



ADDERE
ADDITIVE MANUFACTURING

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ABOUT ADDERE

ADDere was developed by **Midwest Engineered Systems, Inc.** as a large format **3D metal printing solution** for manufacturers.

Our ADDere Systems, Engines and printing services are **ideal for large part and low volume production, prototyping, and much more.**



OUR MISSION

Our mission is to **provide cutting edge 3D laser wire additive solutions** for large-scale, high strength prototypes and short run production metal manufacturing.

OUR VISION

Our vision is to **refine our additive manufacturing technology and it's capabilities**, and **provide that technology to all manufacturers**.



ADDERE **TIMELINE**

The early years of **ADDere** were focused on system and process development. By developing the **laser wire additive process**, **ADDere** was born, and our process created.



2015



LASER WIRE ADDITIVE TECHNOLOGY DEVELOPED

MWES developed the core technology behind laser wire additive manufacturing in early 2015.

ADDERE CREATED

ADDere becomes separate division of MWES in 2016, focusing on 3D printing for large metal part manufacturers



2016 –Q1

ADDERE **TIMELINE**

As we became more **advanced** in our technology, so did our systems.

In just two years, ADDere developed two **laser wire additive printing systems**, each with their own unique set of features.

ADDere was evaluated by **GKN** who chose our technology to install in Oak Ridge National Labs in Knoxville, TN. The cell is set up to exclusively print Titanium **TI-64 components** for the aerospace industry.



BASIC SYSTEM RELEASED

In Q3 of 2016, ADDere developed the first standard system, the ADDere Basic System.

This low cost fully functional system allows part production up to 400kgs and a working envelope of a 1 meter cube for most materials

2016 –Q3

ADVANCED SYSTEM RELEASED

The Advanced System expands the part weight capacity to 2,000 kgs. with a 1m x 1m x 2m working envelope and a submerged inert environment for those metals that react adversely to oxygen.

2017

OAK RIDGE NATIONAL LABORATORY

In 2018, ADDere installed our systems in ORNL, a national R&D facility.

2018



ADDERE **TIMELINE**

Our largest and most versatile system was developed in 2019, the **ADDere Custom System**.

With more advanced systems come more advanced **3D printed components**, such as the rocket nozzle developed for customers in the rocket / space sectors.

Our need to print large scale components with a **high powered laser** in an inert environment led to the development of large-scale ADDere laser safe glove box rooms... the largest room to date is **35' L x 18' W x 18' tall**.



CREATED ROCKET INDUSTRY COMPONENTS

Our team increased our focus from aerospace to outer space, developing nozzles for rockets

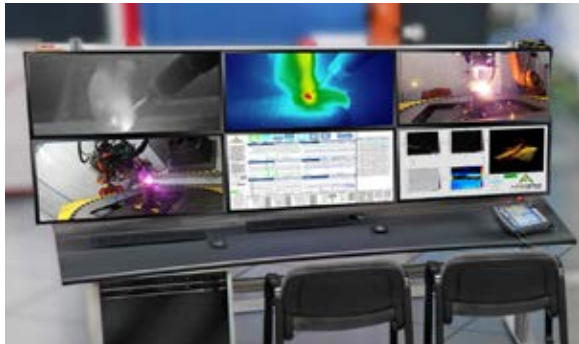
2019

ADVANCES IN LASER SAFE ENVIRONMENTAL ENCLOSURE

This system includes unique active and passive laser safety systems, enhanced purging capability in a low loss gas enclosure.

Additionally there is automation and anti-chamber for high production throughput requirements.

2020



ADDERE **TIMELINE**

In 2021, our team focused on improving our controls platform to handle **instant feedback** with a closed loop system.

What does the future hold for **ADDere**?

We are currently developing **AI technology** to help improve our printing capabilities.

ADDere is the FUTURE of manufacturing!



TRANSITIONED TO CODESYS BASED CONTROLS PLATFORM

Revamped our controls platform to a CODESYS based system, giving real-time & closed loop controls

DEVELOPED COAXIAL LASER DED PROCESS

A coaxial optic allows for increased flexibility with component geometry, increasing our capability with an additional axis of freedom for out of position part forming.

2021

DEVELOPING AI TECHNOLOGY TO CONTROL BUILD

Revamped our controls platform to a PLC based system, giving real-time & closed loop controls

2022



OUR CAPABILITIES

ADDere is focused on **three areas** of service for our customers.

The first is focused on **proving out the build** and **ensuring repeatability** in the 3D Laser Wire printing process.

