



DEVELOPMENT OF A COMPREHENSIVE AND EFFICIENT SYSTEM FOR ADDITIVE MANUFACTURE BY LASER WITH MULTI-DIRECTIONAL WIRE DEPOSITION

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The main objective of the D3SFILA project has been the development of a robust and modular multidirectional wire deposition system for Additive Manufacturing (AM) by Laser, which allows complex parts to be manufactured, guaranteeing the robustness of the process, regardless of the material and deposition strategy, as well as the metallurgical quality of the manufactured component.

In this sense, of all the AM technologies applicable to metals, Powder Bed Fusion with laser is the one that has experienced a greater degree of industrial implementation in recent years, mainly because it allows the manufacture of parts with geometry and designs that are difficult to achieve by traditional manufacturing methods, with great geometric precision and in a controlled environment. However, it has significant limitations, such as the size of the part to be manufactured and a relatively low processing speed. On the other end, Additive Manufacturing by Direct Deposition of Energy (DED), and in particular the additive manufacturing by laser with deposition of wire (WLAM_Wire Laser Additive Manufacturing) is quite interesting, especially in the manufacture of components of medium-large size, required largely by the aeronautical sector, but also maritime, metalworking, toolmaking and other sectors.

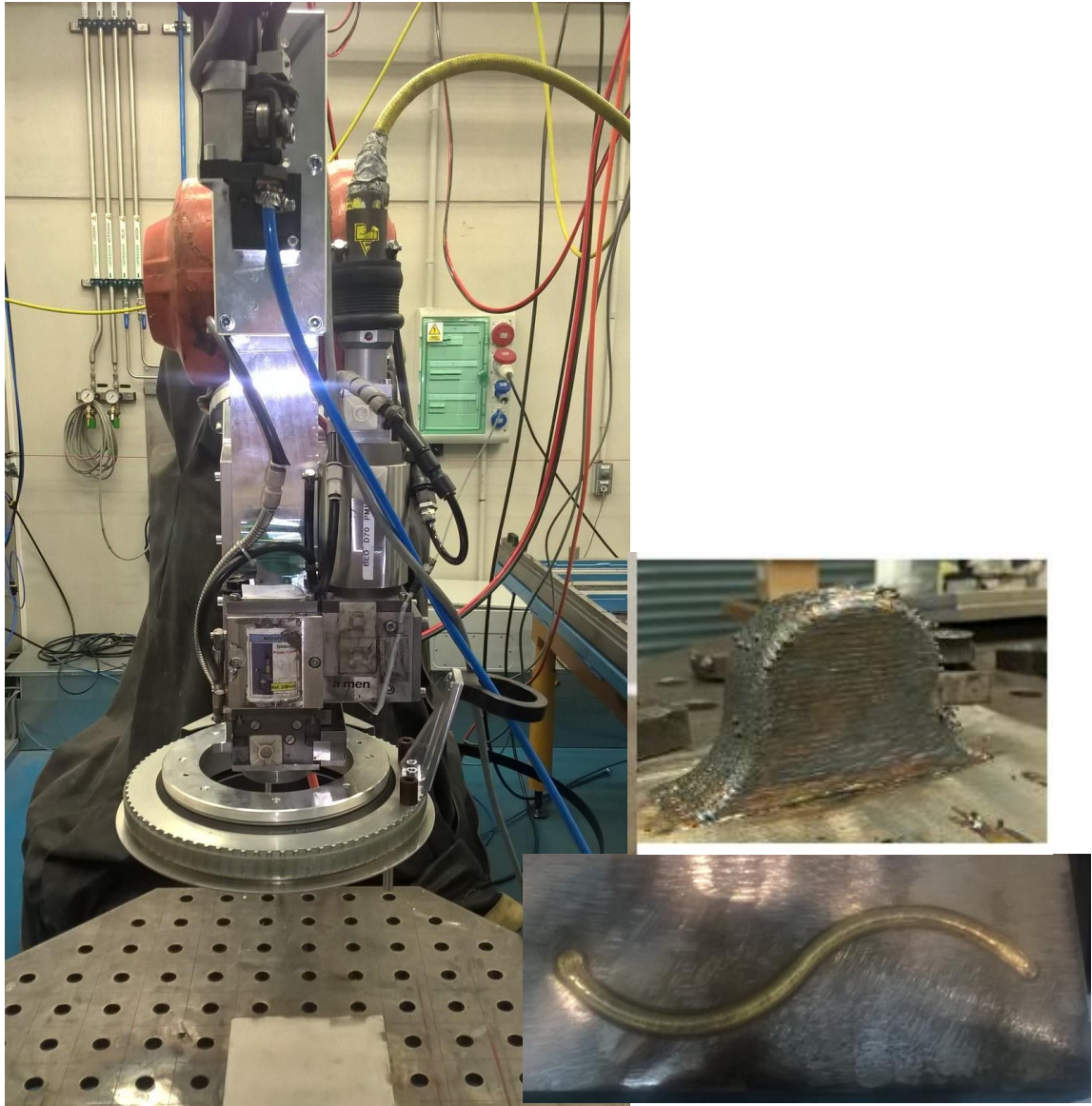
The D3SFILA project arises from the business opportunity detected in the field of Additive Manufacturing of large components and, in particular, in the manufacture of high value-added components for different industrial sectors through the WLAM technique.

