PLEIADES: Integrated sensor-based robotic induction welding

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TWI Technology Fellow

Advanced Engineering Show

Wednesday 29th October 2025

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PLEIADES

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PLEIADES – In a nutshell

A constellation of stars also known as seven sisters?

ADVANCING AEROSPACE COMPOSITES THROUGH INDUCTION WELDING AND NEW VITRIMERIC FORMULATIONS ENHANCED BY INTEGRATED PHOTONIC SENSORS, PROVIDING DATA TO DIGITAL SUPPLY CHAIN, SHM, MAINTENANCE

New composite materials, automation of induction welding processes for composites, sensors development – promoting sustainability & circularity

Type of action: RIA
Service : CINEA

Start date: 1st January 2025
Duration: 36 months

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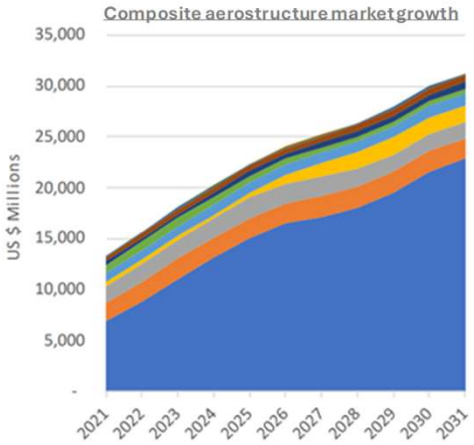
PLEIADES – Our excellence

Current Challenges with the aerostructures market:

- Increase demand for advanced materials that improve aircraft performance & bring cost savings
- Materials that offer light weight properties & withstand harsh environments

PLEIADES is bringing together different disciplines to work towards a holistic solution:

- Undertaking innovating key technologies
- That will play a significant role in advancing further composite aerostructures
- And promote the digital transformation in aviation



PLEIADES – Expected outcome

Advancements in *composite aerostructures* and deliver new tools and processes in support of the European aviation supply ecosystem.

PLEIADES – Key goals

Key goals of PLEIADES

- Promote sustainability and circularity
- Cost savings of 30-40%
- Development of maintenance and repair protocols
- Development of innovative SHM methodology

PLEIADES – Impacts

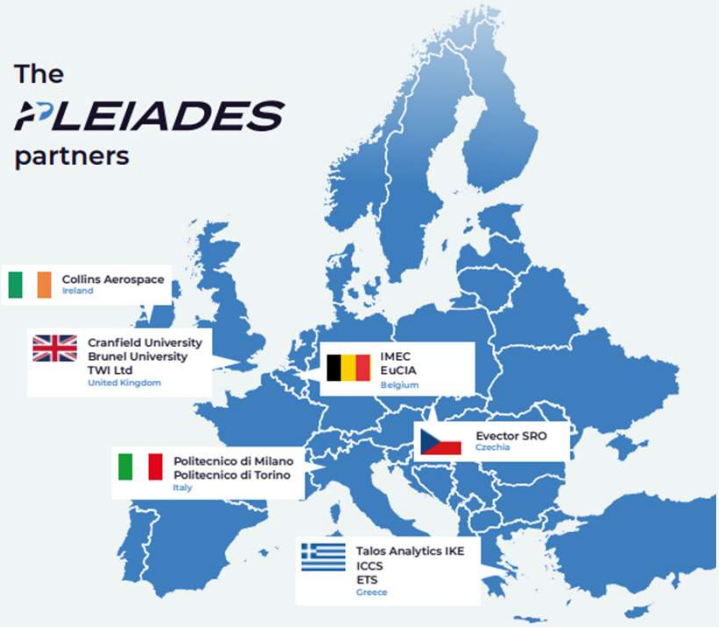
Project results focus on advancements in composite aerostructures and deliver new tools and processes in support of the European aviation supply ecosystem

