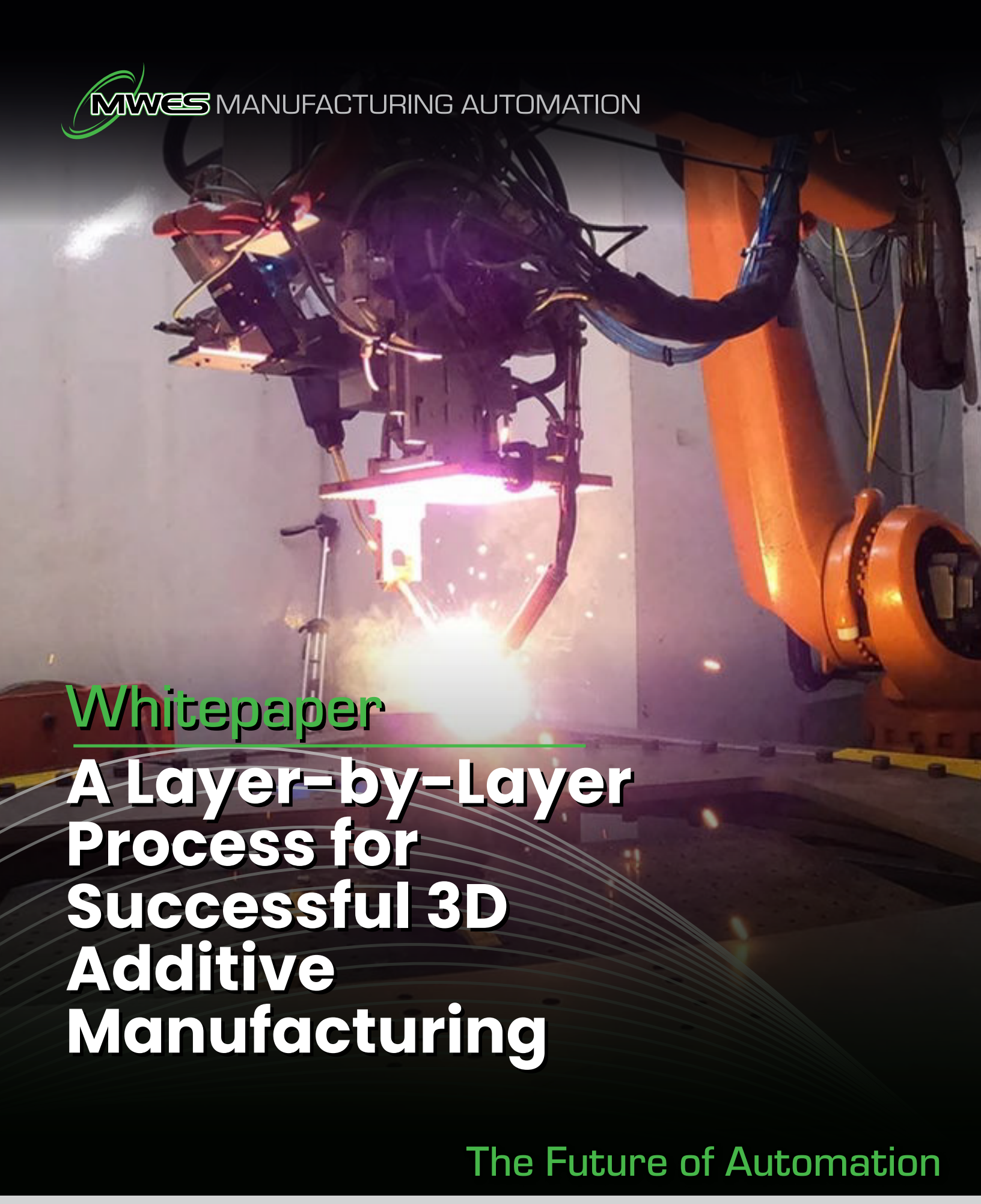
