

How Additive Manufacturing can Impact Companies

Iowa State University

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Center for Industrial Research and Service

Since 1963, we have delivered **proven services** to enhance the performance of industry. Our approach, **Engage. Educate. Embed.**, creates a specific solution that allows each business, along with its community, to prosper and grow. Coupled with a satisfaction guarantee, our typical client has achieved a 200% **return on investment**.

A **vast network** of university and industry experts brings years of professional experience to CIRAS, making us a leading integrator of solutions in Iowa. Clients have reported an economic impact of more than \$2 billion over the past five years.

Improving the profitability of businesses through...

Proven Services

Our customizable services are rooted in applied research and established best practices. They fall into four main categories:



Enterprise Leadership

Transforming your business

- Strategy
- Supply Chain
- Innovation
- Culture



Growth

Creating revenue opportunities

- Government Contracting
- Marketing Strategy
- Exporting
- B2B Networking



Productivity

Strategic continuous improvement

- Lean
- Quality
- Theory of Constraints
- Contract Management



Technology

Re-envision products and processes

- Testing
- Engineering
- Emerging Technologies
- Safety

Our network extends across ISU and the nation

ISU Partners

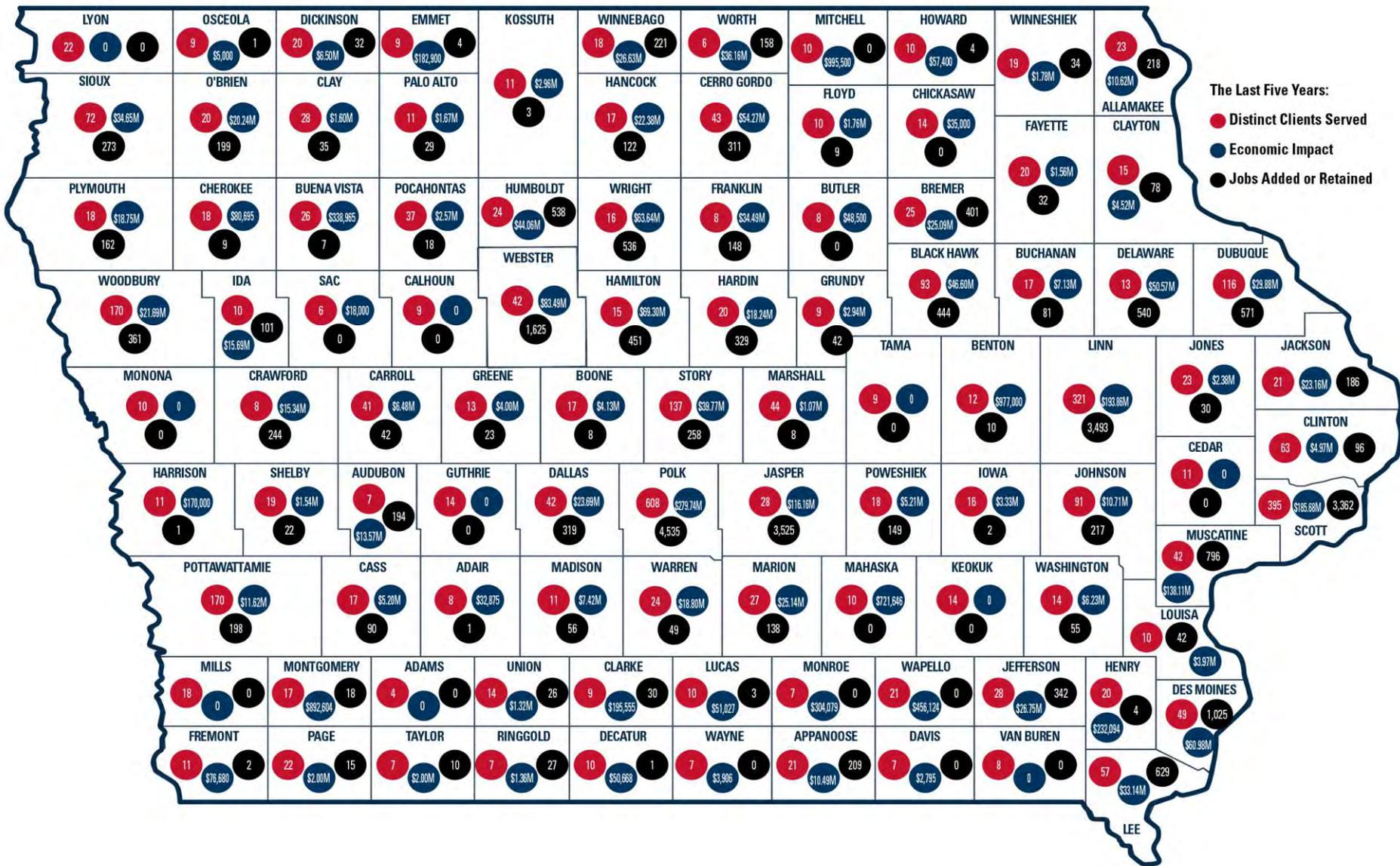
- ISU Faculty and Labs
- Center for Crops Utilization Research
- Center for Nondestructive Evaluation
- College of Engineering
- Community and Economic Development.
- Environmental Health and Safety
- Extension and Outreach
- Meat Science Extension
- Structural Engineering Laboratory

