Hybrid LENS CNC Machine
A Joint Project to Accelerate Industry Adoption of Metal Additive Manufacturing

OPTOMEC
Production Grade 3D Printers... with a Material Difference

AMERICA MAKES

TechSolve
MANUFACTURING & MACHINING EXPERTS

MachMotion
America Makes Project Call

Develop A Cost Effective Method to Accelerate Adoption of Metal Additive Manufacturing Technology by US Industry
Package Optomec Metal Additive Manufacturing Technology into a Modular LENS Print Engine that can be Added to Any CNC Machine Tool
Project Partners

- America Makes: Funding Source
- Optomec: LENS Metal 3D Printing Technology
- MachMotion: Integrated Additive/Subtractive Controller
- TechSolve: Hybrid Process Validation & Optimization
- Lockheed Martin: Technical Advisor
- Benet Labs: Technical Advisor
LENS Metal 3D Printing Technology

- Fully Prints Metal 3D Parts or Prints Metal onto 3D Parts
  - Print Structural metals – titanium, steels, superalloys
  - Add material to existing components
  - Industry proven >17 years
  - Excellent mechanical properties, cast or better

- Provide Value Across the Product Lifecycle
  - Functional prototypes to production
  - Preventative maintenance to part repair
  - Cost effective

- LENS Print Engine Open System Approach
  - Coexist with existing processes
  - Integrate with existing machines
  - Use commercially available materials
The LENS Metal 3D Printing Process

- Digital process – tool path from scans or CAD model
- Multi-nozzle Powder Delivery
- Metal Powder Melted by High Power Laser
- Layer by layer build
- Near Net Shape
What is a LENS Print Engine?

- LENS Core Technology in a Modular Package
- Can be added to New or Legacy CNC Machine Tools
Hybrid LENS CNC Machine

Fadal Vertical Mill Upgraded with LENS Print Engine

- 1990s Fadal
- Laser Safe Hood & Glass
- Dual Powder Feeder Cart
- LENS Print Head on Vertical Stage
- IPG 1kW Laser
- MachMotion Additive/Subtractive Controller
Subtractive Manufacturing

- Maintain full CNC machining capabilities
- LENS print head in idle position
Rapid Prototype Development

- 3D Print functional metal parts, cutting tool now in idle position
- Print and finish with one set-up
- Reduce material Cost > 90%
Complex Part Manufacturing
- Tough to cast, long lead time: 52 weeks
- Combine additive/subtracting processes
  - Machine disk base
  + 3D print vertical thin walls
  - Finish machine
- Delivery Time: 3 Weeks.
- Design changes implemented during development
Hybrid LENS CNC Machine: Application Examples

Restore Worn/Damaged Components

- Combine additive/subtractive processes
  - machine worn area
  + add material
  - finish machine
- LENS low heat input reduces distortion
- Process in use at Anniston Army
Hybrid LENS CNC Machine: Application Examples

Add Wear Surfaces

- Use lower cost easier to machine material for base component
- Add wear resistance materials only where needed
- Build components with designed pores to reduce weight, improve performance
MachMotion supplied controls, drives, wiring, software, and their industry-leading operator’s console to integrate the additive process with standard subtractive machining; while utilizing their expertise in retrofitting legacy machine tools mechanically and electrically to rebuild and repurpose the Fadal Milling Machine.
TechSolve: Validate Hybrid Machine

- Developing a LENS® Engine interface document
- Validating the LENS Engine by working with Optomec to refine the provided hardware, software, and interface functionality to enable full commercialization of the LENS Engine
- Demonstrate the technology in a variety of shapes, situations, and materials
- Provide secondary machining, inspection, and testing on resulting parts which will define the success of the first hybrid (additive and subtractive) retrofit machine
- Validate metrics compared to existing LENS systems related to:
  - Operating costs/sustainability
  - Training requirements
  - Manufacturing Readiness Level (MRL)
LENS Print Engine: Summary Advantages

- **Flexibility** - combine additive & subtractive process in a single tool.
  - Still use Hybrid Machine for subtractive machining operations
  - Also use Hybrid Machine for additive builds
  - Also use Hybrid Machine to combine additive/subtractive operations on a single part

