



# Wavetailor

**Modular laser sources for sustainable production  
of short personalized production series**

*Presentation of the project*

*March 2024*



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## INTRODUCTION - HOW TO USE THIS PRESENTATION

- This presentation can be used either as a standalone document to be converted into a PDF file and handed out
  - Remove this guiding slide
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  - Send it to your contact
  
- You can also pick some slides for introducing a talk which deals with WAVETAILOR's results
  - Remove this guiding slide
  - Copy / paste slides or content as needed
  - Remember to add the disclaimer of the front page and the EU logo





## PROJECT SUMMARY

- The European industry must transition to clean, climate-friendly production systems. Laser-Based Additive Manufacturing (LBAM) emerges as a promising solution, offering fast, flexible fabrication of products with complex geometries and high precision with potential in reducing material waste, energy consumption, and operational costs.
- However, LBAM faces challenges, including high initial equipment costs, limitations in material compatibility, and difficulties in transferring design to first-time right, zero-defect manufactured product.
- The WAVETAILOR project aims to contribute to solving these challenges by demonstrating capabilities of novel economical, energy efficient and flexible LBAM technologies in distributed and sustainable manufacturing of complex multi-material components and assemblies.
- Each production cell in the distributed manufacturing chain:
  - can be composed indistinctly from Laser-based Powder Bed Fusion (PBF-LB) and Directed Energy Deposition (DED-LB) machines.
  - will be equipped with an efficient modular laser source, consisting of multi-wavelength direct diode lasers and processing optics.
  - will use Digital Twins to enhance first-time right and zero-defect manufacturing (ZDM).





## PROJECT OBJECTIVES

- Objective 1: Development of modular, multi-wavelength laser source, multi-beam scanners and processing heads
- Objective 2: Development and implementation of PBF-LB system around new laser source
- Objective 3: Development of a multi-wavelength modular and reconfigurable DED-LB station
- Objective 4: Digital Twin for Laser-Based Additive Manufacturing (LBAM)
- Objective 5: Development of effective, efficient data acquisition, and ML/AI-driven control feedback loop
- Objective 6: Processing of product demonstrators with multi-wavelength approach supported by Digital Twin
- Objective 7: Validation of lower consumption of resources, energy and gender dimensions
- Objective 8: Towards standardization and training developments