External Partners

- Federal Programs
 - DOC/MEP
 - DOD/PTAP
 - EDA/UCP
- Iowa Area Development Group
- Iowa Association of Business and Industry
- Iowa Business Council
- Iowa Farm Bureau
- Iowa Innovation Corporation
- Iowa Lean Consortium
- Iowa Sustainable Business Forum
- Quad Cities Manufacturing Innovation Hub
- NICC and NIACC

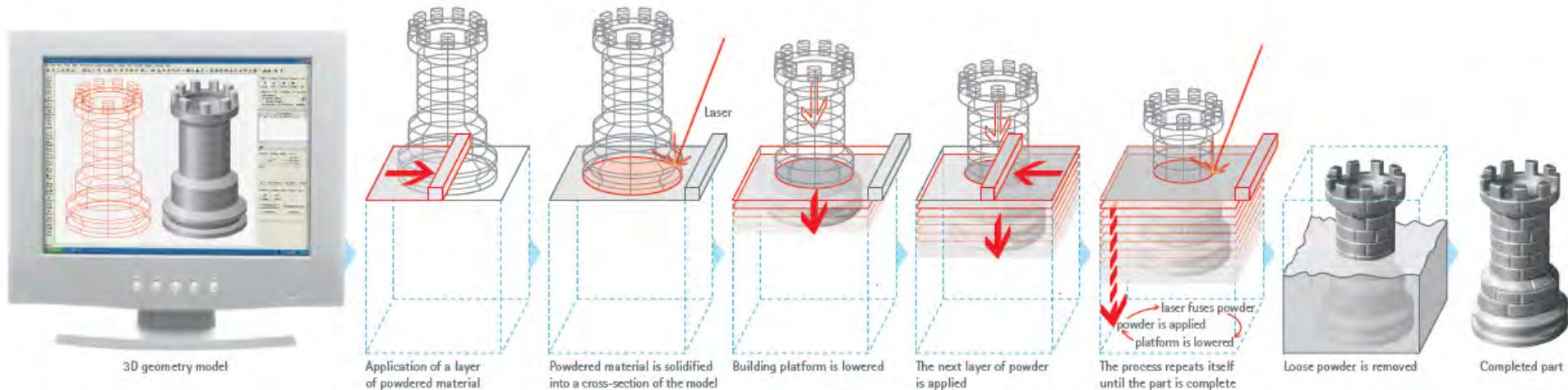
Affiliates

- Iowa Economic Development Authority
- Iowa DOT
- UNI
- Chambers of Commerce
- Councils of Governments
- Local Economic Developers
- Community Colleges
- Public and Private Service Providers
- Others

