

# MX3D

PRINT ON DEMAND SERVICES

INFRASTRUCTURE



SPACE SOLUTIONS

BMW  
GROUP



DAMEN

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Schindler

TAKENAKA

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[www.MX3D.com/services/  
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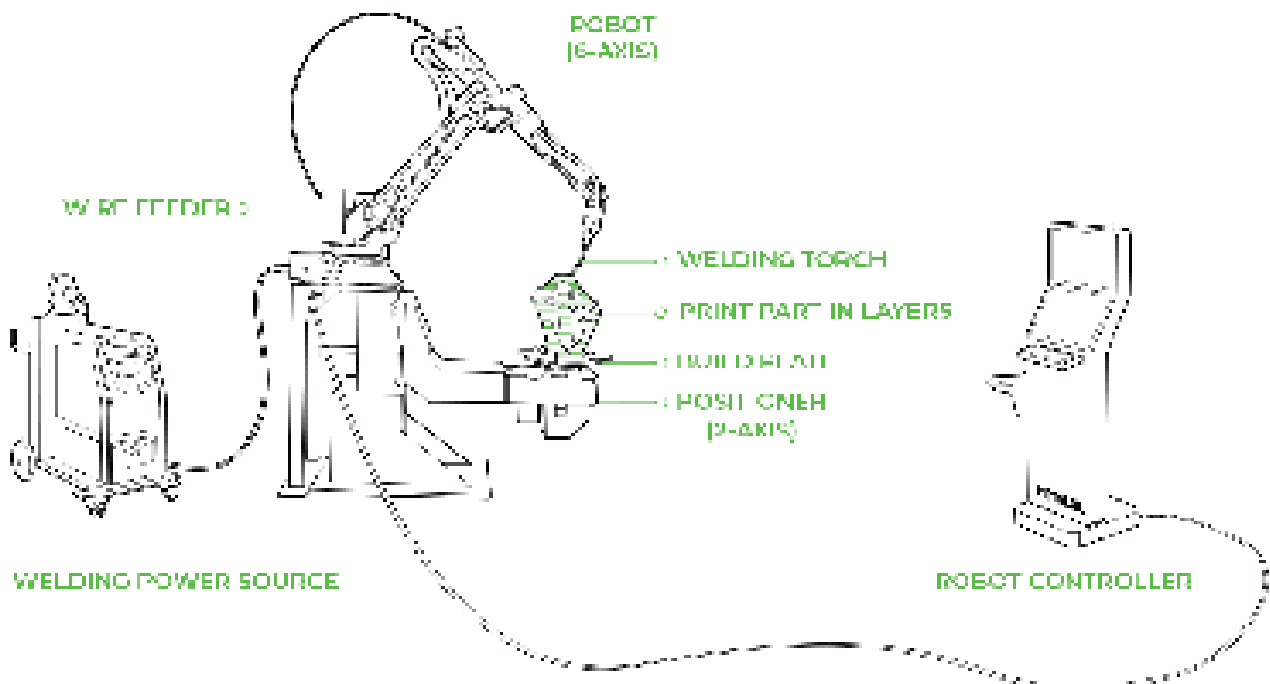
# MX3D - 3D PRINTED STEEL STRUCTURES

## MX3D

- 10+ Robots
- 30+ People, skilled design and manufacturing
- Delivering quality since 2014
- Successfully manufactured bridges, trusses and connectors
- On time attitude

## WHAT IS WAAM?

**Wire arc additive manufacturing**, in short **WAAM**, is a **metal 3D printing technology** in the subsection of direct energy deposition (**DED**). 3D printing, or additive manufacturing has found its way from prototyping into industrial applications and final products. In comparison to subtractive methods like milling and turning, the material is **added layer-by-layer** such that only the material needed is used. Parts produced with WAAM have mechanical properties comparable to cast or forged material.

