



Open Innovation Platform for Optimising Production Systems by Combining Product Development, Virtual Engineering Workflows and Production Data.

AAS-based Digital Twins for Production Equipment in the WAAM Process

4th Press Release – June 2025

The aim of the PIONEER project is to create an Open Innovation Platform and an interoperable digital pipeline that ensures the seamless data flow across the value chain. One of the main components relies on the data manipulation and interoperability between the different tools that generate and use data. Usually, data comes from very different sources and with distinct structures, which makes interoperability and traceability difficult. To tackle this issue, the use of digital twins plays a key role.

Asset Administration Shell (AAS) is the implementation of the digital twin in Industry 4.0. The AAS is the digital representation of an asset, which is anything that provides added value to a company, such as equipment, products, or processes. In this context, AAS provides a standardised way of structuring information provided by different parties, aiming not only to facilitate data exchange but also to ensure that anyone who wants to use this data in the future will have sufficient information about all the assets involved in the data acquisition. AAS supports the use of data throughout the various phases of a product's manufacturing life cycle, enabling traceability and knowledge transfer across the value chain.

Specifically, the PIONEER project applies its developments in two use cases. One of them, the MX3D use case, deals with the manufacturing of a part using the WAAM (Wire Arc Additive Manufacturing) process.

The manufacturing line used comprises a robot and a welding power source as well as a monitoring system composed of an edge server, two cameras (for welding and thermal data), an amperemeter and a voltmeter connected to an oscilloscope, as well as various thermocouples.