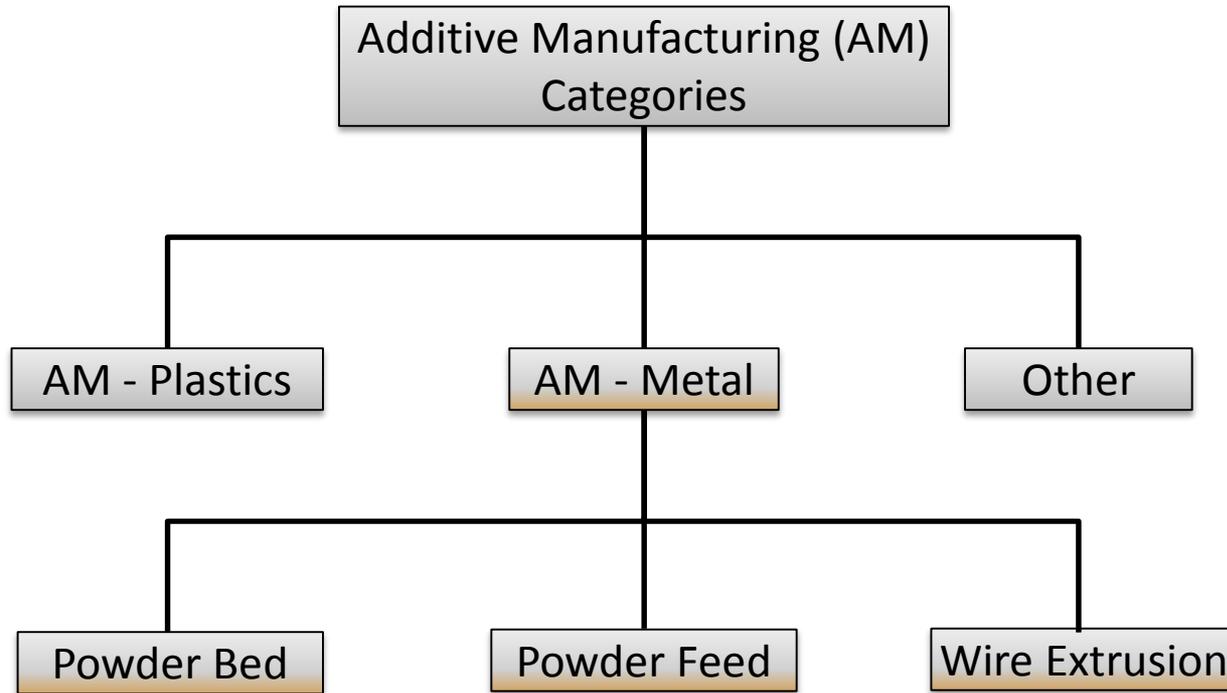


What is Additive Manufacturing?

General functional principle of laser-sintering



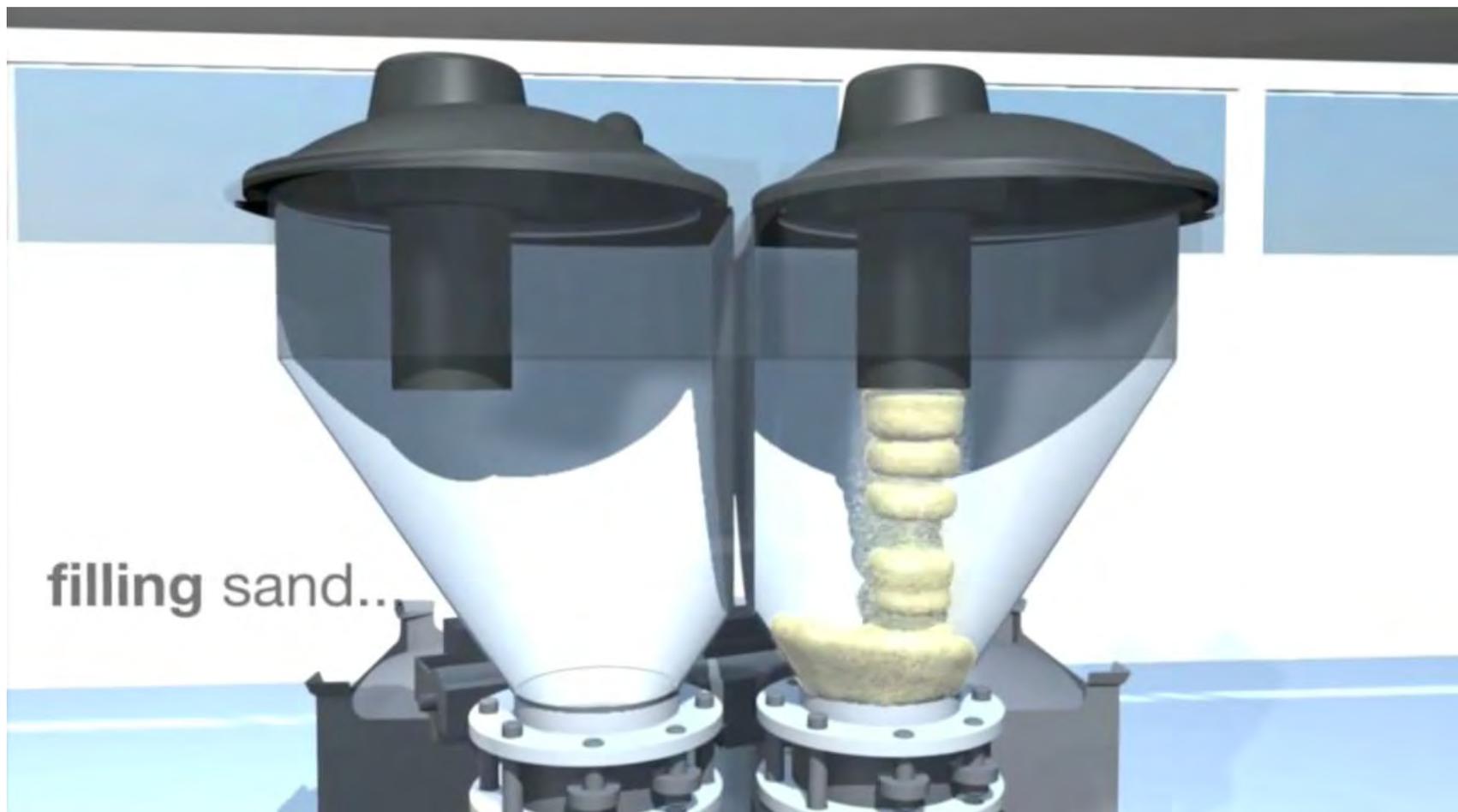
What is Additive Manufacturing?