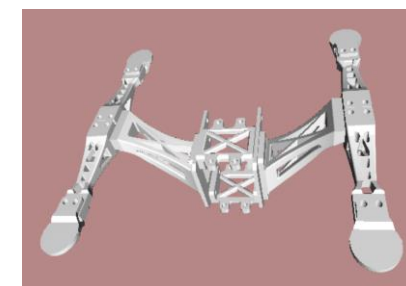


# OVERALL CONCEPT OF WAVETAILOR

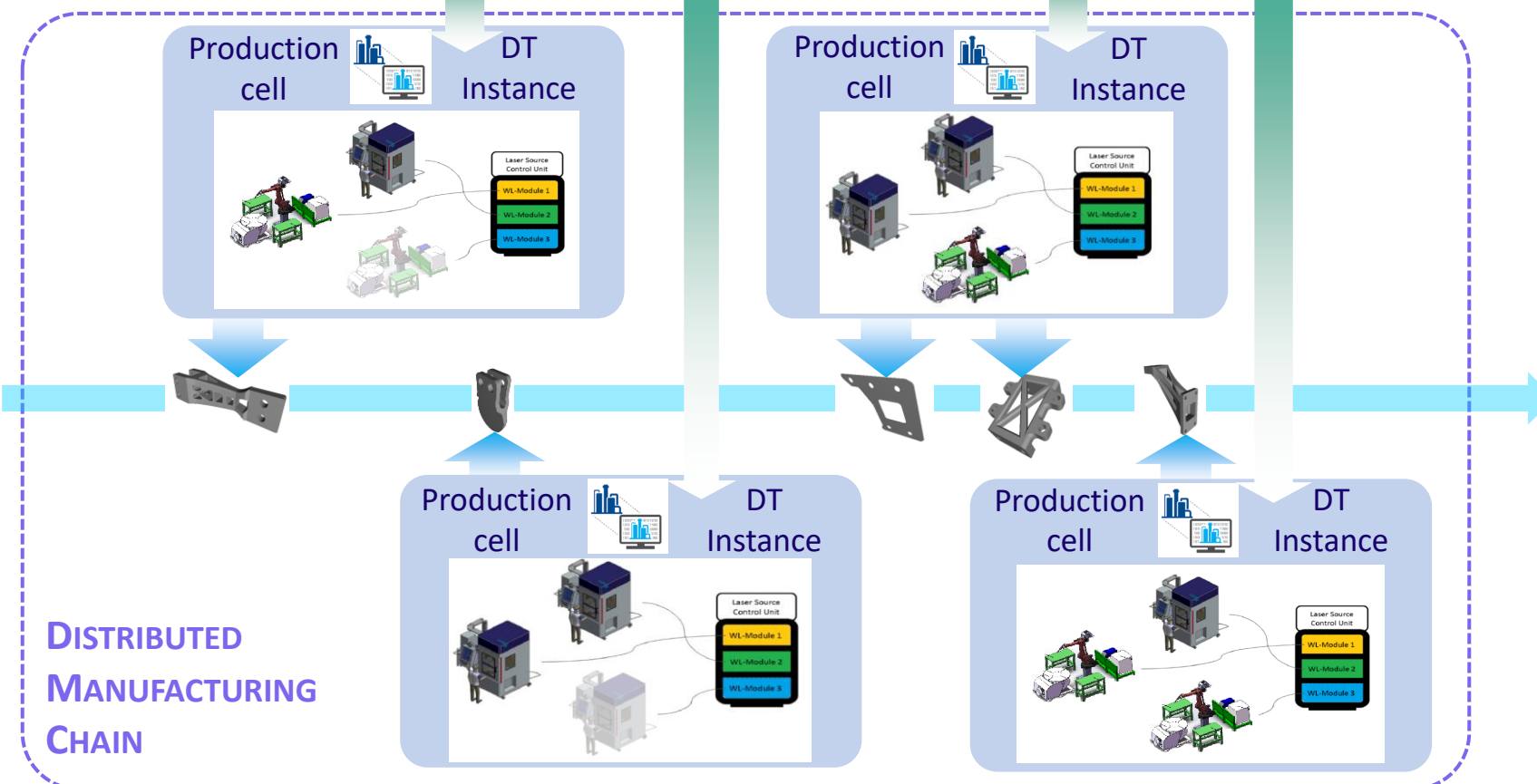


## GOAL

First-time right AM of multi-material component or assembly at - 50% resources



Wavetailor



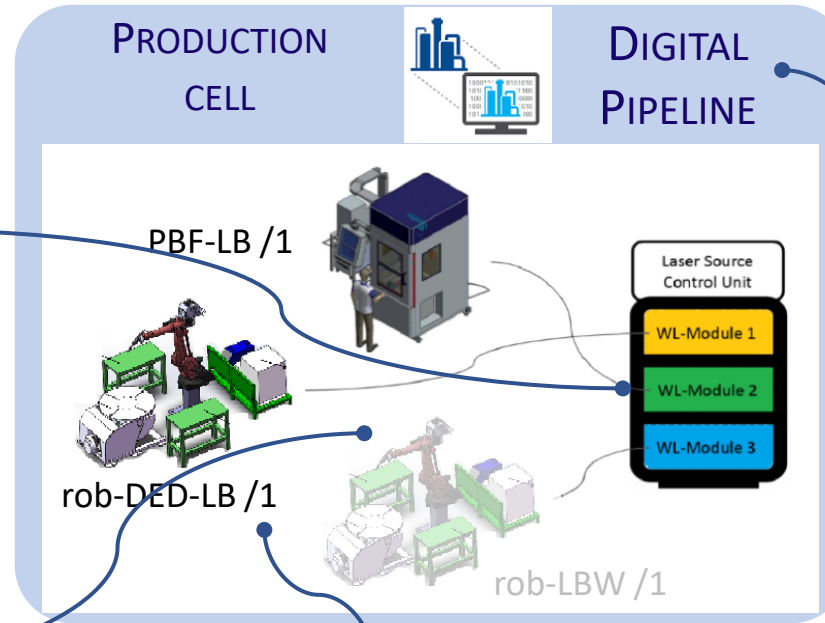


# INNOVATIONS BROUGHT BY WAVETAILOR



## Innovation 1: Laser source level

- ✓ Multi wavelength for easier adaptation to each material
- ✓ Modular approach for:
  - Easy maintenance
  - Connectivity with multiple machines
- ✓ Diode-based for:
  - Higher energy efficiency
  - Lower investment cost
  - Reduced size/weight



## Innovation 4: Distributed manufacturing level

- ✓ Automatic assessment of the DED design for dissolution and recycling of multi-material components
- ✓ Automatic design assessment for disassembly and reuse of multi-material PBF assemblies
- ✓ Integrated ZDM/ZDW strategies based on collected production parameters
- ✓ Deployment of the ZDM/ZDW strategies at multimaterial and assembly level
- ✓ Deploying the Virtual Production Site at delocalized level;
- ✓ Enabling Distributed Additive Manufacturing Chains

## Innovation 2: AM system level

- ✓ Multi-wavelength optics for fast reconfiguration
- ✓ Fully deployed monitoring architecture integrated to the cloud-based ZDM/ZDW

## Innovation 3: Shop floor level

- ✓ Integrated non-stop manufacturing of multimaterial components (DED)
- ✓ First-time-right multimaterial assemblies (PBF)
- ✓ Simultaneous manufacturing of AM parts and assemblies on different AM systems using the same laser source
- ✓ Extensible to other laser-based operations in the future.





## ABSTRACT

WAVETAILOR focuses on two industrial scenarios which are related to the complex multi-material component and assembly. The first one is Directed Energy Deposition of a multimaterial leading edge for a hypersonic hydrogen-driven airplane, while the second relates to the Powder Bed Fusion of complex multi-material assembly of a drone for urban delivery. The challenges in both cases are related with zero-defect manufacturing, sustainability and first-time-right manufacturing. WAVETAILOR aims to solve the high precision in complex material structure manufacturing, the disassembly, reuse and recycling of components, while reducing the environmental footprint of both manufacturing process and the components itself.

