

University of Windsor



FROM THOUGHT TO THING: ADDITIVE MANUFACTURING RESEARCH

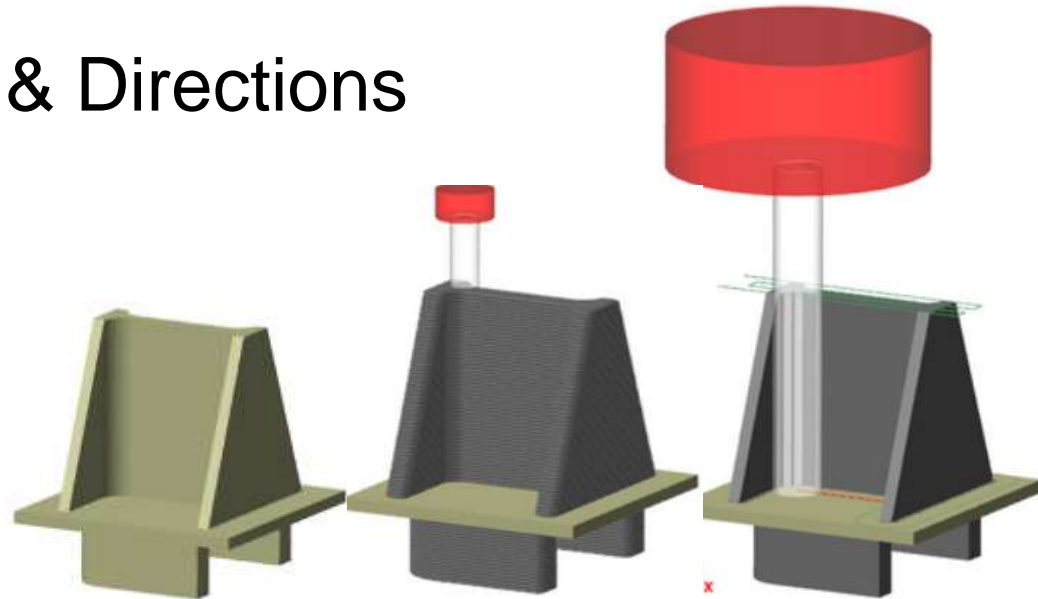
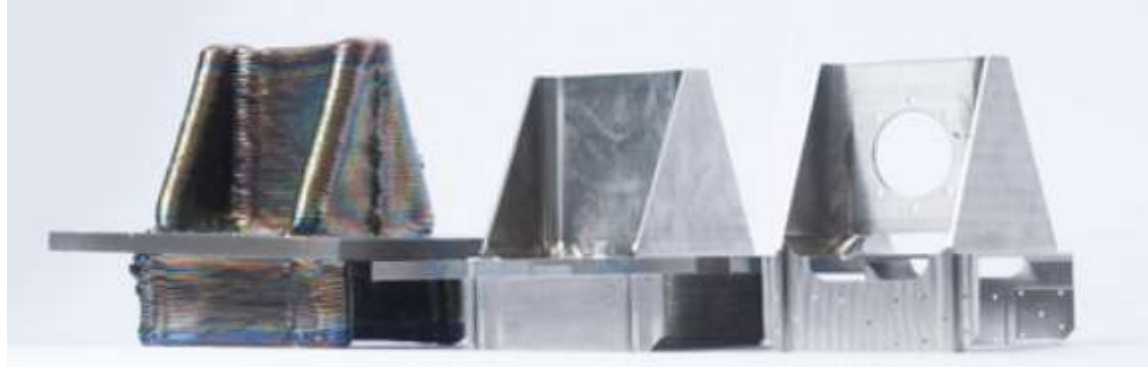


<http://www.shapeways.com/product/QNFAKNW9Z/gyroid?optionId=151818&li=marketplace>

R. J. Urbanic
June 14-15, 2016

Agenda

- Introduction
- Research Questions & Directions
- Concluding Remarks
- Questions