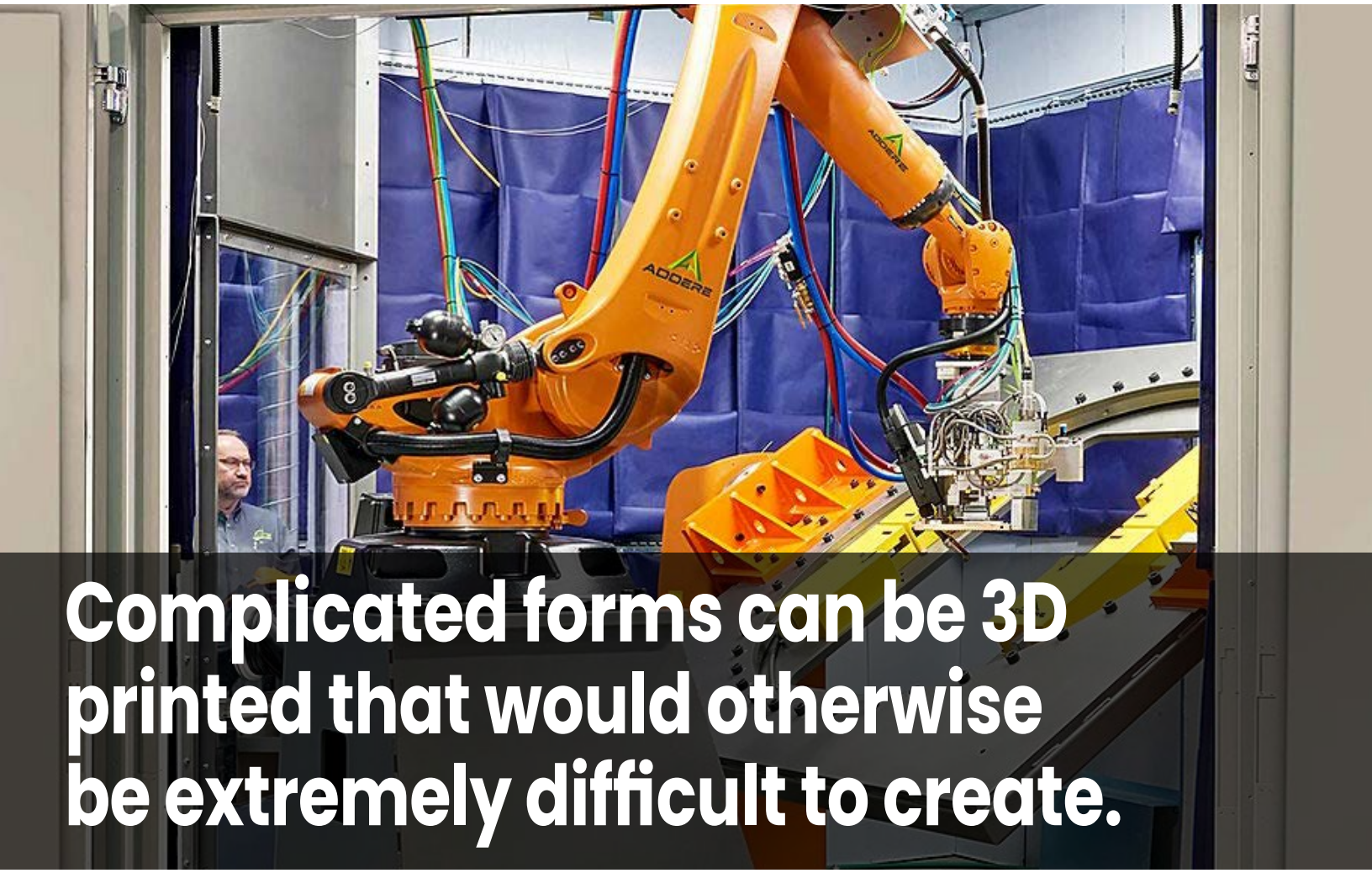
MWES MANUFACTURING AUTOMATION