- Automate the induction welding process, using embedded innovative photonic integrated circuit (PIC) based sensors to characterize the weld area inside the composite - high-volume sustainable manufacturing with integration inspection
- Through use of weld joining method in PLEIADES (no adhesives or fasteners), the embedded sensors and the dataset of the automated welding process - recycling and circularity.
- Benzo-based vitrimer matrix formulation for carbon fiber composites which will combine the advantages of aerospace grade thermoplastics and thermoset typical processing conditions (conventional temperature and pressure) - sustainability and recycling and circularity
- Digital methods include ML enhanced multi physics models, material models and healing models – digital supply chain for aerospace
- Maintenance and repair protocol, based on both the model (ML enhanced multi physics, material, healing) and more importantly on the new vitrimer tests for joints disassembly and reprocessability – sustainability and circularity

12 Partners

36 Months

The PLEIADES partners



6 Countries

€4.7m Funding

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Technical Excellence. 7

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PLEIADES – The partners

12 partners across Europe working on 13 WPs

- TWI Limited (TWI) - UK
- Association Europeenne De Lindustrie Des Composites (EUCIA) – Belgium
- Brunel University London (BUL) - UK
- Collins Aerospace Ireland, Limited (COLLINS AERO) – Ireland
- Cranfield University (CRAN UNI) – UK
- Engineering Technology Solutions EE (ETS) – Greece
- Evektor Sro (EVEKTOR SRO) – CZ
- Institute of Communication and Computer Systems (ICCS) - Greece
- Interuniversitair Micro-Electronica Centrum (IMEC) – Belgium
- Talos Analytics IKE (Talos Analytics) – Greece
- Politecnico Di Milano (POLIMI) – Italy
- Politecnico Di Torino (POLITO) – Italy