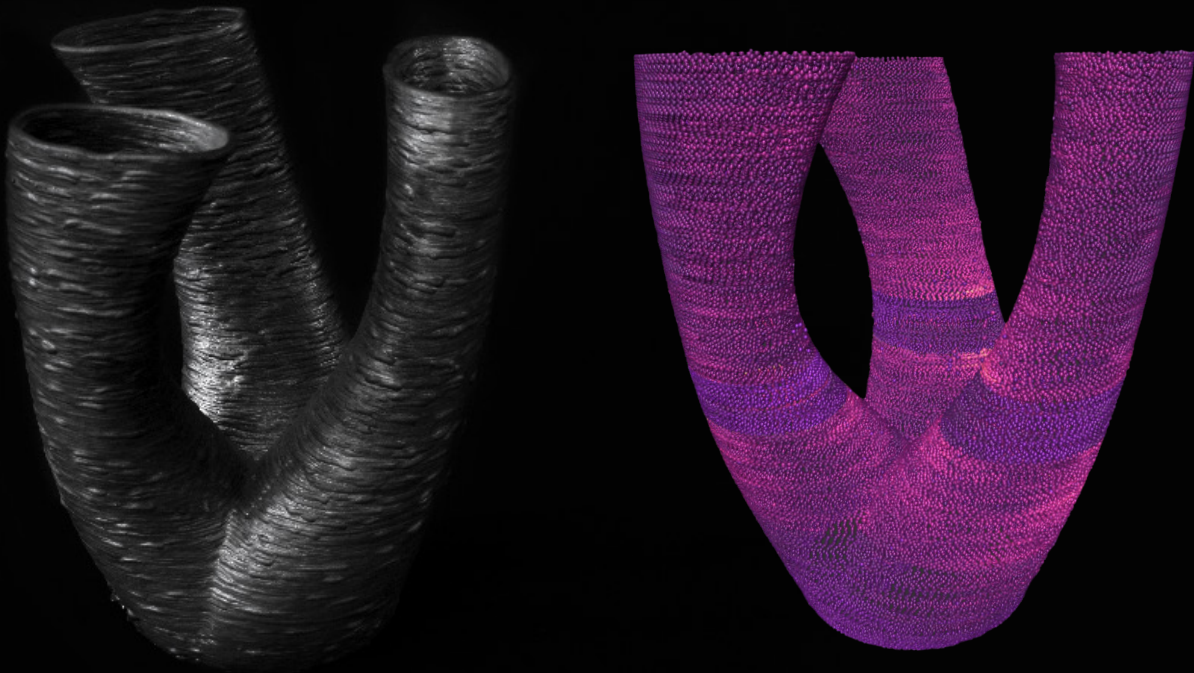


# BENEFITS OF WAAM FOR CONSTRUCTION

**WAAM** is well-suited for producing **complex steel parts**. It enables easy modification of designs without incurring additional tooling costs, making it **ideal** for producing **large volumes** of **parametrically designed parts**.

- No need for **special moulds or fixtures**.
- Ideal for **large volumes of unique connectors**.
- Aligns with the growing interest in **parametric design**.
- TYK welds are eliminated, remaining weld joints are relocated to area with lowest stress.
- From 10>10,000+ pounds of metal per piece.

WAAM generates **less material waste** compared to traditional manufacturing processes. This contributes to **cost savings** and significant **environmental benefits**.



# CERTIFICATION

**MX3D** has a **certified** additive manufacturing facility for **robotic wire arc additive manufacturing** (Wire-DED). The qualification includes control relating to feedstock, equipment, personnel, process and build control covering multiple metal alloys.

The company has **extensive experience** in the **qualification** of special projects working closely with Lloyds Register, The Welding Institute (UK), DNV, GL and Bureau Veritas. It follows **standards** such as SPEC, ASTM, SAE, AISI, and BS.