Whitepaper

A Layer-by-Layer Process for Successful 3D Additive Manufacturing

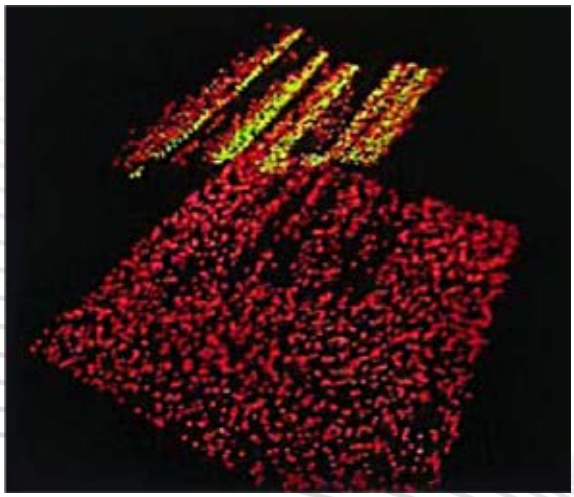
The Future of Automation



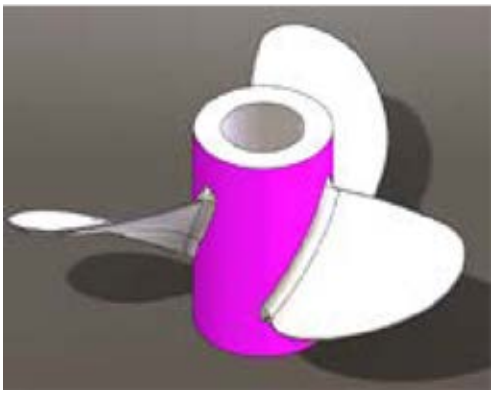
Complicated forms can be 3D printed that would otherwise be extremely difficult to create.

Additive manufacturing commonly referred to as Industrial “3D Metal Printing” is a digital process which uses 3D design data to build components in layers by depositing material. When using exotic metals, material can be deposited to build prototypes and small batches of parts with unmatched precision and speed. Complicated forms can be 3D printed that would otherwise be extremely difficult to create.

MWES’ proprietary process of 3D Metal printing of exotic materials is in demand due to expensive manufacturing methods involving casting or machining out of stock material.



LDD 3-D VIEWER



Advantages of The MWES Additive System

- Hot Wire Deposition
- Dynamic Deposition Measuring
- Integrated Wire and Laser Head
- CAD to Path Software

Applications

- Prototypes
- Small batch production runs
- Replacement parts
- Rebuild surfaces
- Cladding

Exotic Metals & Superalloys

- Stainless steel
- Aluminum
- Titanium
- Cobalt
- Ferrous steel
- Inconel
- Tungsten
- And all of their alloys


Why Additive Manufacturing Is Critical

Prototyping

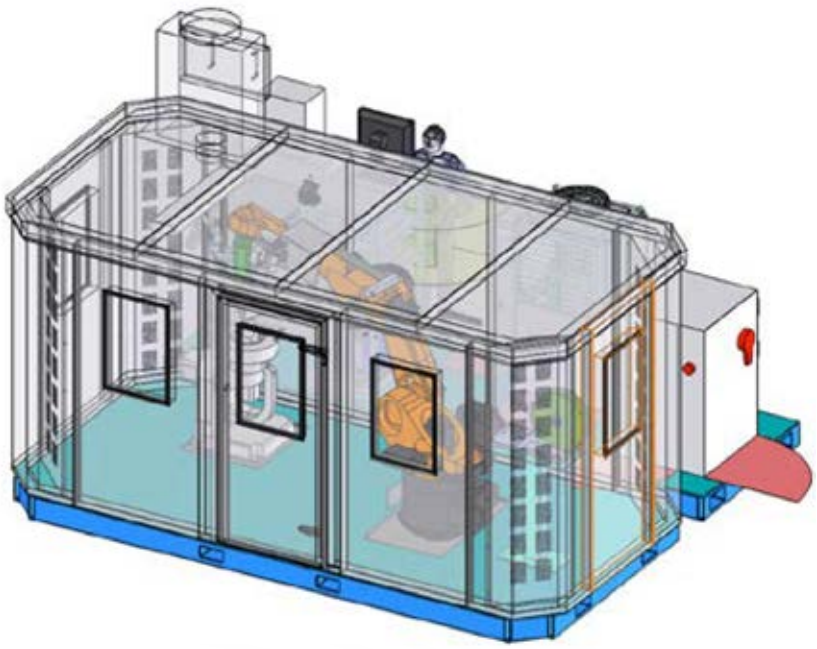
In today's competitive environment, time and cost savings to manufacture components by additive processes compared to conventional methods of casting and then machining or machining out of stock material is in demand. CAD data can be used to create a 3-D part in any form imaginable. Solid free-form fabrication (SFF) allows the use of different metals on different areas of the part to create engineered characteristics specific to an application. Embedded objects can be placed inside the created part to create metallurgical characteristics not possible in conventional manufacturing processes.