AM Technologies

- Binder jetting
- Directed energy deposition
- Material extrusion
- Material jetting
- Powder bed fusion
- Sheet lamination
- Vat photopolymerization

Binder Jetting



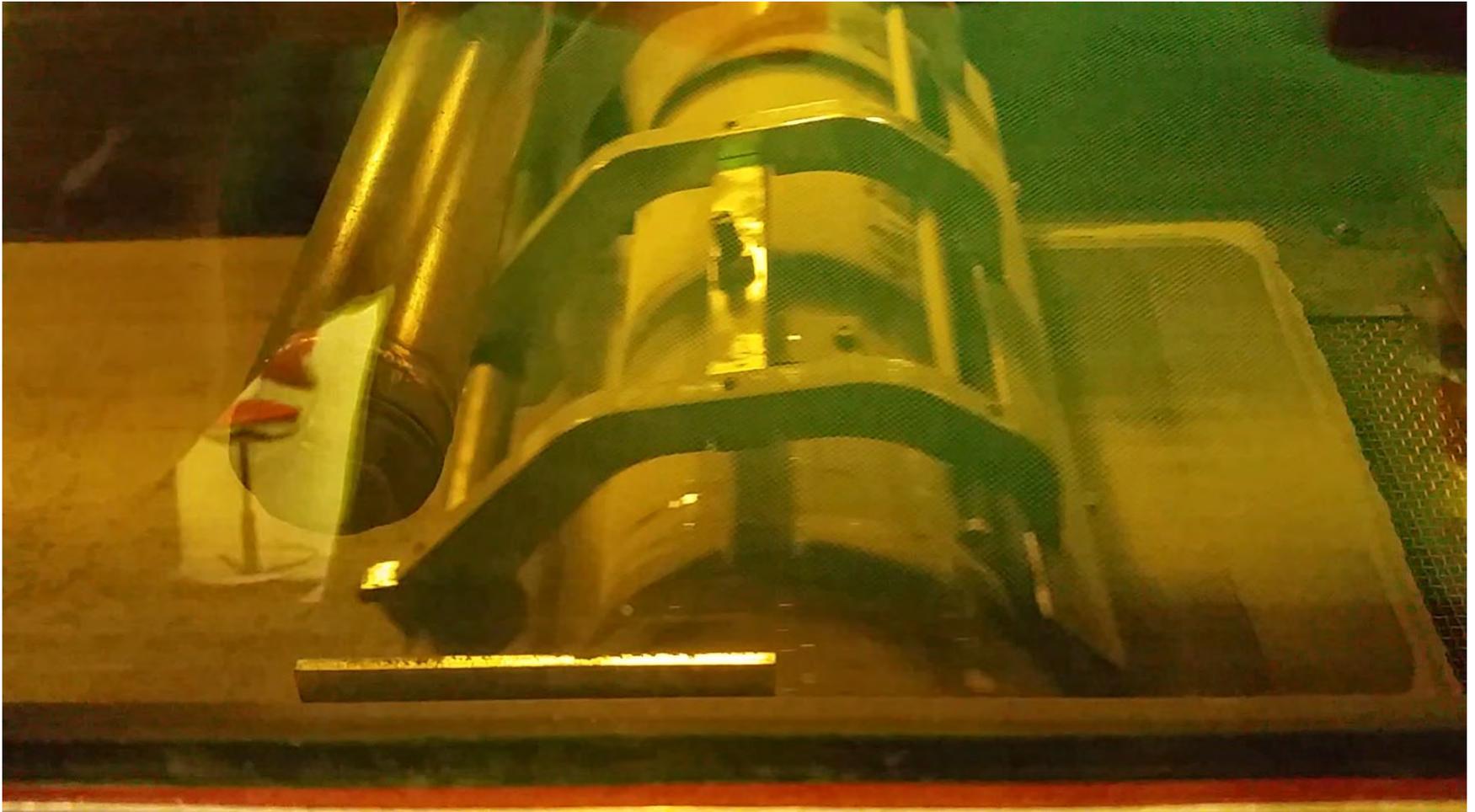
Directed Energy Deposition



Material Extrusion



Powder Bed Fusion



CIRAS Metal AM: Leading Iowa Forward



Build Awareness

- Educational events
 - Public & private
 - Statewide

Cooperative Learning

- Pilot using company designs
- Support company R&D
- Shared research

Develop the next generation

- Student class projects
- Class & club access

IOWA STATE UNIVERSITY

Office of Economic Development and Industry Relations
College of Engineering

CIRAS