**LRQA**  
CERTIFIED

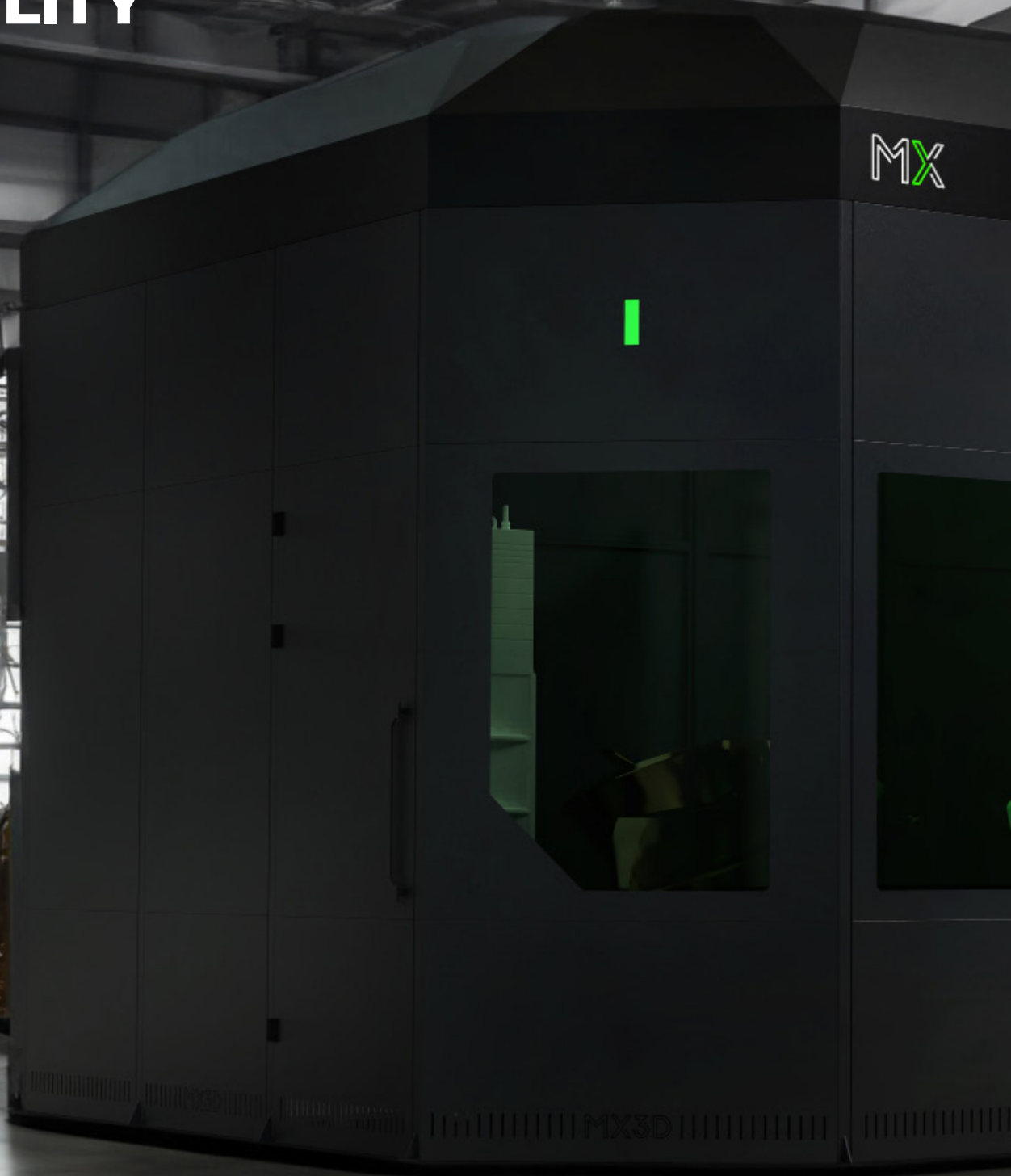
ADDITIVE  
MANUFACTURING  
FACILITY QUALIFICATION

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# FACILITY

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Since 2014 MX3D has been the **innovation leader** in 3D metal printing for steel structures.