Small Batch Manufacturing

Small batches can be produced faster and cheaper through additive manufacturing than building the complex shapes by a casting or welding process.

Flexibility

Flexible manufacturing solutions, such as robots, allow for creating different parts based on 3-D CAD data with minimal time, cost investing for re-tooling and subcomponent manufacturing.

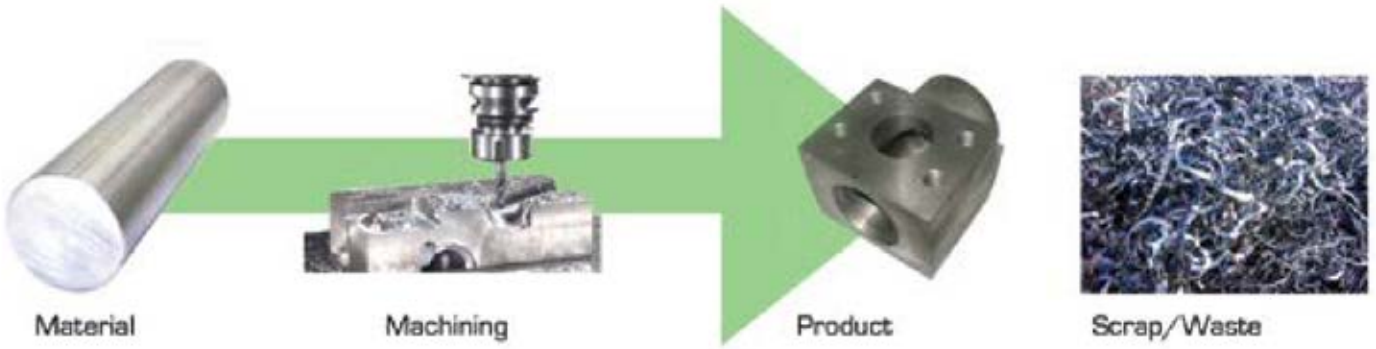


New Design Possibilities

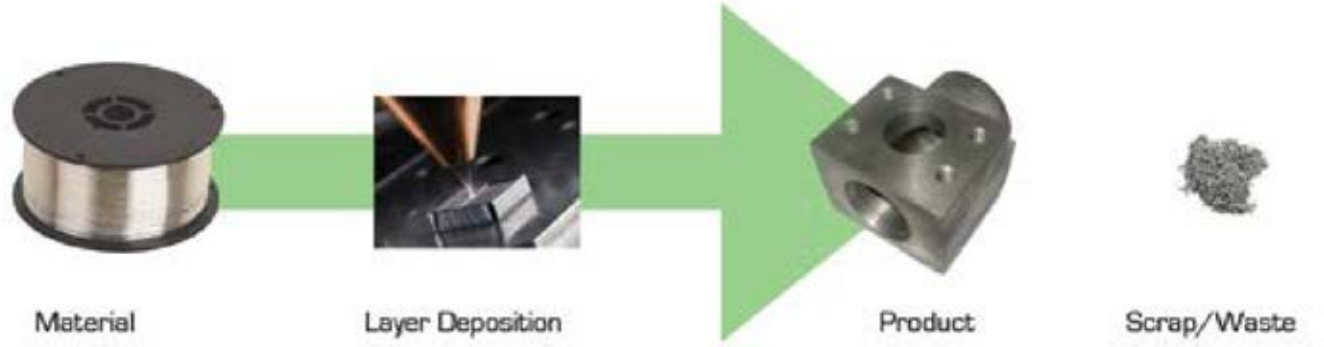
New part designs can be tested for strength and metallurgical performance quickly and accurately with 3-D wire printing technology that would not be practical or possible by conventional methods.