Solutions for Interesting Problems

- Duck and tortoise prosthetics



Furniture.....Medical



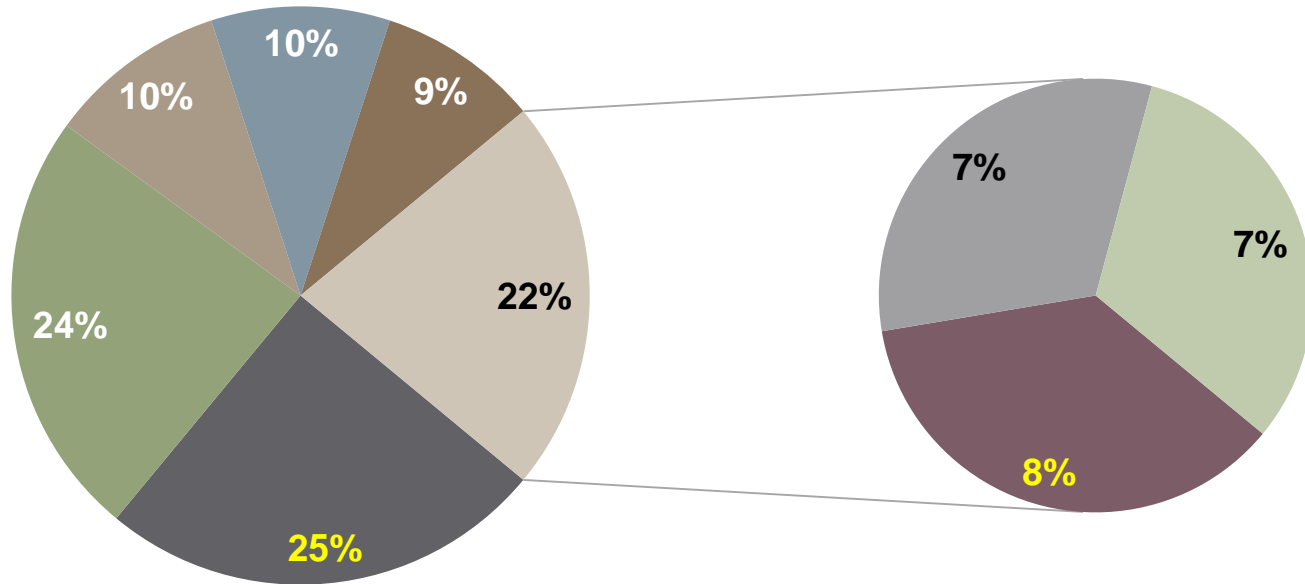
<http://inhabitat.com/bigrep-ones-huge-3d-printer-can-create-life-size-furniture/>



<http://www.3ders.org/articles/20151026-medical-3d-printing-specialist-3d-medical-merges-with-mach7.html>