With **10+ industrial robots**, MX3D has a large production facility **specialised in 3D metal printing** of metal structures. MX3D manufactures parts in a qualified facility, with qualified machinery and materials.



**Gijs van der Velden / CEO MX3D**

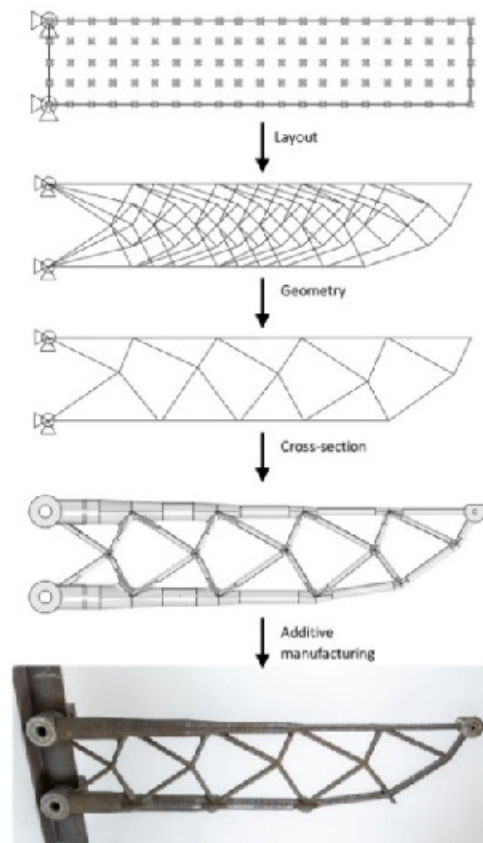
“Our data-centric engineering approach combines design, test results and qualification standards to optimise part design and the manufacturing process. This approach allows for cost-effective mass customisation. It offers an intelligent and innovative perspective for the future of the architecture, engineering, and construction (AEC) industry.”

# MASS CUSTOMISATION

Each connector is slightly different?

Not a problem for MX3D's WAAM system! Where in classic manufacturing variation is costly, for 3D printing each part can be unique.

By following **strict procedure certification** of parts is obtained even when they are all slightly different.



# MATERIALS

## ALUMINIUM

5356: EN ISO 18273: S Al 5356 (AlMg5Cr(A))  
 5183: EN ISO 18273: S Al 5183 (AlMg4,5Mn0,7(A))  
 4018: EN ISO 18273: S Al 4018 (AlSi7Mg)  
 4046: EN ISO 18273: S Al 4046 (AlSi10Mg)  
 4000 series  
 5000 series

## STEEL

### (Stainless) Steels

308LSi: EN ISO 14343 - A: 19.9LSi  
 316LSi: EN ISO 14343 - A: 19.12.3LSi  
 Duplex ER2209: EN ISO 14343 - A: 22.9.3NL

### Carbon Steels

G3Si-1: EN ISO 14341-A: G 3Si1  
 G4Si-1: EN ISO 14341-A: G 4Si1

### High-Strength Steels

NiMo: EN ISO 16834-A: G Mn3Ni1Mo  
 NiCrMo: EN ISO 16834-A: G Mn3Ni1CrMo

### Steel Alloys

Stainless Steels  
 Maraging Steels  
 Tool Steels  
 Mild Steels  
 Low alloy Steels  
 Duplex Steels

## NICKEL ALLOYS

Ni625 EN ISO 18274 : S Ni 6625 (NiCr22Mo9Nb)  
 Ni718 EN ISO 18274 : S Ni 7718 (NiFe19Cr19Nb5Mo3)

## BRONZE

CuSn6: EN ISO 24373: Cu 5180A  
 CuSi3 : EN ISO 24373: S Cu 6560  
 CuAl8: EN ISO 24373: S Cu 6100  
 CuAl8Ni6: EN ISO 24373: S Cu 6328

# LRQA

## CERTIFIED

ADDITIVE  
 MANUFACTURING  
 FACILITY QUALIFICATION

**MX3D uses off-the-shelf welding wire  
 with standard 3.1 material certificates.**

# DUPLEX

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**MX3D** has extensive experience printing various **Duplex alloys** for structural applications.

