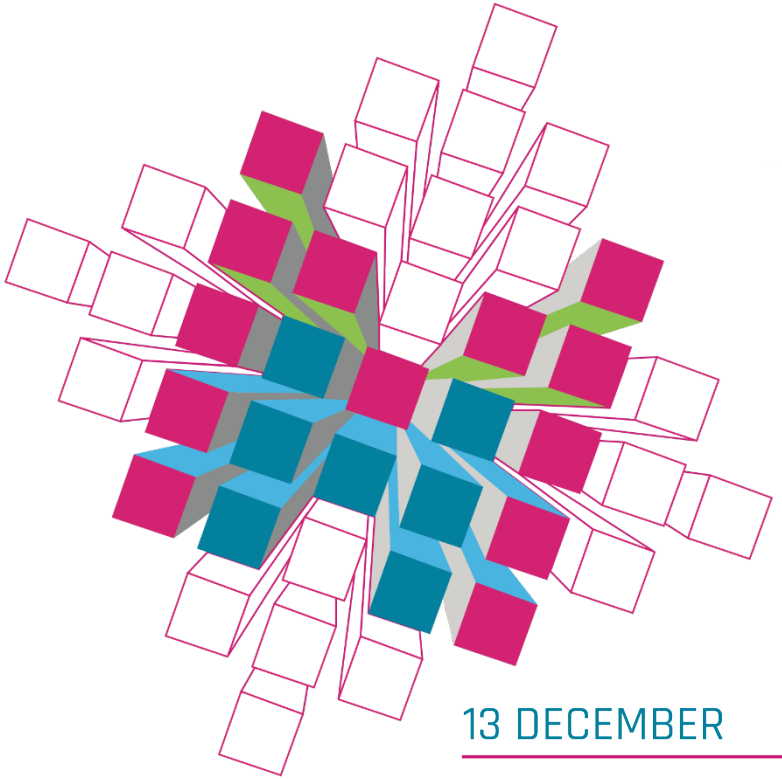

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Additive Manufacturing Challenge

13 DECEMBER

MEETING 2022

MATERIALS

ORGANISING PARTIES

M2i materials innovation institute

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Bond voor Materialenkennis

M2i NAVAL GROUP RAMLAB böhlerwelding EMC2

ARRK Villeroy & Boch KUŹNIA JAWOR GKN AEROSPACE

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TU Delft gorenjegroup Gorenje Orodjarna, d.o.o. valk welding AIR PRODUCTS

BUREAU VERITAS GHENT UNIVERSITY DTU MAN cea EDF Politechnika Wrocławska

WAAM Design Contest - Jury

Dr. ir. Constantinos Goulas (chair)	Assistant professor	University of Twente
Dr. ir. Marcel Hermans	Associate Professor	Delft University of Technology
Dr. Martin Schmitz-Niederau	Senior Expert New Welding Materials & Technology	voestalpine Böhler
Mr. Théo Petitgas	Welding Engineer Additive Manufacturing	Naval Group
Mr. Vincent Wegener	Managing Director	RAMLAB

WAAM Design Contest - Prize

- A Tour and Printing of winning idea at RAMLAB (The Netherlands)