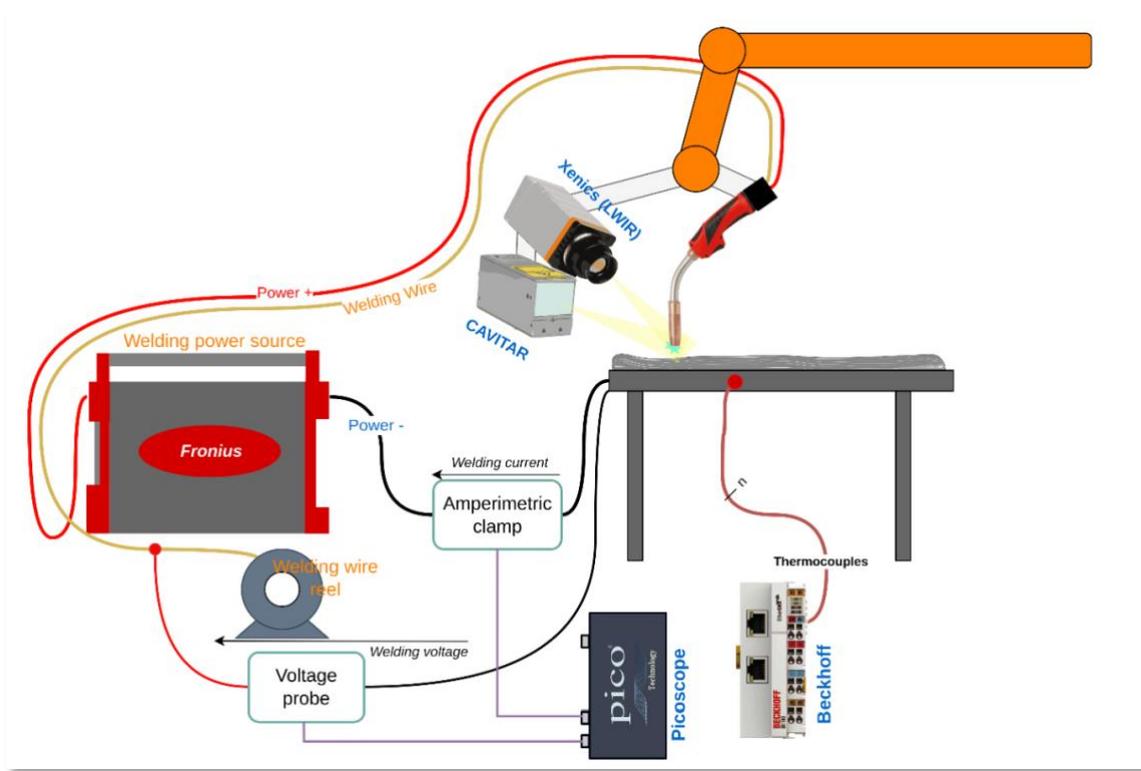


Figure 1: WAAM manufacturing line and its monitoring components

All this different data needs to be structured and associated with each equipment that generates it. For this purpose, the AAS is applied, linking the virtual representation of the asset to its physical counterpart. Each Asset Administration Shell is composed of different submodels, each one encapsulating specific information about related features. For instance, there could be a submodel that incorporates general information about the manufacturer, another one that contains all the documentation of the asset, while an additional one could include all the live operational data being updated by the monitoring system.