AM Metal: State of the Industry

Characteristic	Response
Build Size:	Under 10" cube (typical)
Resolution:	0.004" (Thickness of a post-it note)
Surface Finish:	0.0008" Ra (1000 grit sand paper)
Hole Diameter:	0.020" (without cleaning)
Strength:	98% Densities (better than production)
Tolerance:	0.002" (typical)

Metal AM Benefits

Product Design

- Freedom of design (1a – 2)
- Reduced tolerance
- Reduced assembly costs
- Reduce time to market
- Variant options

Supply Chain

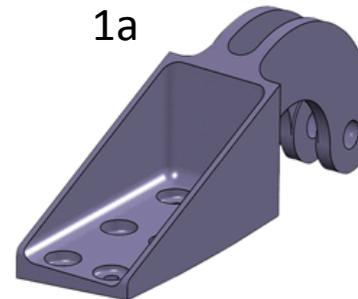
- Shorter supply chain
- Combining parts: Reduced supplier count

Business

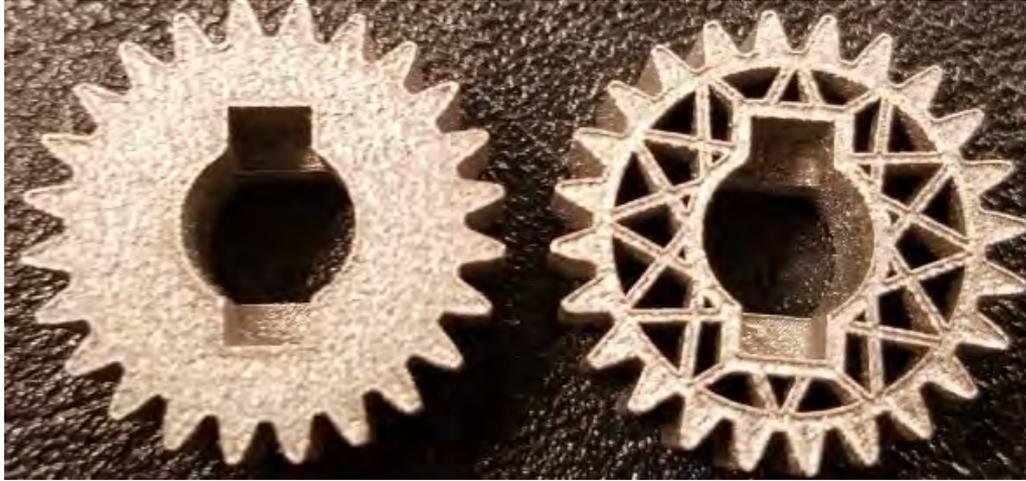
- Rapid response to market demands (i.e. service)
- Specialized products