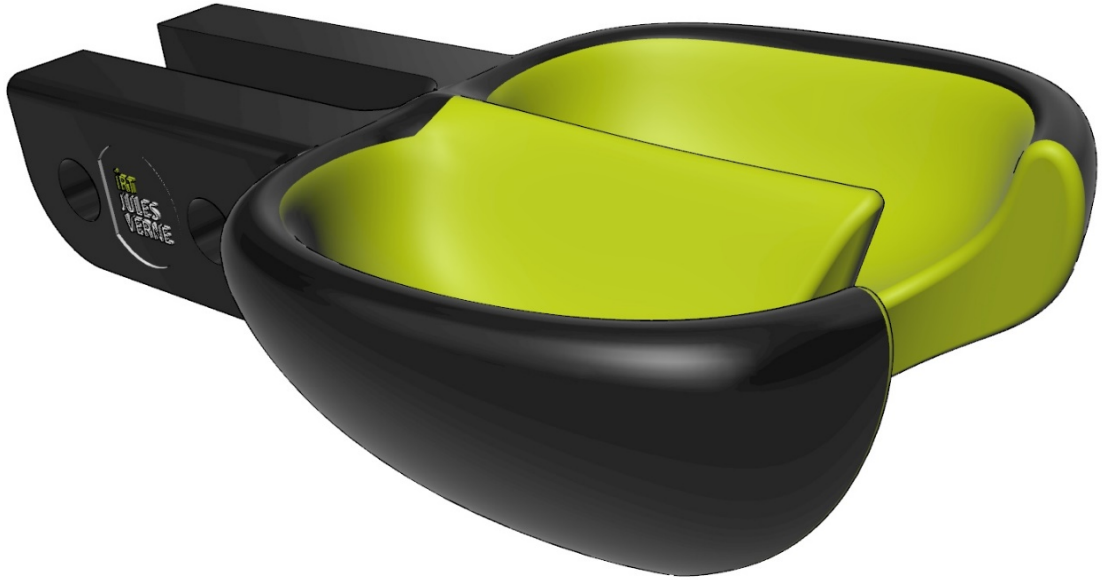
Honourable mention

ThREEColumn

Team:
Lidiana Arrè,
Vittoria Laghi and
Michele Palermo
from University of Bologna

Winner

PELTAM - Smart PELTon buckets produced by multimaterial WAAM



Winners:
Julio Cesar De Luca,
Gregoire Bazin and
Viktor Vavra
from IRT Jules Verne

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IRT JULES VERNE

MANUFACTURING
THE FUTURE

IRT JULES VERNE - KEY FIGURES (SINCE 2012)

PROJECT PORTFOLIO

>110 R&D Projects

225 M€

EUROPEAN ACTIVITIES

19 EU Projects

8 M€

STRONGER TOGETHER

134 Employees

40 Industrial Members

17 SME Members

16 Academic Members

REVENUE & ASSETS

25 M€ Annual Revenue

20 M€ + Equipment Investments

>60 Patents

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IRT JULES VERNE - TECHNOLOGY CENTER ON MANUFACTURING

R&D Thematics

- FORMING AND PREFORMING PROCESSES
- ASSEMBLY Multi Materials
- ADDITIVE MANUFACTURING
- MOBILITY IN INDUSTRIAL ENVIRONMENT
- MANUFACTURING FLEXIBILITY

Technology Transfer

TRL 4 5 6 7

INDUSTRIAL RESEARCH PROJECT

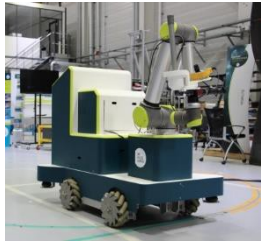
- Colaborative Projects
- Involvement of industrials
- Integration of use cases in the project
- Techno economic assessment

TRANSFER TO THE FACTORY

INDUSTRIAL NEEDS DRIVERS

- **R&D thematics oriented towards Industry 4.0**
- **Integration of partners' capabilities**

Deployement



IRT Jules Verne - Additive Manufacturing Team

Process Competitivity

- Analysis vs Conventionnal Processes
- Costing tool (low TRL)
- High deposition rate
- Recyclage circular economy ACV ACCV

Process Key parameters

- Diagnostic tools and KPI's selection
- WPQ manual / automatic / robotic / DED
- Bill of materials, pre and post process operation

Material => Default librairies

- Dynamic and Static Mechanical Properties
- Anisotropy, compacity
- µstructure, surface, Oxidation

Co-design with manufacturing

- CAD Product for additive processses
- CAM méthods, matérial, equipment
- Process skills and NDT