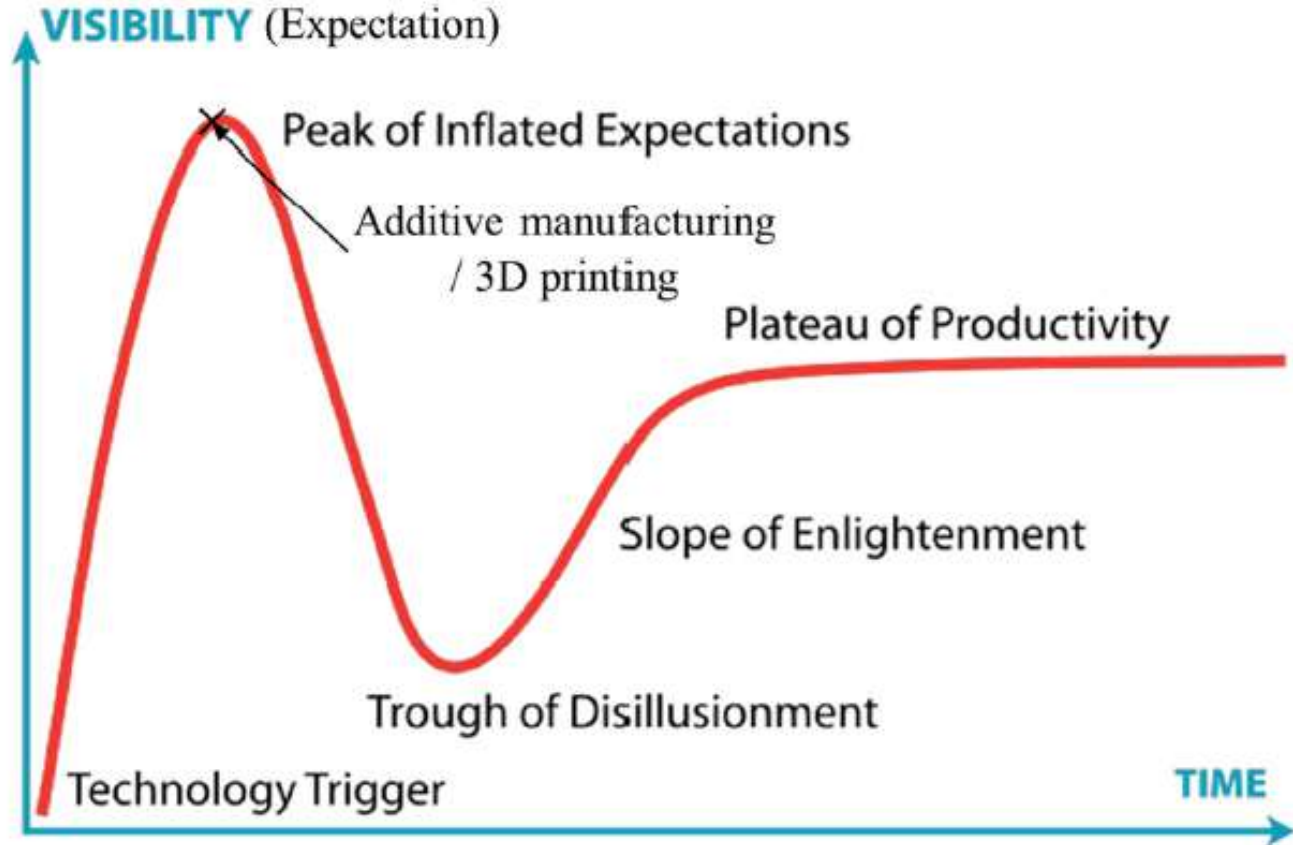
Additive Manufacturing

LAYERED MANUFACTURING DIVISION ACCORDING TO SECTORS



Potential

3D Printing or Additive Manufacturing provides unprecedented control over the shape, composition, and function of fabricated products, as well as a high degree of personalization for individuals