Process

- Reduced/eliminate tooling capital
- Minimize material and energy usage



Metal AM: Freedom of Design

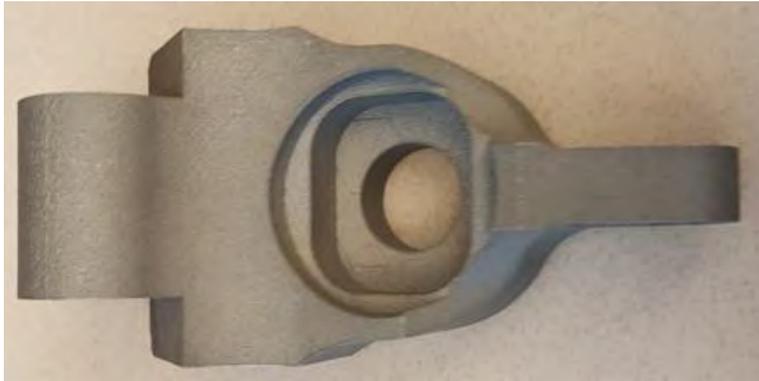


Advantages:

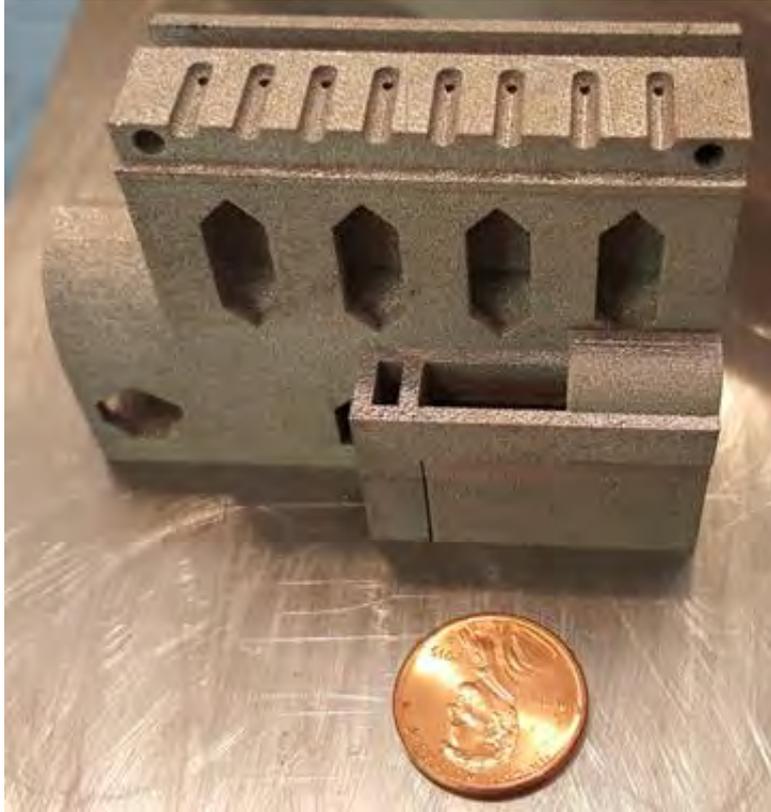
- Less Material
- Faster to process
- Same functional strength