Process distortion reduction

- Welding & AM
- Processes & Material behaviour laws
- Process Health Monitoring
- Hybridization welding & forging

Open platform multi-process

- Diagnostic / Opérability
- Product Mobility / process
- Hybridization

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PROJECT PELTAM

Smart **PELT**on buckets produced by multimaterial WA**AM**

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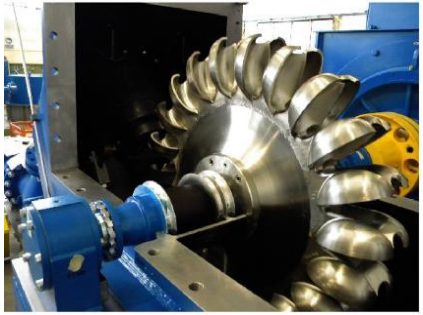
IRT JULES VERNE
LE FUTUR
DE VOS USINES

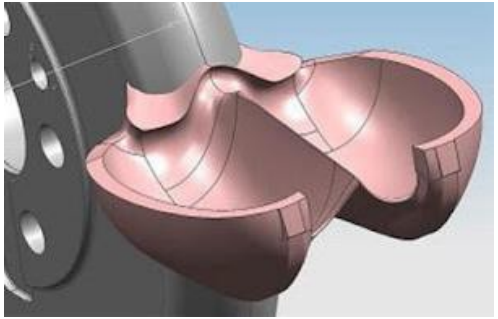
PROJECT PELTAM - Smart PELTon buckets produced by multimaterial WAAM

PROBLEM DEFINITION

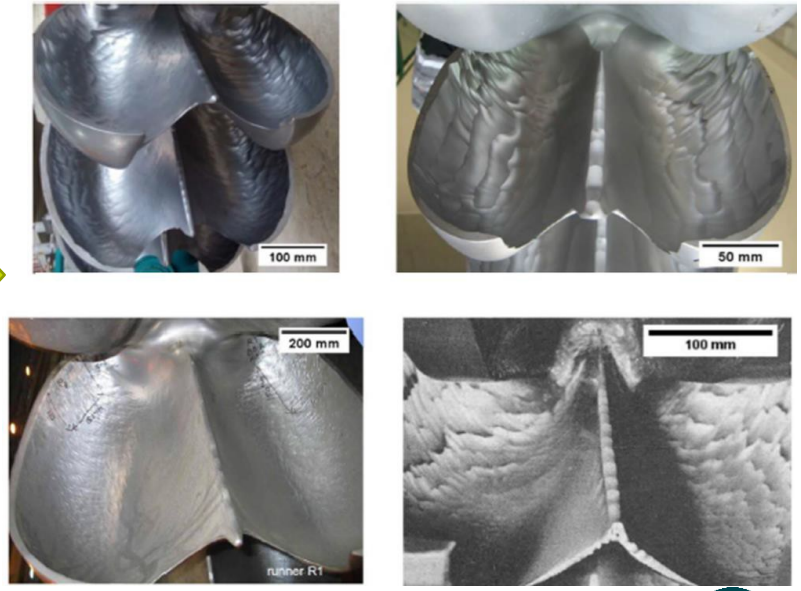
- The main issues encountered by Pelton buckets is wearing during operation, where high speed water jet with abrasive silt wear-out the bucket, reducing Pelton's efficiency up to 8%/year (*Renewable Energy 79 (2015) 96-102*)



PELTON Turbine



PELTON bucket



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PROJECT PELTAM - Smart PELTon buckets produced by multimaterial WAAM