FROM THOUGHT TO THING

Design

- Functional requirements
- Design parameters

Make

- **Process selection**
- **Resource management**
- **Volume, planning horizon**

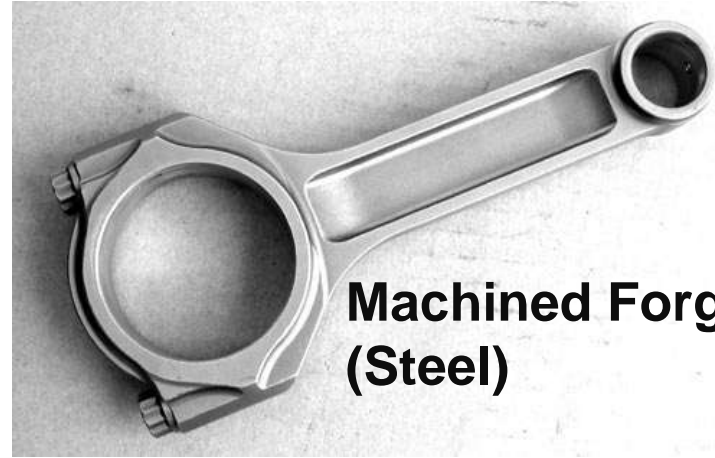
Measure

- Validation methods
 - Conformance to specification
-

Process-Materials Impact Example: Connecting Rod

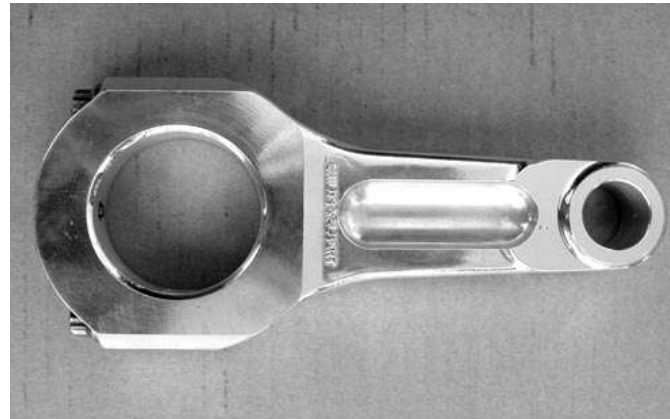


Forged Steel



**Machined Forging
(Steel)**

**Product materials &
fabrication processes
interlinked**



**Machined
Al**

Process Growth Sectors

BAAM: making a car



https://youtu.be/Z6l2oSzl_M

Process Growth Sectors



https://youtu.be/Z6l2oSzl_M

Process Growth Sectors



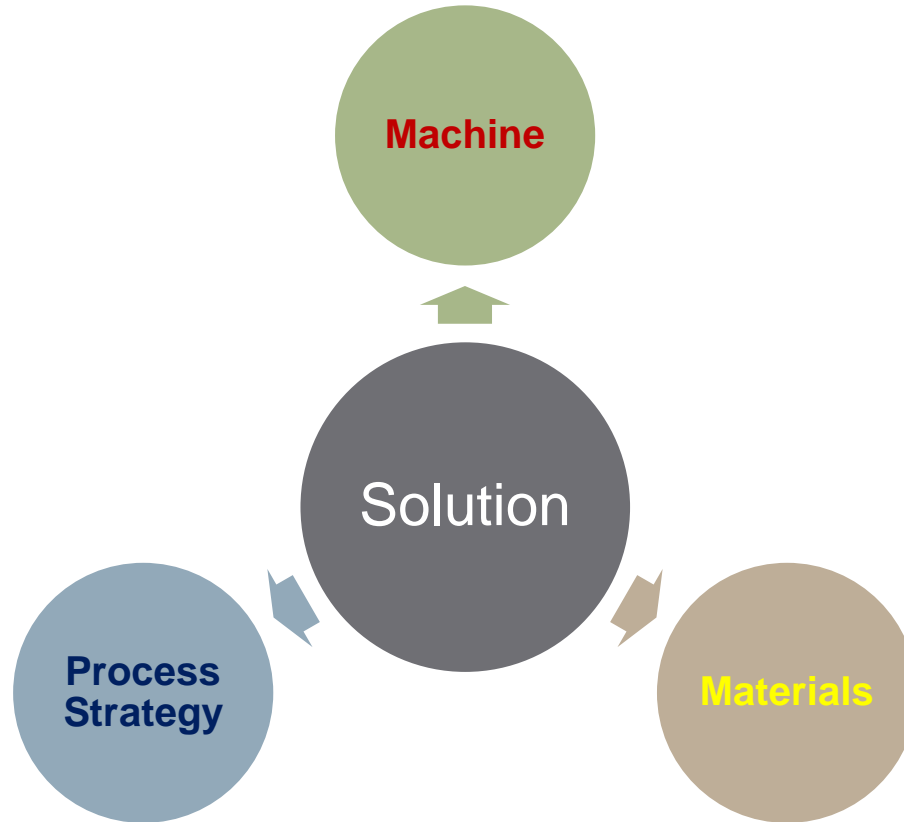
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Process Growth Sectors

