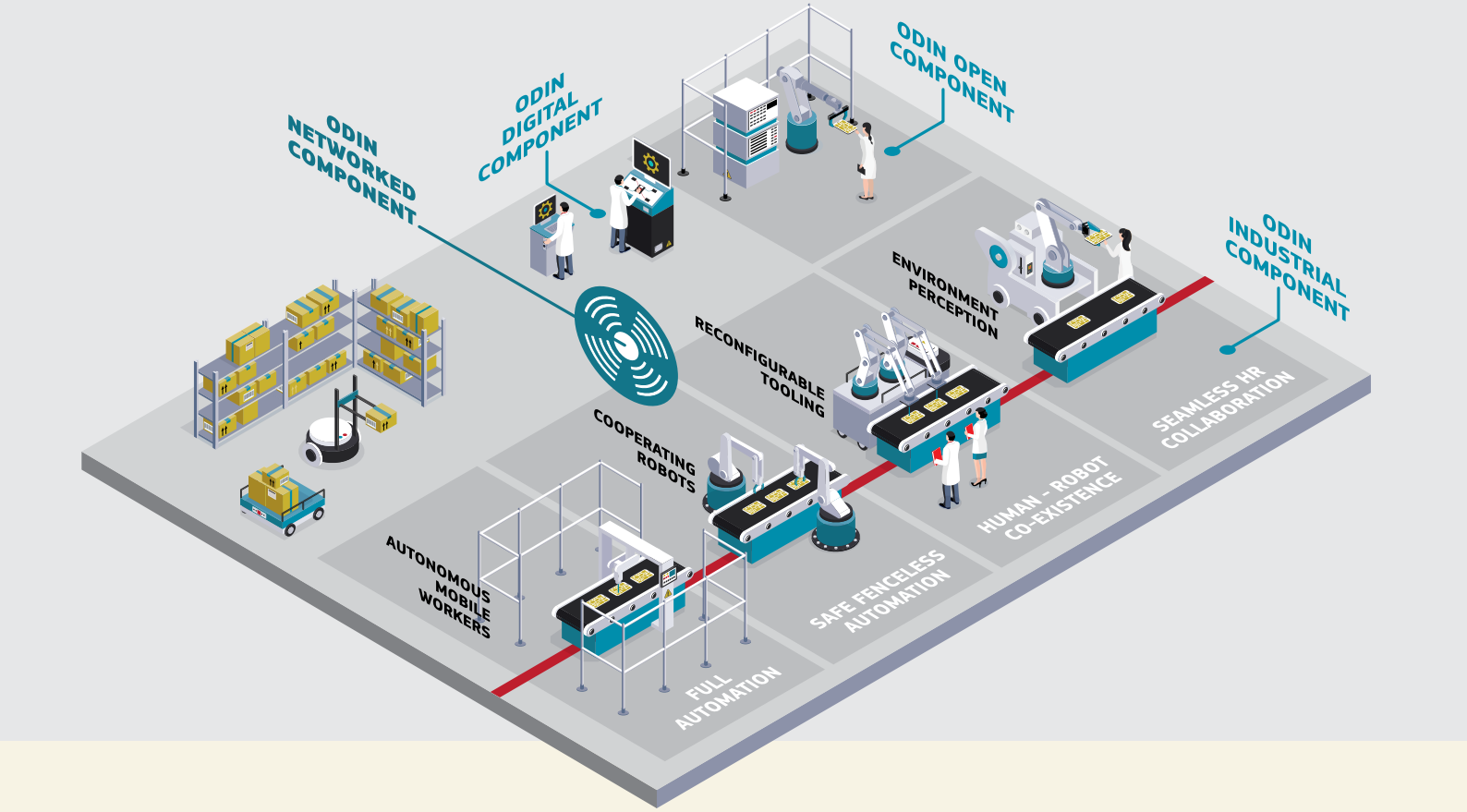
Project Overview

ODIN will bring technology from the latest ground-breaking research in the fields of:

- collaborating robots and human-robot collaborative workplaces
- autonomous robotics and AI-based task planning
- mobile robots and reconfigurable tooling
- Digital Twins and Virtual Commissioning and
- Service-Oriented Robotics Integration and Communication Architectures.