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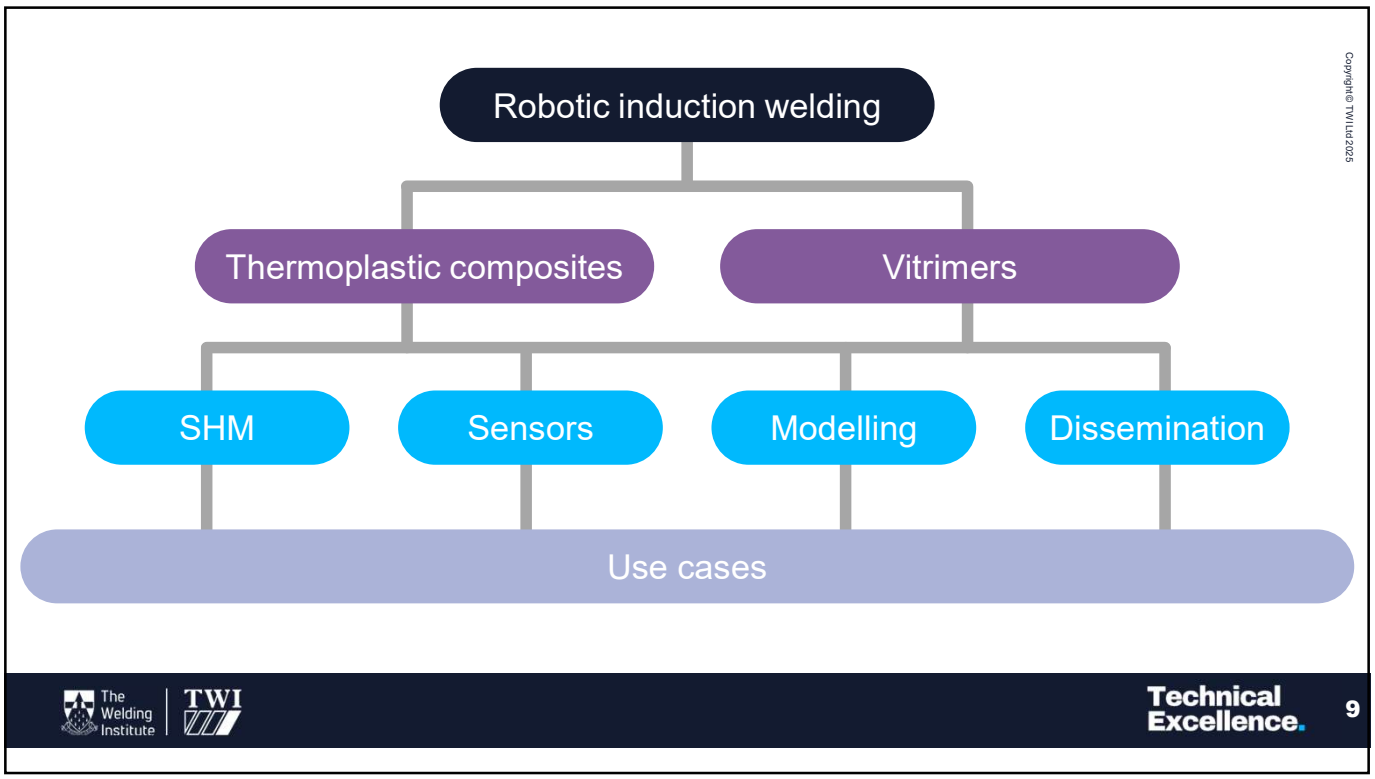
Robotic induction welding
Thermoplastic composites
Vitrimers
SHM
Sensors
Modelling
Dissemination
Use cases
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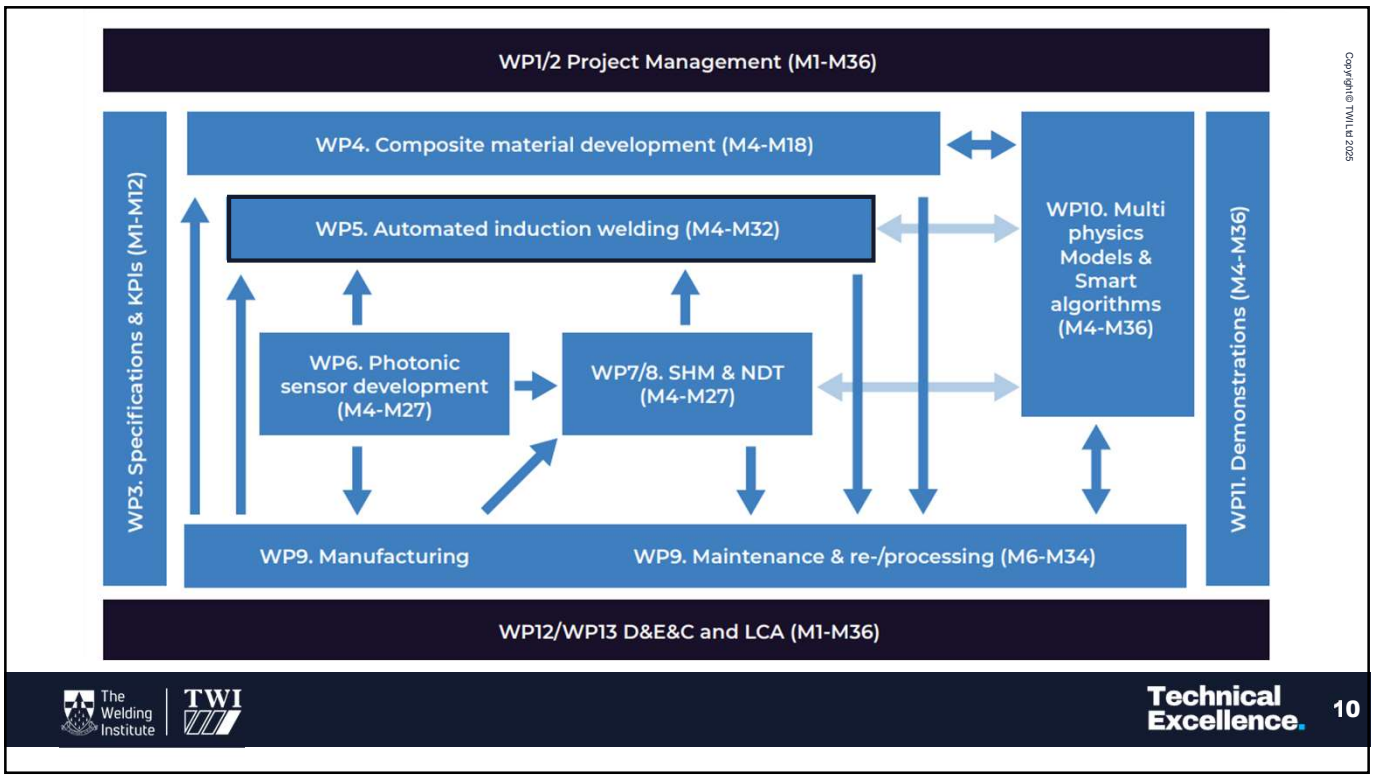
WP1/2 Project Management (M1-M36)
WP3. Specifications & KPIs (M1-M12)
WP4. Composite material development (M4-M18)
WP5. Automated induction welding (M4-M32)
WP6. Photonic sensor development (M4-M27)
WP7/8. SHM & NDT (M4-M27)
WP10. Multi physics Models & Smart algorithms (M4-M36)
WP11. Demonstrations (M4-M36)
WP9. Manufacturing
WP9. Maintenance & re-/processing (M6-M34)
WP12/WP13 D&E&C and LCA (M1-M36)
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Automated Induction Welding

