

grAcefeful AM

Generating an AI-Enhanced Learning Platform to Unlock Professional Careers & Inspection Excellence in Additive Manufacturing

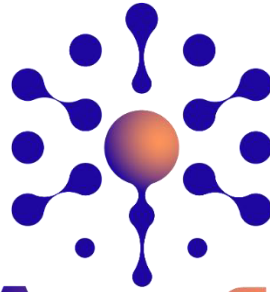
Newsletter #1

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Newsletter #1

1. Introducing the grAceful AM Project

Introducing grAceful AM: Building Inspection-Ready Skills for DED and PBF

Welcome to the first e newsletter of the grAceful AM Project! We are pleased to introduce grAceful AM – Generating an AI Supported Learning Platform to Unlock Professional Careers and Inspection Excellence in Additive Manufacturing, an Erasmus+ Alliances for Innovation initiative co funded by the European Union.

The project is carried out by a strong European partnership composed of FAN3D (Portugal), CESOL (Spain), the European Federation for Welding, Joining and Cutting – EWF (Belgium), Politécnico de Leiria (Portugal), iptech (Greece), the Laboratory for Manufacturing Systems & Automation – LMS (Greece), Laser Akademie GmbH (Germany) and IDONIAL (Spain). Together, these organisations bring expertise from VET, higher education, research, industry, and standardization, ensuring that the project's results are technically rigorous, pedagogically robust, and aligned with real industrial needs across Europe.

Launched in January 2026 and running for 36 months, grAceful AM addresses one of the most pressing challenges in Additive Manufacturing (AM): the lack of qualified inspectors for Directed Energy Deposition (DED) and Powder Bed Fusion (PBF) technologies. As AM technologies evolve, inspection processes become increasingly complex, requiring professionals with advanced technical, analytical, and digital competences. The project responds to this need by developing industry aligned curricula, AI enhanced learning platform, and micro credentials designed to support the next generation of AM inspectors.

DED and PBF are among the most advanced and rapidly expanding AM processes. Their technical complexity—from melt pool behaviour to defect formation—demands highly specialised inspection skills. Yet, the absence of dedicated inspector profiles for these technologies within the International Additive Manufacturing Qualification System (IAMQS) leaves a significant gap in European training and qualification pathways.

A central ambition of grAceful AM is to contribute directly to the evolution of IAMQS. The project is developing inspector profiles, competence units, and

micro credentials with the intention of enabling their future integration into IAMQS pathways, supporting long term adoption and recognition of AM inspection training across Europe.

To achieve this, the project is defining;

- the competences, tasks, and knowledge required for DED and PBF inspection;
- designing structured training pathways aligned with European qualification frameworks;
- creating AI supported learning experiences that adapt to learners' needs;
- embedding green and digital skills to support the broader transformation of the AM sector.

Over the next three years, the consortium will develop;

- inspector curricula, a full set of competence units,
- micro credentials issued by EWF,
- an AI supported learning platform for personalised and self-paced learning,
- train the trainer materials,
- a digital resource library dedicated to AM inspection.

These outputs will be validated through expert workshops, national pilot courses, and iterative refinement to ensure their relevance and applicability.

The project's work plan includes needs assessment and stakeholder analysis, curriculum and training material development, AI enhanced platform creation, pilot testing with VET, higher education, and industry learners, and a series of national and European dissemination activities. By June 2026, the consortium will validate inspection needs and requirements, followed by curriculum design and the development of interactive training materials.

Throughout the project, we will continue to share updates, insights, and opportunities to engage—whether through workshops, pilot courses, or public events. We invite you to follow our progress as we work to strengthen Europe's AM workforce, support green and digital transitions, and shape the future of AM inspection training.

2. Desk Research Report

Mapping AM Inspection Needs: First Insights from the Desk Research

The Future of Additive Manufacturing: Quality, Trends, and the Skills Gap

Additive Manufacturing (AM)—often known as 3D printing—is rapidly transforming how we make things. By building parts layer-by-layer, AM allows engineers to design complex, lightweight shapes that were previously impossible to manufacture.

While technologies like **Powder Bed Fusion (melting metal powder with lasers)** and **Directed Energy Deposition (welding material onto a surface)** are driving breakthroughs in aerospace, healthcare, and industrial repair, they also bring unique challenges. Because these parts are built from scratch, ensuring they are safe and defect-free requires a whole new approach to quality control.

