Integration of 3D Printing / Additive Manufacturing (AM) Into Production

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About Methods Machine Tools

• Headquartered in Boston, MA
• Founded in 1958 with 55+ years of continuous growth
• Largest private importer of machine tools in the US
• 325 nationwide employees with annual sales revenue of $200 million
• Full turnkey solutions provider
Fully Staffed National Offices

• Sales / Service / Support / Showroom / Technical Centers

Charlotte

Los Angeles

Chicago

Phoenix

Detroit

San Francisco
History of Partnerships

- 33 Years
- 8 Years
- 3 Years

- 23 Years
- 6 Years
- 1 Year
About Methods 3D

- Created in 2015 as a subsidiary of MMT
- Partnering with 3D Systems and other 3D printing companies
- Fully integrated with Methods machining, manufacturing, and support
- Dedicated team of applications, sales, and service
- Delivering Additive Manufacturing solutions to production manufacturing customers throughout the US
Past State of Additive Manufacturing

- Additive Manufacturing (AM) has a long history of being a prototyping and demonstration technology
- AM traditionally used for one-offs and customized products
- Specialty manufacturing houses were developed to deliver AM products
- AM properties are expanding and now competitive with traditional materials
- Metals AM expanding into numerous industries (aerospace, automotive, medical/dental, etc)
What is Changing?

• Companies are using AM to design next-generation of products
  • lightweight
  • high-performance
  • conformal cooling
  • mass-production with customization
• Software / Monitoring / Inspection
• Material specifications and standards
• Knowledge-sharing
  • consortiums
  • university courses and training
  • collaborative committees
Is Additive Manufacturing Right For You?

• “You can 3D print **ANYTHING**!”
  • just because you CAN doesn’t mean you SHOULD
  • low-cost, conventionally produced parts
  • single-setup machining

• Identify **ENABLERS** based on design and manufacturing
  • features unable to be produced conventionally
  • customization or low-volume production – parts AND tooling
  • long-lead tooling with low Return on Investment (ROI)
  • supply chain management / capacity bottlenecks
  • low material utilization / excess scrap
Complex Geometries and Part Consolidation

- 3D printing offers unparalleled freedom of design
- Reduce or eliminate multiple assembly operations
- Product quality, durability, and reliability improved
- Throughput increased with less resources
Weight Reduction

• Organic shaped structures optimize weight
• Structural analysis directly feed product design
• Resulting part design optimizes functionality and weight
Supply Chain Management

- 3D printing provides greater control of the supply chain
- Eliminates need to procure castings or forgings externally
- Inventory is produced as-needed on-site
Short-Run or Low Volume Quantities

- No expensive, long-lead tooling required in printing process
- Requires minimal tooling to finish parts
- Positive impact to ROI for vast array applications
- Flexibility to simultaneously build multiple different parts
Faster Time to Market

• 3D printing enables rapid prototyping of concepts
• Iterations can be run in parallel rather than in series
• Direct production conversion eliminates lag in incorporation
Integration of Additive Manufacturing

The process of combining unique capabilities and techniques into a single coordinated solution

- AM is often thought of as a linear manufacturing process

- But, to **truly** implement AM, a different approach is needed
Full Integration Is The Key To Success

- Additive Manufacturing cannot be treated as standalone
  - 3D printers are **"just"** another machine tool
  - no one machine tool can do it all
- Design for Additive Manufacturing (DFAM) must be employed
- All aspects of the production process are interdependent
- 3D printers must be combined with traditional manufacturing processes
Example: Powder Removal and EDM

- Build files must be created with powder removal and EDM considerations
  - Internal cavities and support structure must be designed to evacuate powder
  - Loose powder during EDM will affect cleanliness, wire breakage, and filter quality
- Supports added during build file creation can be removed by EDM
  - Proper support design can be removed to produce a finished surface

Setup of orientation, quantity, and parameters for printing

Recovery of unmelted powder from the build process

Removal of the parts from the build plate and supports
Production Additive Manufacturing

- AM Enables New Products and Processes
- Additive Manufacturing is a Production Process
- AM Machines are Not Standalone
- Integration of AM with Conventional is Critical For Success
- Resources Available to Assist Manufacturers
Questions?