- **Lowers Deployment Cost** – leverages existing capital assets
  - Upgrade vintage machine tools with 21st century technology
  - Accommodate your unique part sizes
  - Eliminates need to develop a custom platform for additive
  - Can also integrate LENS Print Engine with robots or custom automation platforms

- **Eases additive deployment** – familiar HMI eases learning for the machinist

- **LENS** is proven metal 3D Printing technology >17 years
More Press Info on Hybrid LENS CNC Machine

- High resolution photos
- Video clip
- FAQs
- This Presentation
- Presenter Bios

www.optomec.com/media-information/

Pass word = metalam
Hybrid LENS CNC Machine

Thank You for Your Attention

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OPTOMEC®
Production Grade 3D Printers... with a Material Difference

AMERICA MAKES

TechSolve
Process » Performance » Profit

MachMotion
Optomec at a Glance

- Headquarters: Albuquerque, NM plus Advanced R&D in St Paul, MN
- Focused on Additive Manufacturing (1999)
  - LENS® for 3D Printed Metals
  - Aerosol Jet® for Printed Electronics
- $35M Invested in R&D
  - 35 Patents Issues, >50 Pending
  - ~175 Global Customers
Standard LENS Metal 3D Printers

3 LENS Full System Models

- Share Same Core LENS Technology
- Different Build Sizes

Model 850 R
900x1500x900mm

Model MR7
300x300x300mm

Model 450
100x100x100mm
LENS Materials

- Metal Powders commercially available from multiple sources
- Excellent mechanical and fatigue properties
TechSolve At a Glance

1982: Institute of Advanced Manufacturing Sciences founded

1984: Ohio Edison Technology Center

1994: National Institute of Standards & Technologies (NIST) network of 60 Manufacturing Extension Partnership Centers

2000: IAMS becomes TechSolve

2005: TechSolve awarded Smart Machine Platform Initiative

2009: TechSolve launches machine monitoring application ShopViz®

2014: 45+ Member Team: Engineers, MBA’s, PhD’s, Chemists, and former business owners

TechSolve Headquarters
Cincinnati, Ohio

Process improvement & machining services consulting firm
MachMotion at a Glance

MachMotion began in 1999 as a father and son retrofitting machines. Over time it emerged with a competitive advantage in designing and fabricating CNC controls. A four brother team is still the core of our company along with a growing staff of employees.

Our number one goal is to offer to our customers quality products at unbelievable prices. We are continually developing our controls and products with the goal of making them "Plug-N-Play". Our products are non-proprietary so you are not tied to us, giving you the flexibility you need.

Our mission is to empower people who design things. We are dedicated to providing exceptional innovative products, technical support, and customer service at the lowest possible cost. Our focus is to help our customers materialize their ideas by providing the tools and information that will help them transform their concepts into reality.
MachMotion at a Glance

MachMotion System Overview

Control

Motion Controller – Basic IO/Motion Commands

Servo Motion

PLC – Extended IO/Tool Changers/Ladder Logic Applications

Machine
America Makes is a public/private partnership with substantial federal, private industry, and academic investment.

The partnership is a multi-agency collaboration between industry, government and universities, led by the Defense-wide Manufacturing S&T team.

We have an innovation facility in Youngstown, Ohio.

We have more than 130 members and continue to grow.

We are operated by the National Center for Defense Manufacturing & Machining (NCDMM).
Why America Makes

The foundation is laid – in March 2012, President Obama proposed the formation of a National Network for Manufacturing Innovation (NNMI) and America Makes (National Additive Manufacturing Innovation Institute) was launched in August as the initial Institute of Manufacturing Innovation (IMI).

The vision is simple – leverage our nation’s brilliant technical minds in all corners of government, industry and academia to accelerate the adoption of additive manufacturing technologies in the U.S. manufacturing sector and increase domestic manufacturing competitiveness.

The goal is bold – create truly collaborative environments to bring technology advancements from the lab to the factory floor, create jobs, produce more competitive products, and ultimately reaffirm our place in the global market.
When America Makes
America Works