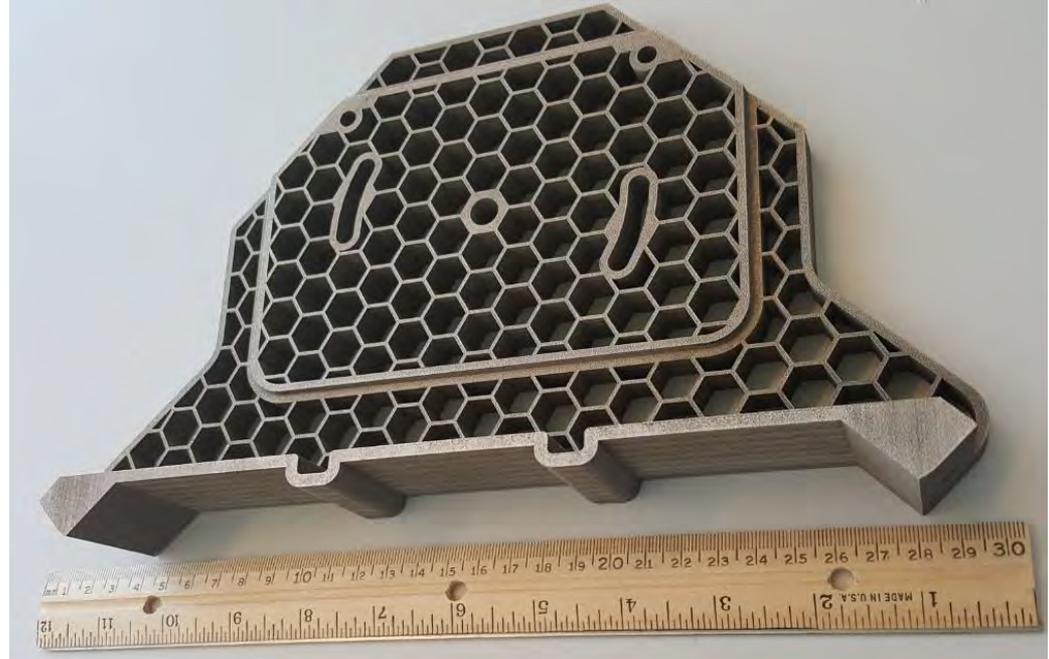
Metal AM: Company Parts – R&D



Metal AM: Company Parts - Process



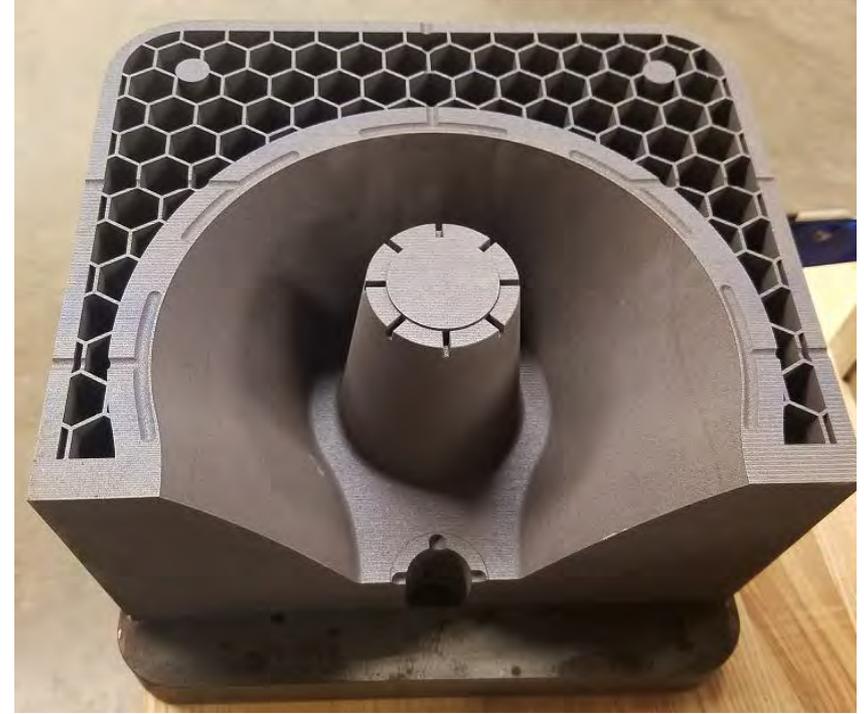
Dispensing Head



Location Fixture

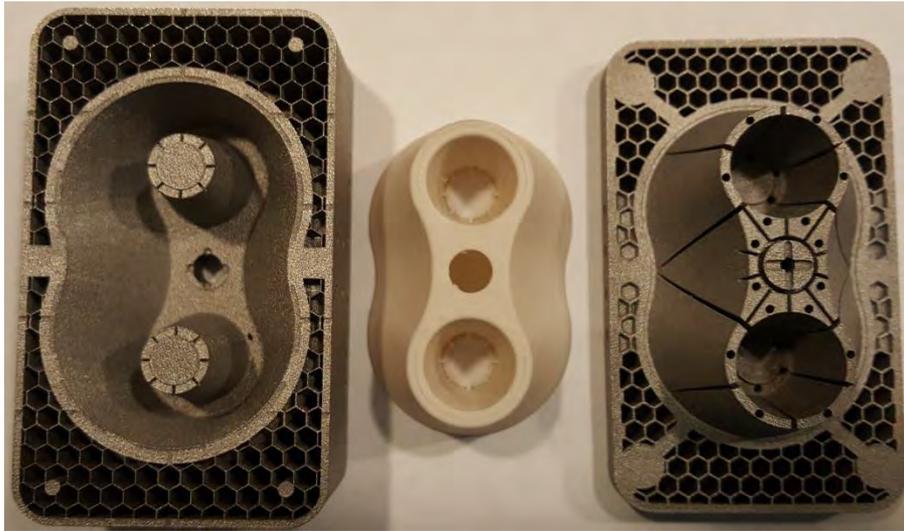
Metal AM: Plastic Tooling

Focus on making the things that make the things.