WP5

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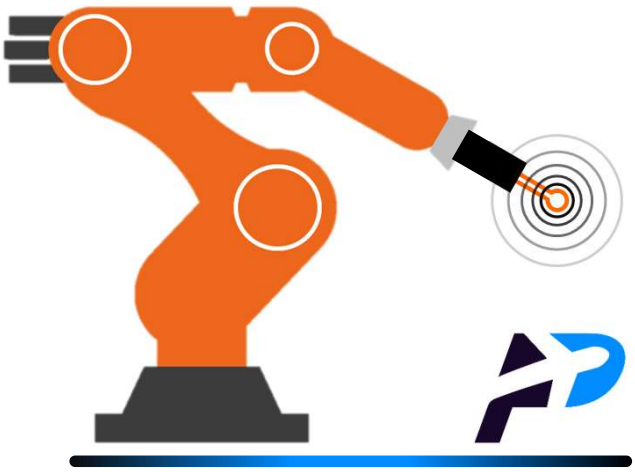

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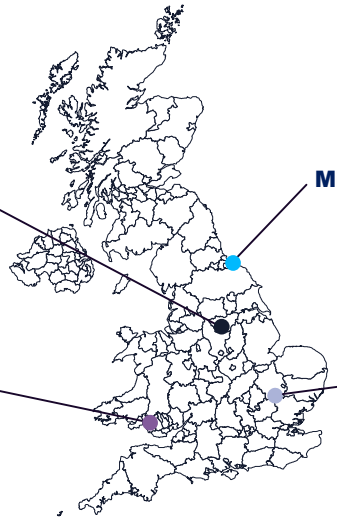
TWI UK Offices

Rotherham

Port Talbot



Middlesbrough

Cambridge

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WP5 – Automated induction welding development

- T5.1 Automated Robotic induction welding process development
- T5.2 Robotic induction welding process for PLEIADES vitrimer
- T5.3 Joint design and testing
- T5.4 Data collection and analysis
- T5.5 Embedded photonic sensor integration in induction welding process

TCTOOL

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2023

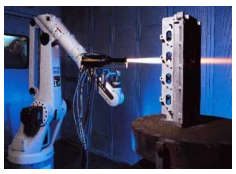
The TCTool project was funded as part of the Clean Sky initiative under grant agreement number 865131.