To achieve this, three main pillars are developed in the project: 1) flexible energy efficient photonic setup based on modular diode-based laser source and multi-wavelength optics;

2) full reconfigurability of this setup, to use minimal energy and material resources in manufacturing of two use cases and 3) ZDM and ZDW strategies at assembly level controlling the compliability of complex multimaterial products at machine level, shop floor level and delocalized manufacturing chain level. The latter pillar will be based on digital sibling (shop floor level) and twin (cloud level) for automatic assessment of component/assembly design for circularity; first time right process planning using synthetic legacy data and ZDM/ZDW based on real time process and post-process monitoring. When the WAVETAILOR objectives are achieved, the manufacturing process of the two use cases will have spent 200MWh of energy less, 923kg of waste less, while the production costs are going to be 50-65% lower. In order to prove this a dedicated sustainability study is provided along the project.





## GENERAL INFORMATION

- **Project acronym:** WAVETAILOR
- **Title:** Modular laser sources for sustainable production of short personalized production series
- **Call:** HORIZON-CL4-2023-TWIN-TRANSITION-01 (Twin Green And Digital Transition 2023)
- **Funding Scheme:** IA - Innovation Action
- **Grant Agreement No** #101137974
- **More information:**
  - <https://wavetailor.eu>
  - <https://cordis.europa.eu/project/id/101137974>

### Partners

- JOANNEUM RESEARCH (Coord.) AT
- COVENTRY UNIVERSITY UK
- LORTEK ES
- PRIMA ADDITIVE IT
- NLIGHT EUROPE IT
- Z PRIME DE
- DESTINUS SPAIN ES
- AEROTECNIC METALLIC ES
- MORPHICA IT
- AUSTRIAN ENERGY AGENCY AT
- TEMATYS FR





# PARTNERS

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AUSTRIAN ENERGY AGENCY



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