Duplex stainless steels are a family of **corrosion-resistant alloys** known for their exceptional combination of strength and resistance to corrosion. These materials exhibit a **dual-phase micro-structure** of **austenite** and **ferrite**, which impart unique properties suitable for a wide range of applications.

Duplex stainless steel's dual-phase structure contains roughly equal proportions of austenite and ferrite. This metallurgical structure is the primary driver behind their superior characteristics with better corrosion resistance, particularly **chloride stress corrosion** and **chloride pitting corrosion**, and higher strength than standard austenitic stainless steel such as type 304 or 316.

Duplex steels are **divided into four groups**, based on their pitting corrosion resistance.

**Pitting corrosion calculated |  $PREN = \%Cr + 3.3 \%Mo + 16 \%N$ .**

**1. Standard Duplex | PREN range: 28-38**

Typically Duplex 2209, easy to weld.

Applications: Wide range, the most used.

**2. Super-Duplex | PREN range: 38-45**

Developed for gas and chemical industries. Superior corrosion resistance, harder to weld due to higher amount of alloy elements.

Applications: Deep-water offshore oil production.

**3. Hyper-Duplex | PREN range: >45**

Later developed to meet oil and gas / chemical and petrochemical industries.

Applications: oil & gas, chemical/petrochemical production.

**4. Lean Duplex | PREN range: 22-27**

Developed more recently for building and construction industries. Corrosion resistance close to austenitic grade with higher mechanical properties.

Applications: Bridges, pressure vessels or tie bars.



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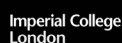
# CERTIFIED STRUCTURAL AND MATERIAL ANALYSIS

MX3D produces parts with mechanical properties comparable to those of cast or forged material and aligned with new and existing international standards.

**MX3D collaborates** with **certified partners** across the world to **validate the material** and structural properties of WAAM-printed elements.

## Certified partners

- **Arup, Engineering Services (INTERNATIONAL)**
- **Element, Material Research (INTERNATIONAL)**
- **Imperial College London, Engineering Services (UK)**
- **Bologna University, Engineering Services (IT)**
- **Belgium Welding Institute, Material Research (BE)**
- **Norwegian University of Science and Technology, Material Research (NO)**
- **University West, Material Research (SE)**
- **Technical University of Twente, Structural Research (NL)**
- **Technical University of Eindhoven, Fatigue (NL)**





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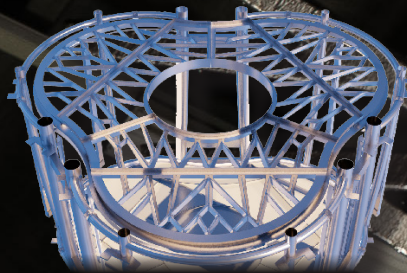
# USE CASES

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**Takenaka**

**Solstice Bridge**

**Optimised Truss System**



SOM

  
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# TAKENAKA

MX3D produced **Structural Steel (Duplex) Connectors**, designed in collaboration with the engineers of Takenaka, one of the largest architecture, engineering, and construction firms in Japan.

**\*Weight is 45Kg**

| Duplex 40 Kg + Mortar 5KG

**\*Key mechanical properties**

| Standard Duplex 2209 PREN range: 28-38

**Project Goals:**

- Pavilion Expo 2025 Japan.
- Increase design freedom.
- Include space for mortar to increase fire safety.
- Reduce reliance on experts/scarce labour.
- Integrate the full manufacturing chain in BIM.