TWI expertise in robotic processes

Joining

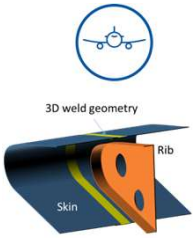
NDT

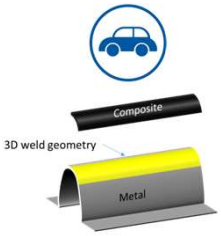
Cutting

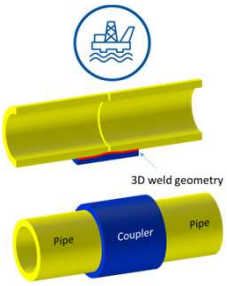


Coating

Induction welding







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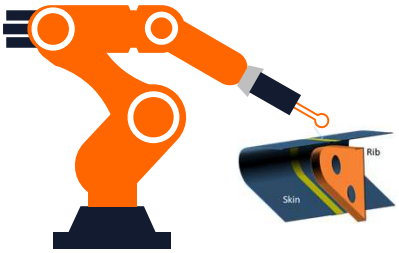
PLEIADES WP5 – Technology



Induction weld

Welding parameters:
Power, frequency, current, voltage, speed, temperature, pressure…

Process simulation

Inspection

Inspection results:
UT, XCT, µW, thermography…

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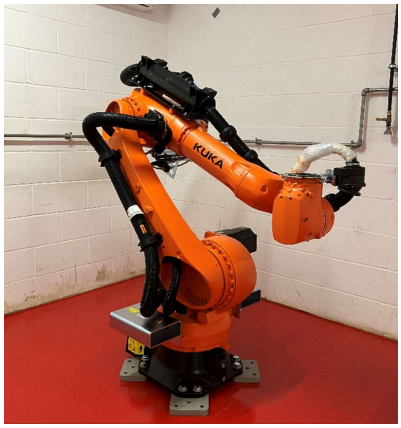
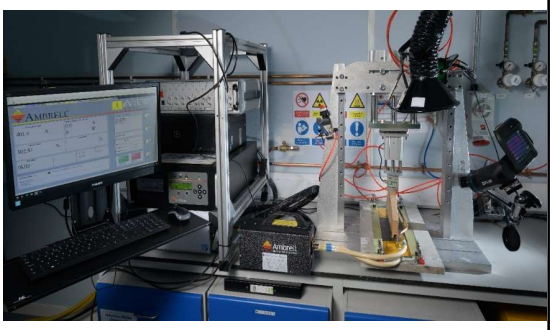
PLEIADES WP5 – Technology

Fontijne LabPro 60



KUKA IONTEC KR50



Ambrel EasyHeat 8310

PLEIADES WP5 – Technology

This project has received funding from the European Union's Horizon 2020 research and innovation programme. Grant agreement 871875.

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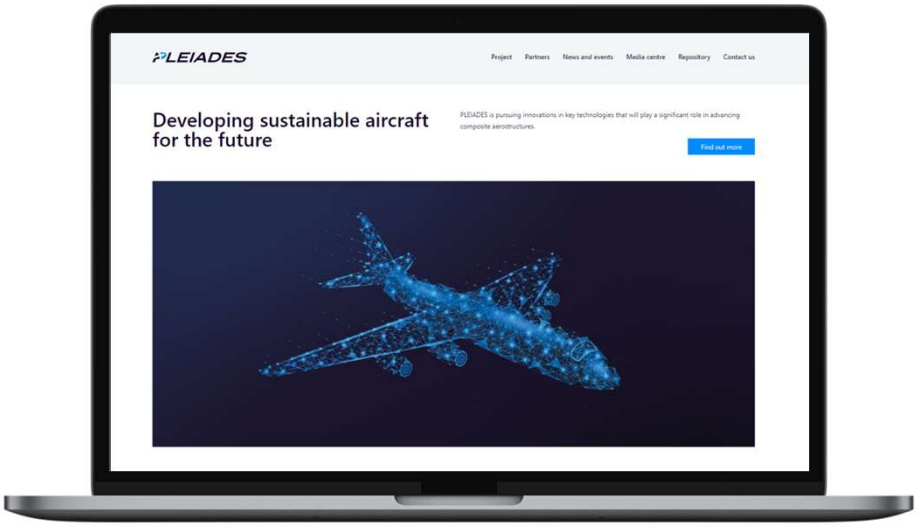

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The PLEIADES project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement no. 101192721.