PRESS RELEASE

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The main applications cover aerospace, oil &gas and power generation industries

The 4D Hybrid Autonomous robot and the new frontiers of Additive Manufacturing

Background: the Innovative characteristics of 4Dhybrid

The **4Dhybrid project** has been funded under the European Commission Horizon 2020 - Call 723795 and involves 20 Partners from 10 different countries. The project is coordinated by Prima Industrie and the consortium involves 12 industrial players, operating as technology suppliers and end users. SUPSI is responsible for the research and technical coordination of 4DHybrid.

The 4DHybrid main objective is to develop a new concept of hybrid additive manufacturing, supporting the Maintenance Repairing Operation (MRO) value chain with particular focus on medium to large size high added value components.

In detail, this entails the development of compact and low-cost modules including laser source, deposition head, sensors and control that can be integrated on robots and machines; such modules embed various technologies to enable additive and subtractive technologies - such as Direct Energy Deposition (DED) and Ablation or Cold Spray (CS) – in addition to technologies for monitoring and inspection.

The 4DHybrid equipment portfolio is conceived for running both in a standard production facility and in off-shore harsh environment. This makes the project results suitable for aerospace, oil &gas and power generation industries. The modularity concept together with the adoption of complex sensor-based monitoring systems will enrich the current state-of-the-art hybrid solutions with promising prototypes (Technology Readiness Level - TRL7), aiming to provide new possibilities for production and repairing sectors, where a multitude of technologies and equipment will be flexibly adopted.

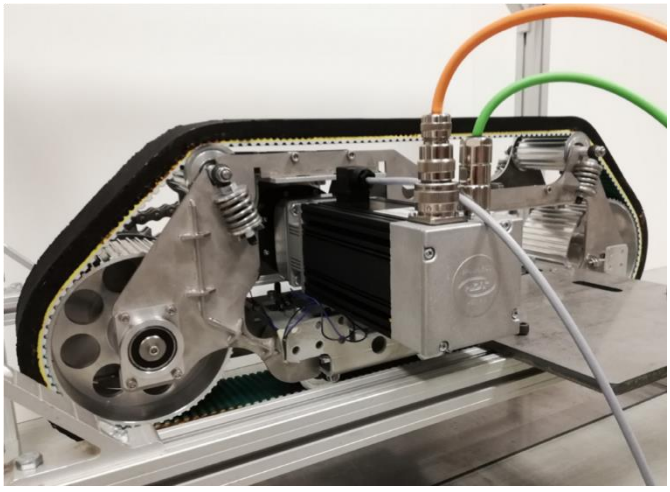
The project exploitation strategy: Out of the lab. Into the market

The project exploitation strategy relies upon major industrial stakeholders of the project consortium that are very active in the MRO industry. For example - Prima Industrie will include in the company product portfolio the deposition modules for DED and Comau will launch a new generation of robots for additive manufacturing and milling operations. With SUPSI, ARM Lab – having the advantage of abundant industrial network of partners - deeply operates in supporting National and European industries to enable the adoption of cutting-edge solutions. 4D Hybrid modules can be integrated in any sort of manufacturing equipment, thus avoiding major overhaul at industrial level. With this regard, a key sensitive aspect for us is to deploy solutions that are frictionless for end-users and demand for a very limited ramp-up time. This should ensure a faster and efficient absorption of project results. Also, 4D Hybrid demonstrators are currently running in ARM physical laboratories to support side activities, such as industrial mandates and equipment commissioning to industrial customers; this boosts our comprehension of advantages and drawbacks during the modules' integration in the overall production infrastructure and industrial value chain. The idea is always to target the realization of reliable and industrially robust solutions.