To strengthen the EU production companies' trust in utilizing advanced robotics, the vision of ODIN is:

"to demonstrate that novel robot-based production systems are not only technically feasible but also efficient and sustainable for immediate introduction at the shopfloor".



MEET OUR PILOTS

THE AERONAUTICS PILOT CASE

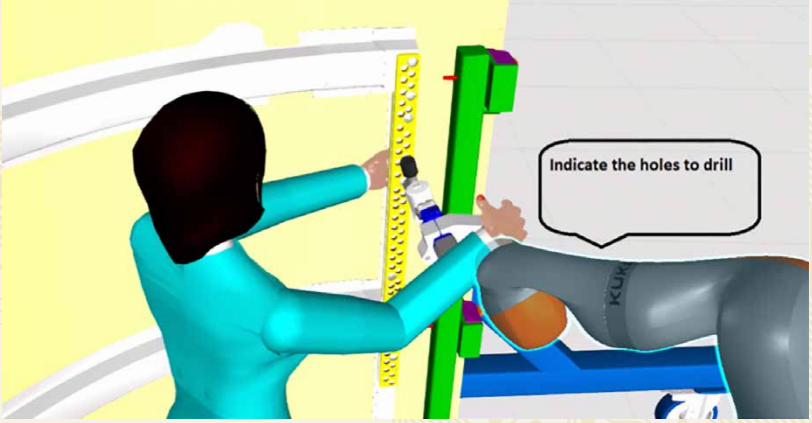
ODIN Aeronautics Pilot Case, led by AEROTECNIC, entails implementing, demonstrating, testing and validating in a real operational environment the different technologies and systems developed in ODIN, in its aerospace composite manufacturing and assembly facilities in Cádiz (Spain), in the assembly line of the Fan-Cowls of the Airbus A320 Neo.

The developed system will address three different tasks related to the Fan-Cowls production, and common on the aeronautics sector in general, and currently performed manually.

- Template based drilling of CFRP co-bonded areas, performing complex manipulation operations with a high potential of damaging very costly parts in an irreversible way.

- Transportation between working stations, operating in a shared environment, manipulating parts in order to fit into tight spaces and ensuring that no damage can occur to the part, as well as detecting any possible collision.

- Inspection checks for assembly tasks, ubiquitous on the aeronautics sector and present in multiple locations and phases of the production, very time consuming and with a large potential for automation and digitization.



These tasks are implemented into one of the most impactful programs of the aeronautics industry, a sector characterized by a comparatively low volume, high variability, and high value adding production.

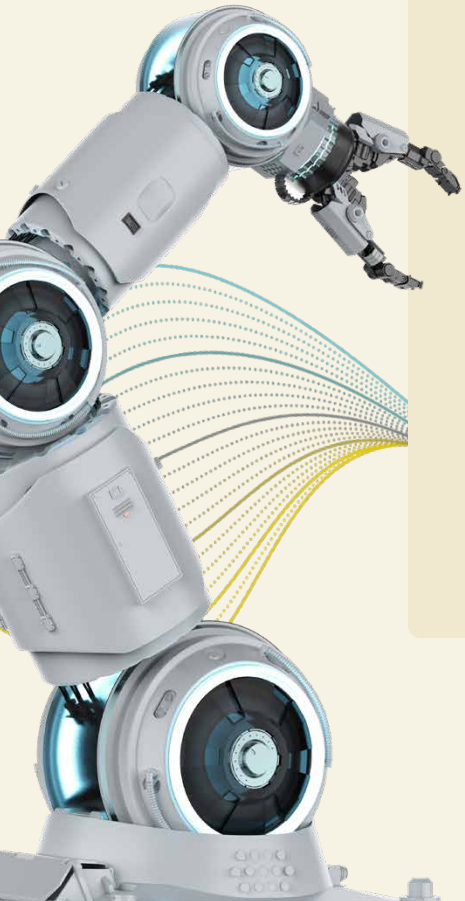
In these production plants several different production routes share a common space, which is addressed with a changing dynamic production environment, flexible and scalable, but difficult to automate. For implementing automation into this type of production, versatility and low overhead for integrating new tasks/references into the system is required, as a single purpose specific automated system rarely provides the appropriate return on investment.