The second consists of **assisting our partners** with **printing on-demand parts** as a service.

The final service offering **allows our partners to print parts in their facility** through the use of either a standard or completely custom built ADDere system.



INDUSTRY REACH



SPACE



AEROSPACE



OIL / GAS



POWER GENERATION



MINING



AUTOMOTIVE



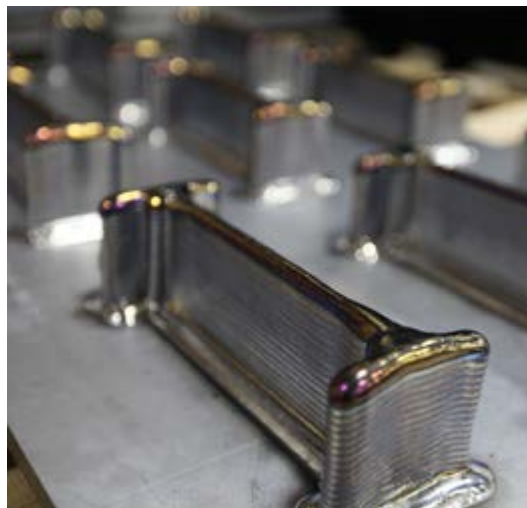
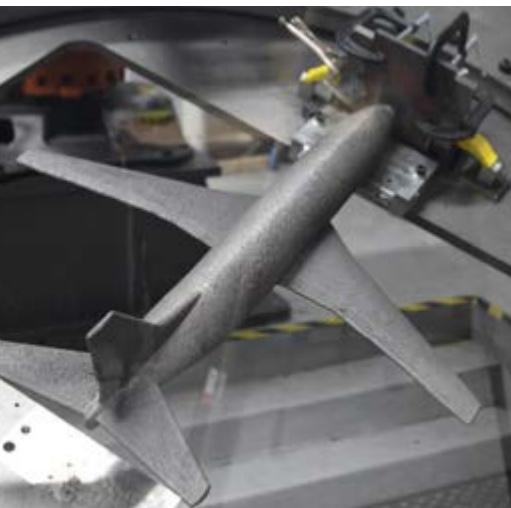
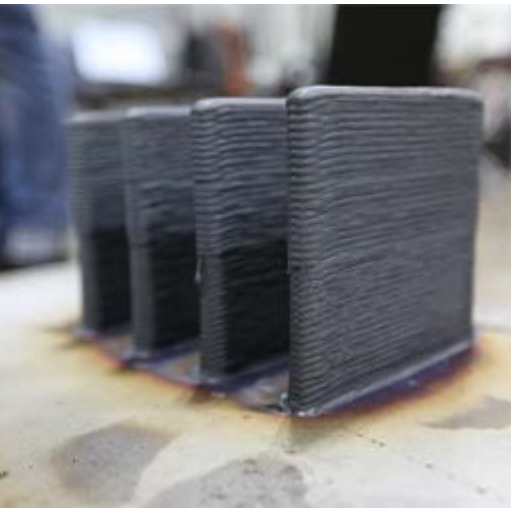
ADDERE

ADDITIVE MANUFACTURING

STATE OF THE ART FACILITY

TYPICAL APPLICATIONS

1. Nozzles
2. Domes
3. Exhaust Ducts
4. Piping & Ducting
5. Combustor Components
6. Missile Bodies
7. Blades / Airfoils
8. Manifolds
9. Heat Shields
10. Mixing Channels



PROPELLER FIN



PROJECT DETAILS

MATERIAL:

Stainless Steel

DETAILS:

- A. 1800 layers tall
- B. 30 hours to build
- C. 180 lbs. of material
- D. Hollow part with 6mm wall thickness

BOAT PROPELLER

Concept of ADDere capability
for demonstration at IMTS
Tradeshow 2015.



PROJECT DETAILS

MATERIAL:

Stainless Steel

DETAILS:

- A. 30 min construction time
- B. 10 lbs of material

WHEEL HUB



PROJECT DETAILS

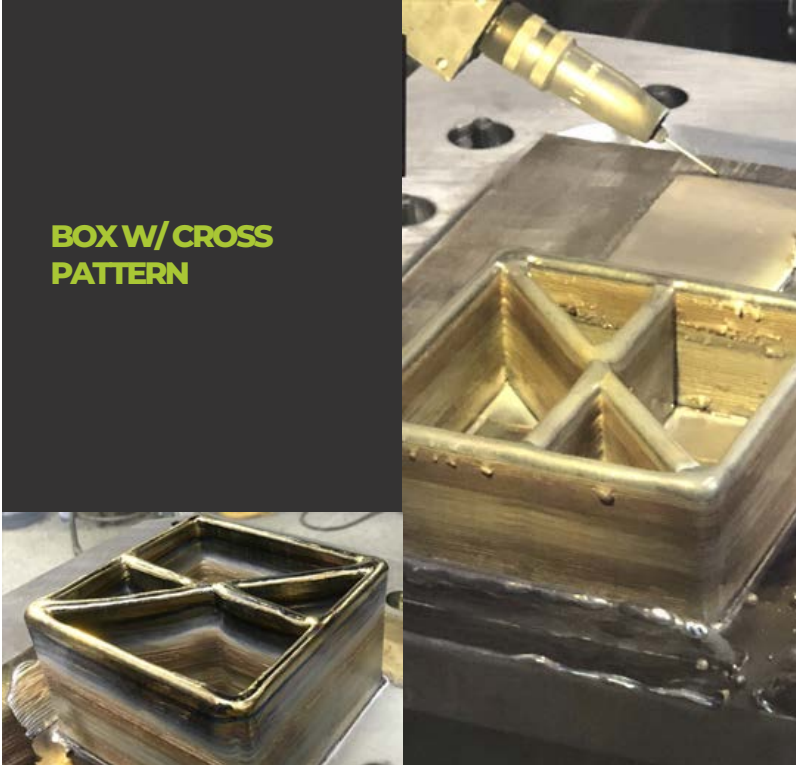
MATERIAL:

Stainless Steel

DETAILS:

- A. 200 lbs. of material
- B. 10 hours of construction time

**BOX W/ CROSS
PATTERN**



PROJECT DETAILS

MATERIAL:

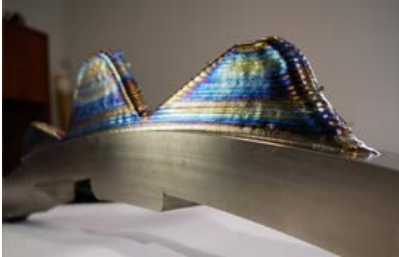
Ti64

DETAILS:

- A. Process capability testing
- B. Strength evaluation
- C. 3 lbs of material
- D. 45 min construction time



PART CLADDING



PROJECT DETAILS

MATERIAL:

Ti64

DETAILS:

- A. Evalutaiton of part cladding
- B. ~10 lbs. of material
- C. 2 hrs of construction time

FARNBOROUGH ADDITIVE TEST PART

Challenging part for 3D
manufacturers of titanium.



PROJECT DETAILS

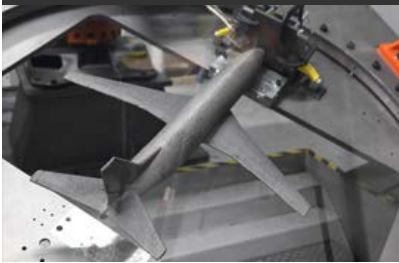
MATERIAL:

Ti64

DETAILS:

- A. ~5lbs. of material
- B. 30 mins of construction time

AIRPLANE



PROJECT DETAILS

MATERIAL:

Stainless Steel

DETAILS:

- A. Demonstation part
- B. 20 hrs. of construction time
- C. 90 lbs. Part weight
- D. Hollow part with 6mm wall thickness

ROCKET NOZZLE



PROJECT DETAILS

MATERIAL:

Stainless Steel

DETAILS:

- A. Demonstration part
- B. 100 lbs. Part weight
- C. 20 hours construction time
- D. Stress relieved and machined
- E. 6mm wall thickness prior to machining



COMMONLY USED ALLOYS

		COMPATIBLE WITH	
MATERIAL GROUP	MATERIAL	REPAIR / CLADDING	FREEFORM MANUFACTURING
TITANIUM ALLOYS	Ti-6Al-V4	X	X
	CP Ti	X	X
	Ti-6-2-4-2	X	X
STEEL ALLOYS	304L SS	X	X
	316L SS	X	X
	410L SS	X	X
	420L SS	X	X
	13-8	X	X
	15-5	X	X
	17-4	X	X
	Alloy 1.2709	X	X
	Invar 36	X	X
	JBK-75	X	X
	NASA HR-1	X	X
NICKEL ALLOYS	Inconel 617	X	X
	Inconel 625	X	X
	Inconel 718	X	X
	Inconel 722	X	X
	Alloy 230	X	X
	Hastelloy X	X	X
	Monel K500	X	X
COBALT ALLOYS	Cobalt - Chromium	X	X
	Stellite 21	X	X
	Alloy 188	X	X
ALUMINIUM	AlSiMg	X	X
REFRACTORY	C103	X	X

OUR SYSTEMS

ADDere offers **two systems** in addition to our **part development and prototyping services**.