Comparison of Manufacturing Processes

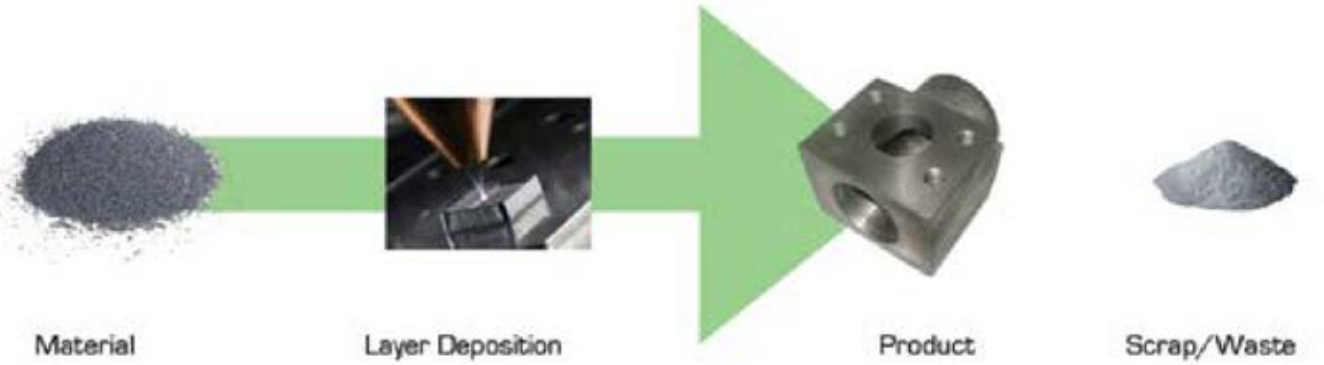
Conventional Manufacturing (subtractive) Process



MWES Additive Manufacturing Process



Powder Additive Manufacturing Process



Adoption & Integration Strategies

Companies who are interested in the following can either purchase a MWES' additive manufacturing cell to self-produce parts or order small batches of parts from MWES while implementing our engineering expertise in this technology as a service.

- Prototypes
- Small batch production runs
- Replacement parts
- Long-lead time spare parts
- Rebuild surfaces of worn components

Custom CAD data will be imported into the CAD/CAM software where it is prepared for the additive process. The part will be “sliced” into layers and the robot path will be generated off line. Process information can be added automatically and manipulated manually.

The generated path and process information will be translated through a post processor and automatically transferred to the robot controller. The robot then can execute the program and generate the part layer by layer. The 3D laser printing process allows for clean metallurgical parts and guaranties penetration into the previous layers. Post processing of the part for surface preparation might be required, such as machining of the critical surfaces.

Process & Materials for Producing Quality Parts

Methods of Metal Deposition:

- GMAW welding
- TIG welding with cold or hot wire
- Plasma powder welding
- Laser powder welding
- Laser cold wire
- Laser Hotwire and more

In order to determine the correct process for a 3D printed part, a number of factors need to be considered, such as:

- Availability of the material to be deposited
- Expected final dimensional resolution of the part
- Purity and metallurgical characteristics
- Size and volume of the component
- Quantity of components required
- Blanks or base to build the components on

3D Printing Process Comparison

	Availability of Base Materials	Cost of Base Materials	Speed of Process	Surface Finish/ Resolution	Metallurgical Characteristics & Purity
GMAW Welding	★ ★	★ ★	★ ★	★	★
TIG Welding with Cold & Hot Wire	★ ★	★ ★	★	★	★ ★
Plasma Powder Welding	★	★	★	★ ★ ★	★ ★
Laser Powder	★	★	★	★ ★ ★	★ ★ ★
Laser Cold/Hot Wire	★ ★	★ ★	★ ★ ★	★ ★	★ ★ ★

Good: ★ | Better: ★ ★ | Best: ★ ★ ★

Current & Future Additive Manufacturing Applications

- Fuel Manifolds
- Forming Dies
- Valve Bodies
- Suspension Components
- Drive Train Components
- Brake Calipers
- Turbo Charger/Supercharger Impellers
- Rocket Booster Nozzles
- Earth Moving Wear Components

About Midwest Engineered Systems

MWES has identified the need in the industry to provide a complete solution for additive metal manufacturing. MWES has partnered with several well-known international vendors to develop a complete and scalable additive metal manufacturing solution.

MWES Offers:

- Planning of the work-piece
- Preparation of the slicing program
- Translation into the robot path program
- Process development for laser welding
- Laser optic system
- Hot or cold wire feed
- Safety equipment
- Tooling configuration

MWES provides the equipment, process, and continued engineering support to our customers for the ever-changing demands of metal manufacturing.

Need more information regarding your additive metal manufacturing application? Contact MWES to review your specific requirements, help you determine what equipment would be the most successful, and get a custom quote.

MWES MANUFACTURING AUTOMATION

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The Future of Automation