In order to achieve a substantial increase in productivity in repeatable processes where people and robots can work seamlessly and effectively, automating several tasks in a flexible and versatile set, the following actions will be taken:

- **Develop** a system capable of operating on a dynamic environment, thanks to its enhanced mobility and intuitive interactions with the operators, allowing a single system to cover multiple non-static working stations and tasks with reduced setup preparations and times.

- **Habilitate** a common working environment, introducing collaborative, autonomous and mobile robotics to work in tandem with employees in the aeronautical industrial environment in tasks expandable to multiple production routes.

- **Create** digital validation tools for these robotic systems to enable scalability with minimal complexity and integration risks, allowing frequent process reconfigurations and changes, as well as perfect traceability of the processes and easy interpretation of task results, being supported by the appropriate interoperability and connectivity.



THE WHITE GOODS PILOT CASE

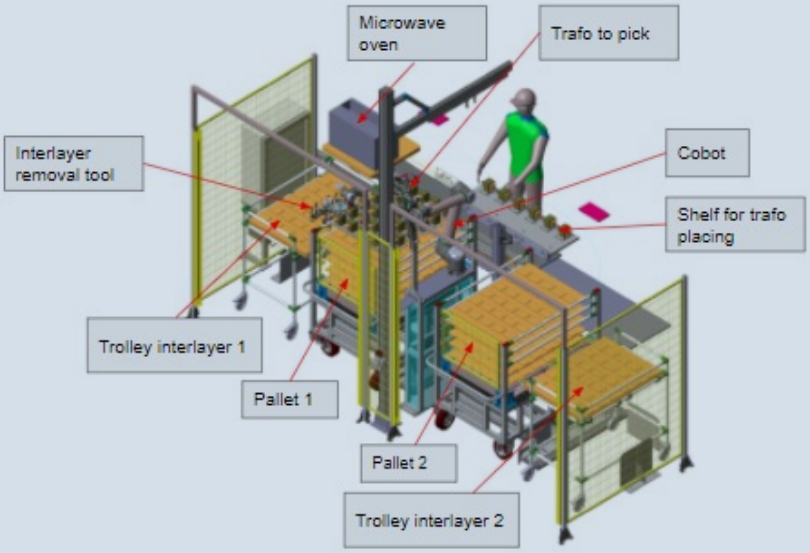
The WHR pilot is focused on the creation of a Digital Twin of an existing cooperative robotic cell currently installed in the Microwave factory located in Biandronno (ITA).

The cell is a workstation in which the robot is sharing the same space with a human operator, and its task is pick a quite heavy part, an electrical transformer of 4.5 kg, from a container and place it in a shelf close to operator: this improve the ergonomic condition of the worker who is working in the so called golden zone and strike zone, limitation the excessive rotation and inclination of the back.

The work-cell has been considered a really good examples and has already been exported to other very similar production line. However, in the current situation, all the activities of reconfiguration of the workplace has to be performed in a traditional way: once a need emerges in an explicit way in the shopfloor, a team of engineers analyze the need and design the new workplaces using basic tools (e.g. 2D drawings, calculation worksheet, writing new code and reprogram the robot both in the lab and then directly in production typically using non-working days such as weekends or holidays period.

All this translates in high cost of reconfiguration and high time to market the solution to the factory. Moreover the impossibility to test different solutions could leave the more risky ones, but perhaps also the more convenient ones, not explored at all.

The scope of the pilot is to build a Digital Twin (DT) of the workplace, so to allow its fast reconfiguration (e.g. to easily modify Cobot selection, programming and integration whenever a new product is introduced into production system) giving the possibility to simulate Cobot behavior in advance to ensure maximum level of efficiency together with safety for human operators and finally, enable the opportunity to monitor and control with advanced digital system the working parameters of the robotic application so to ensure preventive and predictive maintenance actions.



As a result, the Digital Twin will allow Whirlpool to improve its process of reconfiguration of the workcell (in case of changes in product or parts, increase of production rate, re-balancing of activities in all the production line, transfer to other production lines, etc.) reducing the overall conceptualization, design and commissioning phases and enhancing the capability of evaluating and embedding innovative solution (such as new safety devices, vision systems, robotic arms and grippers).