The 4D Hybrid Autonomous robot

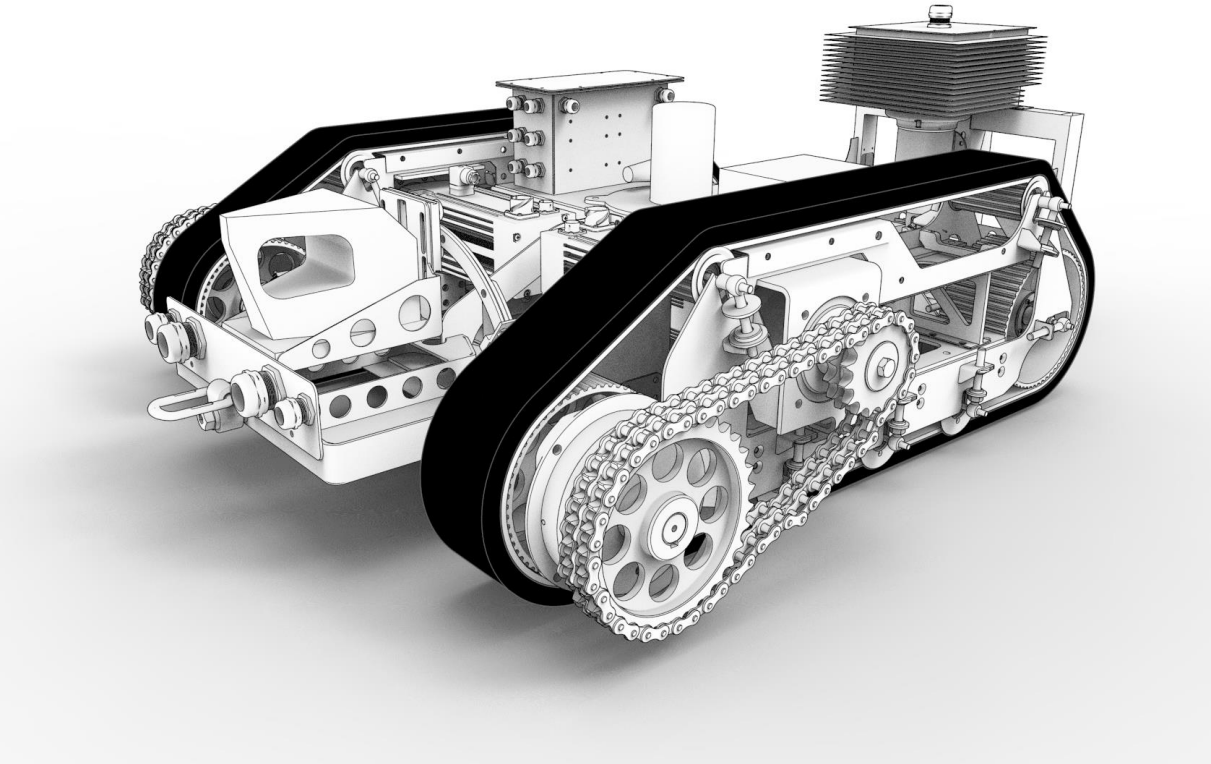
During the first two years of the project the 4D Hybrid Autonomous robot has been developed, to perform detection and reparation of metal vertical surfaces in offshore environments.

In order to do that, a 3D Scanner and a Cold Spray gun have been integrated on it. The 3D scanner implemented for the mobile platform is an Artec Space Spider commercial scanner able to reconstruct the surface and individuate the corrosion/defects on the metal surface. The Cold Spray system instead is the 4D Hybrid module, designed during the project by SUPSI.
It is used to deposit new metal coating on the surface; the coating can be realized in both stainless steel or aluminium alloys.



In order to be able to climb vertically extremely slippery surfaces, the robot has been designed as a tracked vehicle, equipped with two robust rubber belts, which keep contact with the surface, thanks to a powerful vacuum-based adhesion system, placed at the its centre. The two aforementioned rubber tracks allow the robot to move on the metal surfaces with two different degrees of freedom; it goes back/forth and rotates, even on its main axis.
While performing Cold Spray based processes in open environments the implementation of specific recovery strategies for the dispersed powder becomes fundamental. In order to avoid such dispersion the robot is equipped with a powder recovery system that sucks up the powders and carries them until the top of the ship. The Autonomous robot is designed in order

to work with different conditions of the metal surfaces; corroded, not corroded, in presence of water and dirt and with an environmental temperature ranging between 3 to 35°C.



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