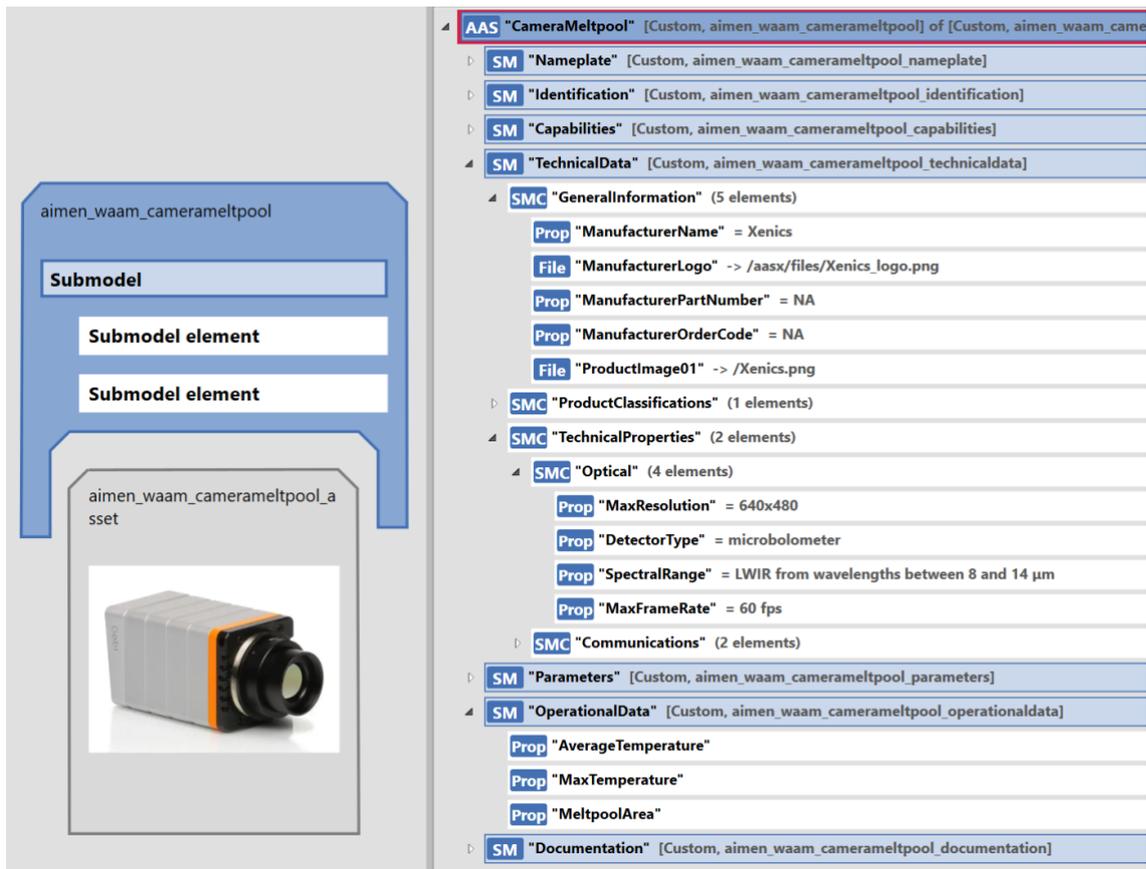


Figure 2: AAS model for the camera that records the meltpool of the WAAM process

Once the modelling of all the asset's features is complete, the final step is to link this virtual asset with the physical data being recorded. In the MX3D use case, this was done in the following way. The data is captured using a multimodal monitoring software (SmartHub) that connects with various monitoring equipment via different protocols. Then, using an OPC UA server, the data is sent to a platform server that hosts the different AAS and maps the data to each property modelled in the AAS inside the Operational Data Submodel. In this way, one AAS not only contains all static information about the asset but also the dynamic data sent by the monitoring system.

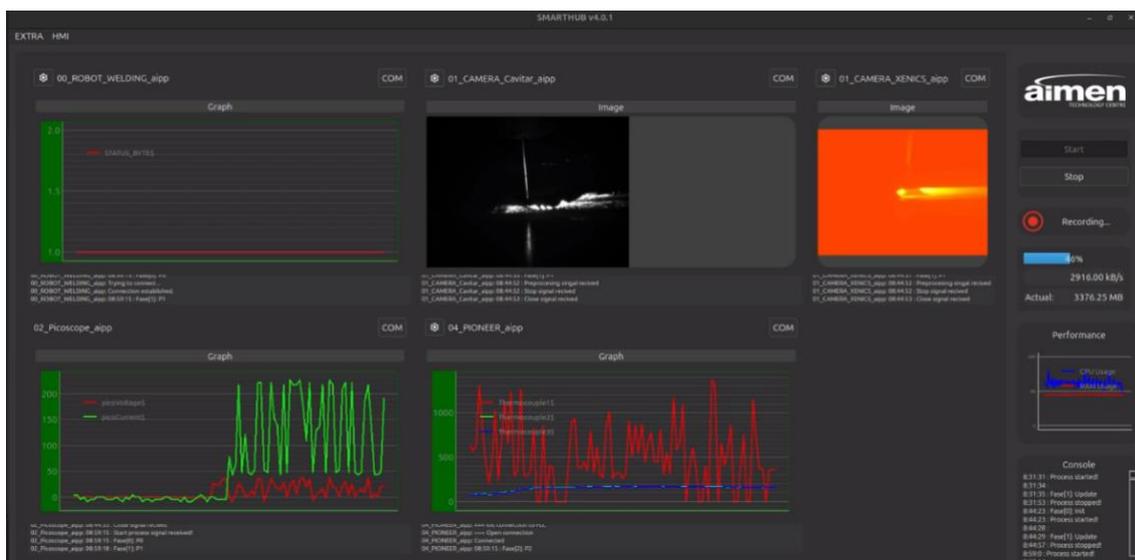


Figure 3: SmartHub acquiring data from the monitoring equipment

In conclusion, the use of AAS enables the linking of real-time data from a manufacturing line to a virtual digital twin, which contains all relevant information about the different assets, including manufacturer details, technical specifications, and documentation, among others. This illustrates how the Asset Administration Shell provides a standardised way to connect the digital world with the physical one.

ABOUT THE PROJECT

This Horizon Europe project took off in January 2023. PIONEER develops and implements an interoperable Materials-Modelling-Manufacturing Ecosystem, enabling multidirectional dataflow throughout the material value chain by connecting the production's various stages. Combining a design-by-simulation approach with manufacturing and quality data, PIONEER optimises product development strategies in high-mix/low-volume production schemes.

Project Title: Open Innovation Platform for Optimising Production Systems by Combining Product Development, Virtual Engineering Workflows and Production Data.

Project ID: 101091449 | **Start Date:** 01/01/2023 | **Project Duration:** 36 Months

Project Partners:



FOR ADDITIONAL INFORMATION, PLEASE CONTACT

Project Coordinator: AIMEN

Daniel Gesto dgesto@aimen.es

Technical Coordinator: AIMEN

Felix Vidal fvidal@aimen.es

Dissemination & Communication Manager: CORE IC

Iliia Kantartzi ikantartzi@core-innovation.com

FOLLOW US