THE AUTOMOTIVE PILOT CASE

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The Groupe PSA use case is located on the Terminal Assembly line:

All the components of the car (dashboard, seats, windows, windshield, belts, motor block, wheels, bumpers, etc.) are added to the body at the Assembly line. This is where the vehicles take their final aspects over more than 1000 meters of manufacturing lines. Finally, each vehicle will undergo a series of tests in the Quality Control area to check the proper functioning of the main systems such as safety, mechanical components, electronic system or lighting.

Integration of new vehicle difficulties:

- Large quantity and diversity of parts
- Variability of the production
- Variability of the diversity
- Share the task Human/robot
- Parts Logistic
- Quality control & Correction
- Large quantity of data hard to select/find the determinant
- Adaptability of the task & process to get the cycle time
- Reduced energy consumption

These adjustments include :

a) dynamic reallocation of tasks to resources

b) automatic update of the process parameters;

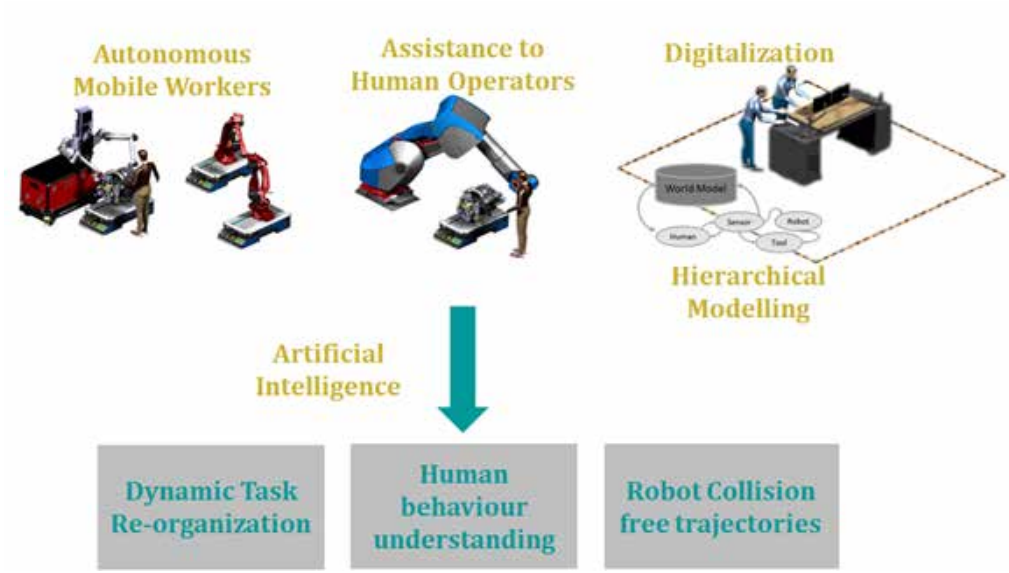
c) variation in the production schedule (which is not necessarily in a dedicated line).

In addition, the level of automation varies with the complexity of the assembly process. For instance, many tasks are fully automated and over need more dexterous process that requires human effort.

To overcome this challenge, we will develop a fence less environment where robots can adjust their behaviour and collaborate with human operators. Depending on the car type, the workload needs to be balanced and optimally distributed among robots and humans. Therefore, safe tools are required for safe reconfiguration in fence less environment.