# SOLSTICE BRIDGE

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- Design | **Cyrus Clark**, Lead Architect City of Amsterdam.
- Dimensions | **30-meter-long** pedestrian bridge.
- Location | Oostenburgervaart, a canal on the east side of the city centre.
- 360 subtly different handrail balustrade poles, each one slightly different from the previous one to create a sense of transitioning motion.
- **24/7** mass production.
- **Hybrid Manufacturing** (printed directly on bridge elements) to reduce manual assembly.

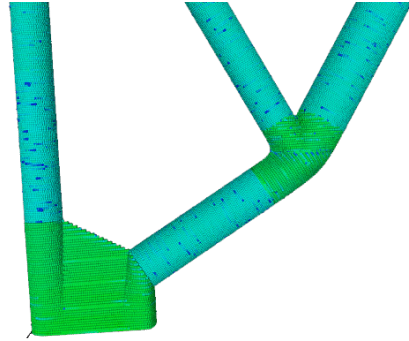




## OPTIMISED TRUSS SYSTEM

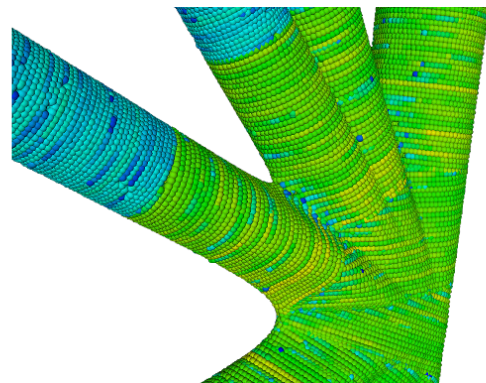
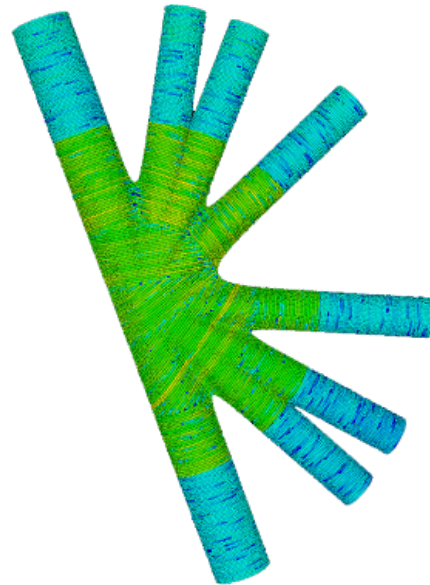
“From design to final verification for the mass customisation of structural elements”.

Together with partners in the complete supply chain, **MX3D** has developed an innovative production strategy for the design, manufacturing and qualification of the WAAM process for infrastructure applications.



### Optimized Metal Trusses

- Up to **90%** weight reduction.
- Stainless steel **308LSi**.
- Parametric design module.
- Automated **FE verification**.
- Automated file preparation for additive manufacturing with robotic wire arc additive manufacturing (WAAM).
- Active monitoring by MX3D control system.
- Automated insight into manufacturing time and cost.
- Workflow qualification and product certification by **Bureau Veritas**.
- Proven footprint reduction.



Imperial College  
London



MX3D



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# M1 SYSTEMS

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**BMW GROUP  
US DEFENSE -ERDC  
SHIMODA  
EMPA  
DALHOUSIE  
CIT SENAI**



The **M1 Metal AM System** offers a turnkey solution for printing high-quality, medium-to-large-scale metal parts.

The system is the industry standard for robotic WAAM systems and has been acquired by for example the **US Army** and **BMW Group**.

Built with quality hardware components from renowned manufacturers, the M1 Metal AM System integrates **MetalXL**, MX3D's **dedicated WAAM-workflow** for advanced CAM, control/monitoring, and post-print data analytics.

**M1** includes an **8-axis** industrial robotics system enabling complex prints, a multi-transfer mode GMAW power source for flexible print procedures, and a WAAM-dedicated **MX3D Control System** for intelligent automation, real-time print monitoring and high-resolution data logging.

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