The Core Challenge: Why Traditional Inspection Falls Short

Traditional inspection methods look at the outside of a finished part. However, 3D-printed components can hide internal flaws. AM parts are prone to unique defects:

- **Porosity:** Tiny, trapped air bubbles or microscopic holes that can weaken the material.
- **Cracks & Delamination:** Separation between the printed layers.
- **Residual Stresses:** Internal tension caused by rapid heating and cooling, which can warp the part.
- **Anisotropic Behavior:** The reality that a 3D-printed part might be stronger in one direction (e.g., horizontally) than another (e.g., vertically).

To catch these issues, the industry is moving away from post-production checks and toward **Integrated Lifecycles**—combining design, simulation, and manufacturing into one continuous digital workflow.

Advanced Tools for Next-Gen Quality Assurance

Because you cannot always see a defect from the outside, the industry relies on advanced **Non-Destructive Testing (NDT)**—methods to test parts without damaging them:

- **X-ray CT (Computed Tomography):** Essentially a medical CAT scan for industrial parts, allowing inspectors to see deep inside complex, internal geometries.
- **Advanced Ultrasonics:** Using high-frequency sound waves to scan for hidden cracks or voids.
- **Multi-Modal Data Analysis:** Combining dimensional checks (measuring the part), mechanical testing (testing strength), and chemical analysis to get a complete picture of quality.

Strategy: The Inspection Intensity Matrix

Not every 3D-printed part requires the same level of scrutiny. A bracket for a commercial aircraft requires far stricter testing than a plastic prototype for a home appliance.

To balance safety and cost, the industry uses an **Inspection Intensity Matrix**. This framework maps out different industrial sectors against their safety risks:

	AM applications from Industrial sectors					
	Aerospace	Medical Devices	Automotive	Energy	Industrial	Consumer goods
VERY HIGH Complete volumetric CT scan	Engine parts			Turbine parts Pressure vessels	Pressure vessels	
HIGH Feature-specific volumetric CT scan	Structural brackets	Surgical implants	Tooling Structural and engine components	Heat exchangers	Component repair Structural parts	
MEDIUM Dimensional & Surface NDT	Non-critical components	Prosthetics	Electrical vehicle components		Injection moulds	Technical parts
LOW Visual inspection only		Non-critical medical devices			Non-critical industrial components	Technical parts assembly
NONE						Non-technical parts

Closing the Skills Gap: What the Industry Needs Next

As production speeds accelerate to meet market demands, the human workforce must evolve alongside the technology. To fully unlock the value of AM, the industry must urgently invest in:

- **Digital & AI Skills:** Training inspectors to use AI-driven software that automatically detects defects in scan data.
- **Advanced Data Interpretation:** Moving from simple visual checks to understanding complex, data-heavy 3D inspection models.
- **Harmonized Standards:** Creating universal rules and qualifications so that a 3D-printed part certified in one country is recognized globally.

3. Call to Action

Follow the next steps of grAceful AM

As grAceful AM moves forward, the project will continue sharing updates on its activities, results and upcoming opportunities for stakeholder engagement. The first months of work are laying the foundations for the development of future training resources in Additive Manufacturing inspection, with a particular focus on Directed Energy Deposition (DED) and Powder Bed Fusion (PBF).

Over the coming months, the consortium will keep stakeholders informed about the project's progress, including insights from the desk research, next steps in the needs assessment process and future developments related to the AI-supported learning platform.

A key next step of the project is the establishment of the **grAceful AM Working Group**, bringing together **industry experts, training organizations, and IAMQS stakeholders** to contribute directly to the development of future AM inspector training.

The Working Group will play an essential role in:

- ✓ Validating findings from research and stakeholder activities
- ✓ Refining and strengthening the identified skills framework
- ✓ Bringing practical perspectives from professionals and industry stakeholders
- ✓ Ensuring that real-world AM needs are reflected in future educational pathways

Follow grAceful AM through the project website and LinkedIn page to stay informed about upcoming news, results and opportunities to connect with the project.

Website: <https://graceful-am.eu/>

LinkedIn: <https://www.linkedin.com/company/graceful-am/posts/?feedView=all>