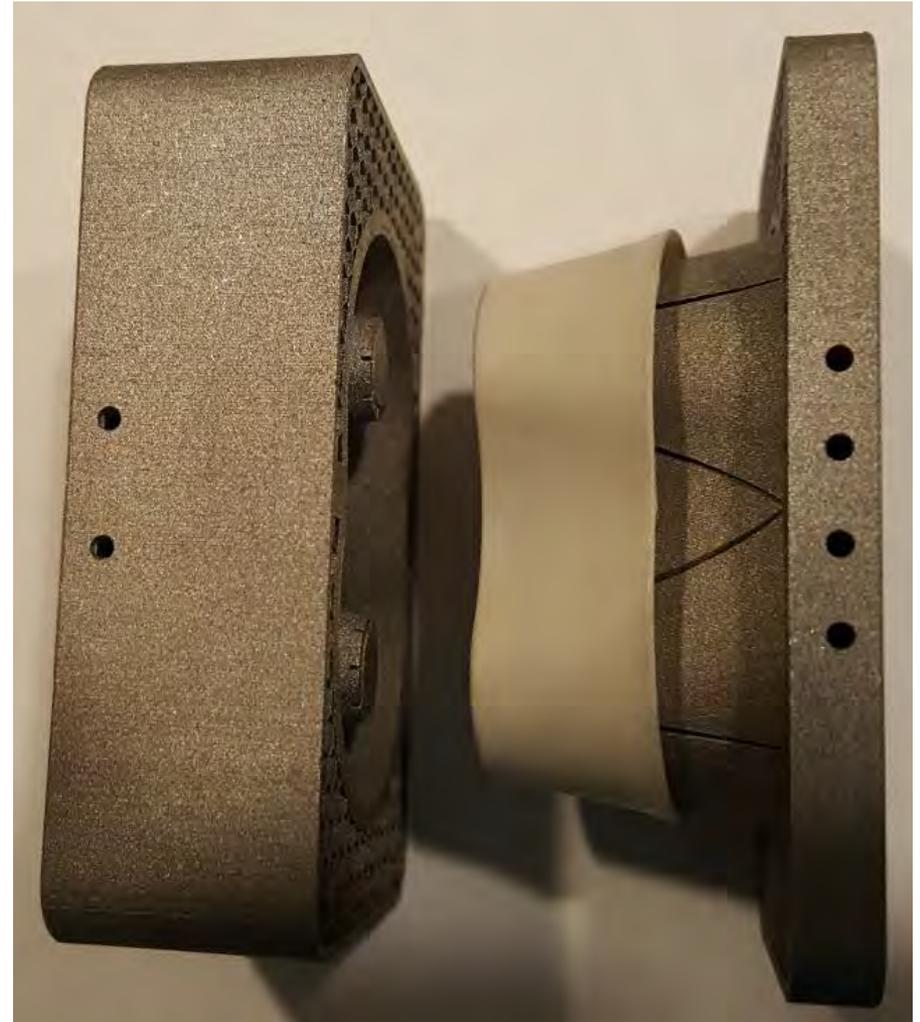


Note the conformal cooling lines.

Metal AM: Plastic Tooling



Core and Cavity set with sample of the part.



Metal AM: Plastic Tooling



Metal AM: Plastic Tooling



Note:

- Modular concept
- Split cavity due to size

AM: Closing Thoughts

- It's a complex and ever evolving tool
- Complexity is “free” – Freedom of Design
- Allows you to use the iterative cycles – Fail fast, fail early
- It WILL be a tool used by Iowa Manufacturing going forward
- It can be confusing with all the technology options, so find a partner to help you....like CIRAS
- Many educational institutions have or are obtaining the technology, so students can become more familiar with it
- Companies can be too focused on just moving a part from traditional manufactured to a AM manufactured process without looking at the design and functional requirements of the part (waste)

Questions?