READ OUR LATEST BLOG POSTS

AI based task planning for work re-organization

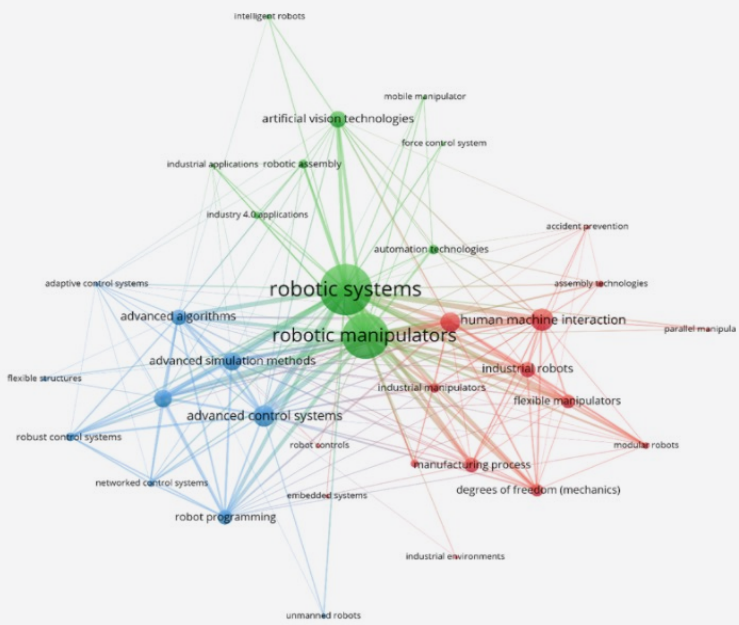


ODIN encompasses the concept of modular and reconfigurable production and will work towards demonstrating that novel robot-based production systems are not only technically feasible, but also efficient and sustainable for immediate introduction at the shopfloor. ODIN aims to introduce cooperating resources including autonomous mobile robots and high payload collaborative robots, able to collaborate and assist human operators during production.

To support this hybrid production paradigm and the autonomy required for enabling the dynamic reconfiguration of the production system it is vital to efficiently organize all production entities and plan their activities by reasoning over the real time shopfloor status.

Read the full blog post here

Flexible robotics challenges for the transport industry



Unlike traditional automation, the evolution of robotics allows human-machine collaboration. Instead of repeating the same cycles in a fixed sequence, it adapts according to the context, achieving full cooperation with the enviroment. Similarly, several robots can collaborate with each other for the following purposes:

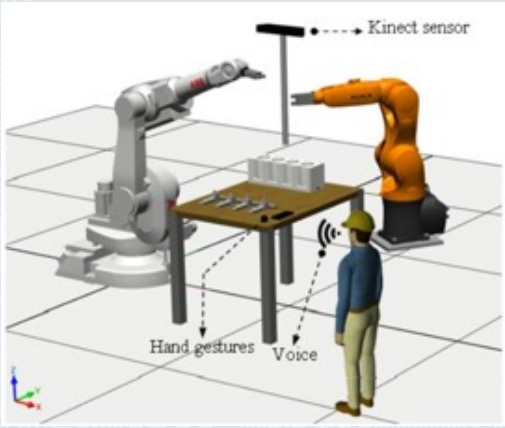
-Execution of tasks that are not ergonomic or with a high risk for the safety of people.
-Execution of non-value-added tasks.

To provide flexibility to manufacturing processes:

...by adapting tasks according to the context.
...by moving to different positions or lines.

Read the full blog post here

Digital twin of Human robot collaboration enabled through sensor data fusion



Human-Robot Collaboration (HRC) allows human operators to work side by side with robots in close proximity where the combined skills of the robots and operators are adopted to achieve higher overall productivity and better product quality. Compared with the traditional robotic production, HRC empowers a manufacturing paradigm shift towards a high level of flexibility, adaptability, and controllability. However, robots used today are often controlled by native rigid codes that cannot support an efficient HRC.