Currently there are only two laser head manufacturers that offer specific equipment for FA by laser with wire feed. In both cases it is multidirectional coaxial heads that allow material to be deposited in any processing direction,

which is a great advantage when it comes to increasing flexibility in the manufacture of parts. However, these are very complex heads from the optical point of view. This complexity requires working with laser sources of medium-high beam quality, results in a considerably high cost of the head as well as more complex maintenance, making the process more expensive.

In this context, within the framework of the project, the following **technological challenges** have been addressed:

- The requirements of the different materials to be processed in the project have been defined. The corresponding samples have been manufacturing by WLAM and mechanically characterized.
- The integrated wire deposition system has been developed. Thanks to its modularity, it is valid for the 2 different laser heads to be used during the project. This system will allow to manufacture parts by multidirectional movements, with a higher contribution deposition rate than current coaxial heads. In addition, a specific gas diffusion system has been developed. It allows to keep the gas flow independently of the processing direction, controlling the cooling of the solidified zone to maintain its properties and preventing oxidation. This development is based on thermo-fluid dynamic numerical simulations of the WLAM process carried out during the project.
- The optimal wire deposition manufacturing strategies have been implemented in the offline programming of WLAM process, starting with simple cases to validate the system, prior to the demonstrators manufacturing phase.
- During the final phase of the project, the demonstrators defined at the initial phase have been manufactured with the corresponding base materials.



D3SFILA CONSORTIUM

In order to face this ambitious challenge, a multisectoral consortium of five Galician companies has been consolidated, with the necessary skills and knowledge to cover all the activities of the project:

VIGOSYSTEMS

ROBOTING
AUTOMATION + PROGRAMMING

Hydracorte


FUNDICIONES REY

 **intaf**
promecan
grupo intaf


aimen
CENTRO TECNOLÓGICO

VIGOSYSTEMS has been the coordinator of the project and its main role was the development of the modular wire deposition system.

ROBOTING has been the partner in charge of the deposition strategies module optimized for WLAM.

HYDRACORTE, as a service provider based on laser technology, has been the partner in charge of the implementation of the solution developed in the project in its facilities.

FUNDICIONES REY has had the role of final user of the technology and has proceed to the definition of requirements and validation of one of the demonstrators proposed in the project.

INTAF PROMECAN has had the role of final user of the technology and has proceed to the definition of requirements and validation of two of the demonstrators proposed in the project.

With the aim of promoting innovative activity within companies, strengthening its international leadership capacity and improving its competitive position, the consortium has counted on the support of the **AIMEN Technology Centre**, with extensive experience in the development of new advanced manufacturing processes, and particularly in those related to Additive Manufacturing.

PROJECT FUNDING

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