ADDere consist of the **Standard System** which is a compact portable system and the **Custom System** which is ideal for large-scale manufacturing operations.

Both systems are offered as enclosed units and in a number of configurations that can best suit your business' manufacturing operations.





STANDARD SYSTEM

Motion Device:

6-Axis Robotic Motion System

Build Part Size (L x W x H):

1m x 1m x 1m working envelope

Built Part Max Weight:

400 kg including fixturing

Laser Power:

4-20kW Laser

Wall/Layer Size:

Typical 5-6mm pass width and 1-2mm layer height

Sensor System:

Real-time, Closed-loop fixed optic with options for coaxial or dithering spot

Enclosure:

Full laser safety enclosure with options for an inert gas environment. Unitized base and separate utility base for easy transport.

Material Delivery:

500-amp hot wire system with power source tracked by closed-loop feedback control



CUSTOM SYSTEM

Motion Device Options:

3+ Axis Gantry System, 6+ Axis Gantry System, 8+ Axis Robotic Motion System

Build Part Size (L x W x H):

20m x 6m x 2m working envelope

Built Part Max Weight:

Up to 10,000 kg payload

Laser Head Options:

Scanning Head – 4-20+kW, Coaxial Head – 4-30kW, Fixed Focal Spot – 2-20kW, Blown Powder Delivery Head – 2-16kW

Laser Power:

4-30kW Laser

Wall/Layer Size:

Typical 5-6mm pass width and 1-2mm layer height

Sensor System:

Real-time, Closed-loop zoom optic with options for coaxial or dithering spot

Enclosure:

Custom-built full laser safety enclosure with options for an inert gas environment. Operator access for consumables without depleting the environment. Option for automation material handling through an anti-chamber.

Material Delivery:

500-amp hot wire system with power source tracked by closed-loop feedback control

OUR **ENGINES**

Along with the complete ADDere systems, we also provide **additive engines**.

The **ADDere Additive Engines** can be retrofitted onto an existing robot system or on an entirely new robot system. We currently have drivers that are compatible with ABB, KUKA and FANUC robot systems.

The ADDere Engines include the robot end effector module, the hot wire delivery system and the ADDere Software.





SCANNER / SIDE WIRE

Laser Power (max): 20kW

Laser

Wire Size: 0.6-1.6mm

Minimum Single Bead Thickness: 4mm

Maximum Single Bead Thickness: 20mm

Maximum Deposition Rate: 30lb/hr*

Features:

Hot Wire Compliant, Water Cooled, Vary Bead Thickness on the Fly, Camera Process Monitoring (optional), Melt Pool Monitoring (optional), Closed Loop Control (optional)



HIGH POWER COAXIAL

Laser Power (max): 30kW

Laser

Wire Size: 0.6-1.6mm

Minimum Single Bead Thickness: <2mm

Maximum Single Bead Thickness: 15mm

Maximum Deposition Rate: 35lb/hr*

Features:

Hot Wire Compliant, Water Cooled, Vary Bead Thickness on the Fly**, Camera Process Monitoring (optional), Melt Pool Monitoring (optional), Closed Loop Control (optional)



LOW POWER COAXIAL

Laser Power (max): 8kW Laser

Wire Size: 0.6-1.6mm

Minimum Single Bead Thickness: <1mm

Maximum Single Bead Thickness: 15mm

Maximum Deposition Rate: 12lb/hr*

Features:

Hot Wire Compliant, Water Cooled, Vary Bead Thickness on the Fly**, Camera Process Monitoring (optional), Melt Pool Monitoring (optional), Closed Loop Control (optional)

ADDERE SOFTWARE

The **ADDere runtime system** delivers the geometric source file to a specific motion device. The embedded wire feed rate, hot wire control, laser power, laser spot size and print speed coordinate with the geometric motion.

With ADDere, the optional runtime sensor data from the laser profiler, infrared camera, hot wire system and/or part view IR camera can be used as real-time feedback. **Custom process specific algorithms** can be created in the ADDere software to affect the build process.





OUR PARTNERS

KUKA



PART FINISHING SERVICES

- Grinding
- Deburring
- Sanding
- Welding
- Polishing
- Painting



ADDERE
ADDITIVE MANUFACTURING

GET A QUOTE

www.addere.com

1.414.327.0000