Read the full blog post here

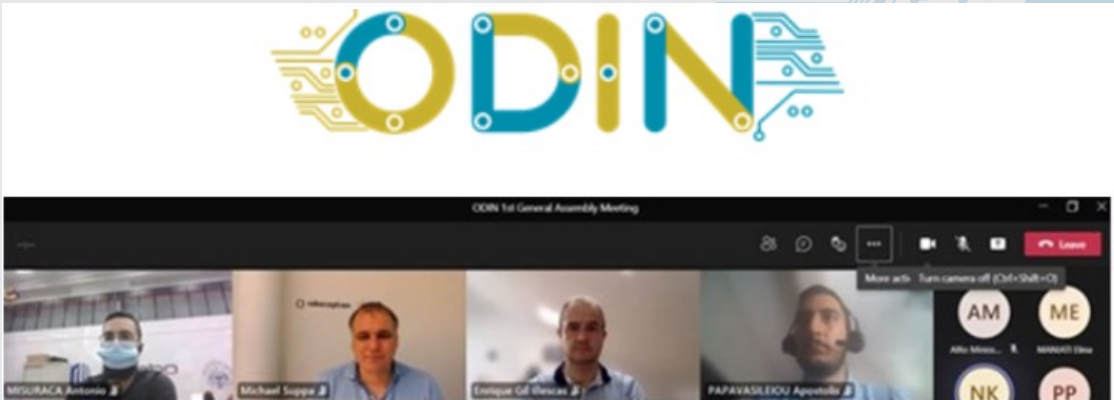
Human-robot collaboration pilot line

Pilot lines, as early test-beds for production lines, are excellent instruments for experimentation, knowledge-transfer and eventual commercial uptake. They facilitate prototyping to speed up time-to-production and can be utilized by industry to assess the return on investment of new products, processes and methodologies. Pilot lines can therefore play a crucial role in the diffusion of basic and applied research knowledge from academia to industry, engaging and convincing relevant stakeholders. On the other hand, providing SMEs access to pilot lines gives academia also a close view to the needs and interests of the industry. This close collaboration is a key factor in boosting the innovation capability of both academia and industry.

Read the full blog post here

EVENTS

ODIN 1st GENERAL ASSEMBLY MEETING



On **July 8, 2021** we had our 1st General Assembly meeting virtually, discussing about our progress during the first 6 months of the project. All partners contributed with insightful presentations about the status of their work and future steps.

Stay tuned for exciting news during the implementation of the ODIN project!

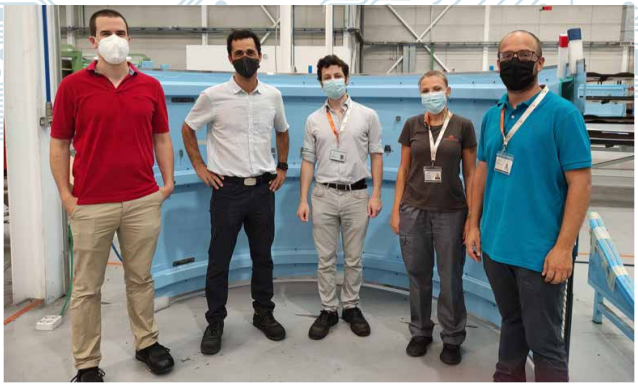
AEROTECNIC AND TECNALIA MEET FOR A WORKSHOP AT AEROTECNIC PREMISES IN CADIZ, SPAIN

September 15, 2021 -

After many virtual meetings, our partners from **AEROTECNIC** and **TECNALIA** Research & Innovation finally meet for a workshop at AEROTECNIC premises in Cadiz (Spain).

In conclusion of the use-case detailed definition phase and as one of the first actions of the technical development phase, TECNALIA visited the workshop of AEROTECNIC in Cadiz (Spain). It has been the culmination of a series of virtual meetings between the two ODIN partners where they have worked together to share the understanding of the current workflow of AEROTECNIC processes and to define in detail the ODIN implementation for the aeronautics use-case.

As main outcome, during the visit, the ODIN team was able to clarify with the personnel directly working in the workshop, some of the technical questions that arouse in the previous virtual meetings. Questions such as "Will the current drilling template attachment system be sufficient to fulfill automation requirements? Which will the best configuration to grasp the FC be, for transportation purposes considering the dimensions of the FC, the robot, and the shopfloor? Which of the inspections are more prone to be automated?" have a clearer answer after the visit. The ODIN team remarks the importance of the previous series of virtual meetings to study the use-case in advance. They have been the key to maximize the outcome of the physical visit.



ODIN AT THE METAL INDUSTRY AND TECHNOLOGIES INTERNATIONAL TRADE FAIR (MINDTECH 2021)

Our partner **TECNALIA** participated in the Metal Industry and Technologies International Trade Fair (MINDTECH) which was held on September 14 – 16, 2021 and took the opportunity to disseminate ODIN at TECNALIA's stand. The visitors where able to get information about the ODIN project through the available brochures and TECNALIA's personnel presentations.

ODIN

Open-Digital-Industrial and **Networking** pilot lines using modular components for scalable production

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