PROPOSAL OF SMART MULTI-MATERIAL PELTON BUCKET

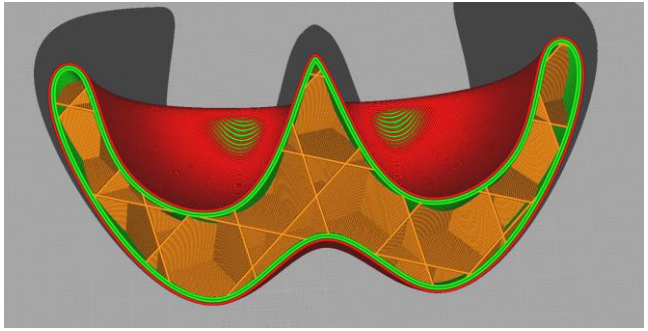
- **PELTAM proposes WAAM to produce multimaterial Pelton-bucket with the advantages of:**
  - Reduction of buckets weight, which in turn will potentially reduce maintenance and wear of Pelton's mechanical system;
  - Improving water jet abrasion resistance on the bucket – functionalised with very hard cladded surface (multi-material);
  - Reduction of CAPEX with cost reduction from WAAM – reduced buy-to-fly ratio energy to produce the Pelton bucket;
  - Reduction of OPEX of the Pelton turbine, with less maintenance and stops due to surface abrasion and mechanical wear;
  - Flexibility on the maintenance when necessary to re-cladding the bucket (OPEX impact);

Bi-material Functionalisation /smart structure

Stainless steel

Clad ***Stellite 12 or 6***

Low buy-to-fly / weight reduction



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LOOKING FOR CONSORTIUM IN THE CALL:

HORIZON-CL4-2023- TWIN-TRANSITION-01-02 - High-precision OR complex product manufacturing

IRT JULES VERNE can Collaborate in the following fields:

- **Additive manufacturing processes with high material deposition rate (WAAM, polymer wire deposition);**
- **Production of large parts with automated welded smaller patches for precision molds**
- **Weld/AM Multi-physics modelling/simulation of processes (AM - residual stresses and precision part manufacturing);**
- **Dimensional Tolerancing/kriging methodology with AI approach;**
- **Metrology, monitoring, analysis and control of manufacturing processes and NDT of parts and structures (in-line and off-line)**

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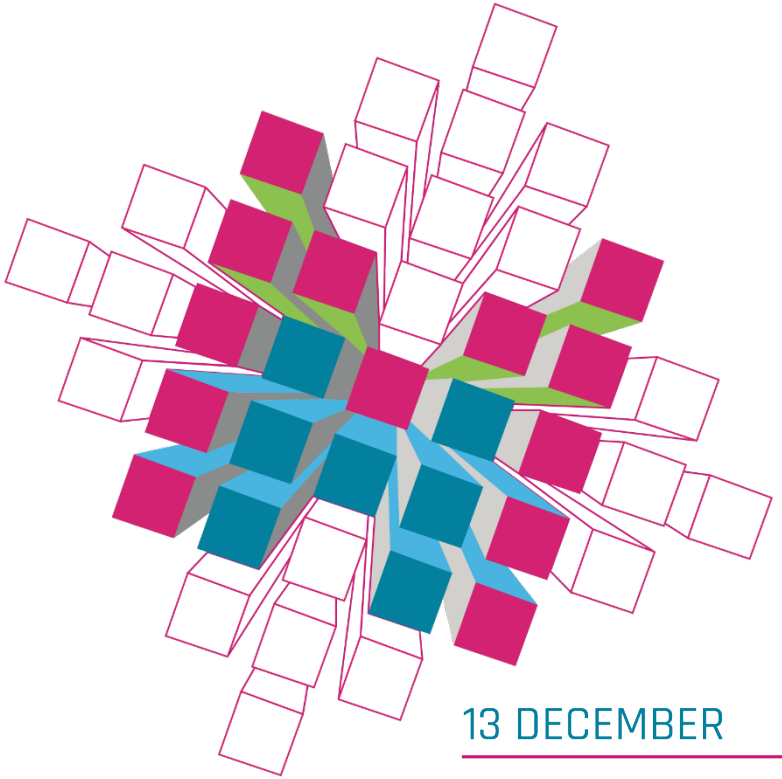

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