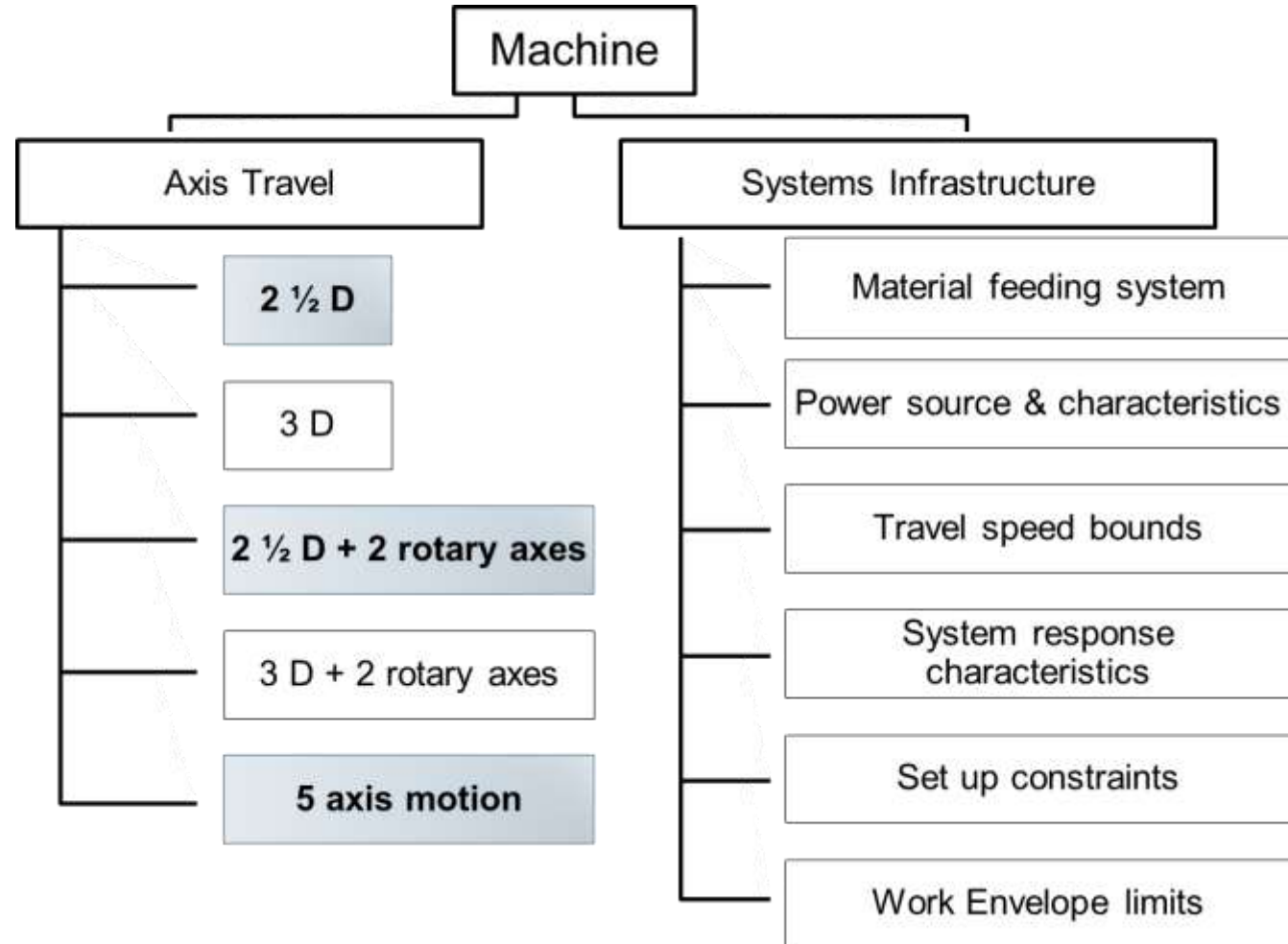


<https://youtu.be/YpGHrE88WWQ>

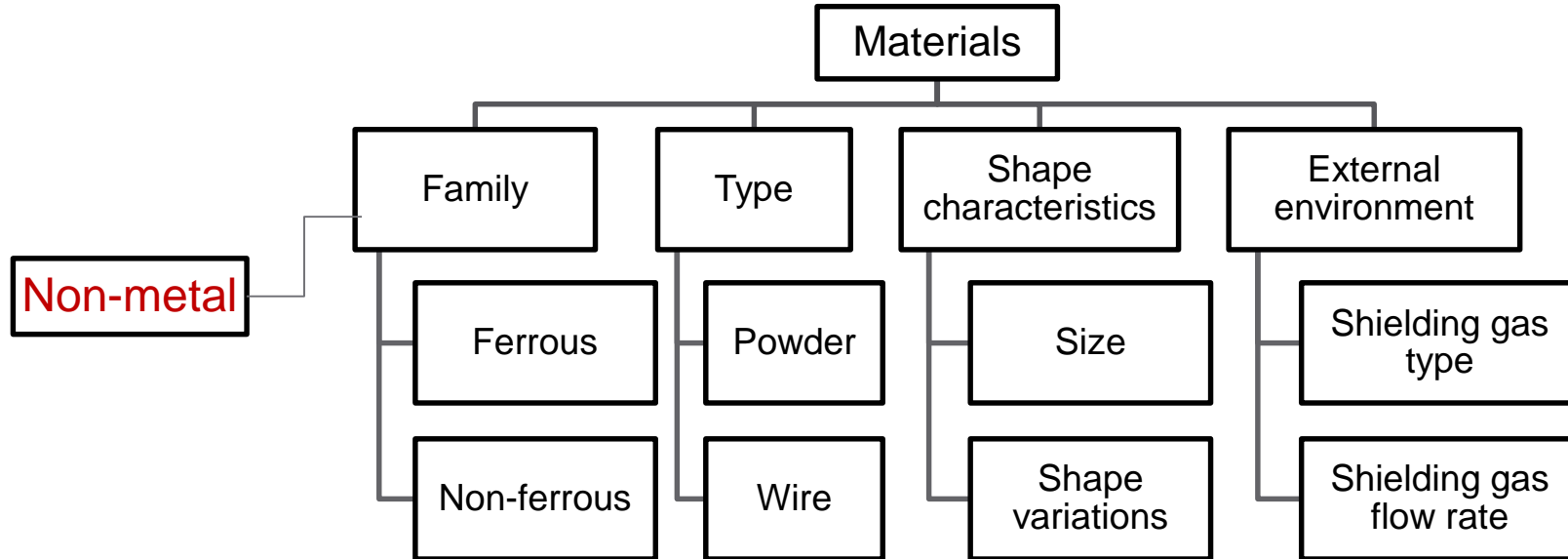
Research Questions



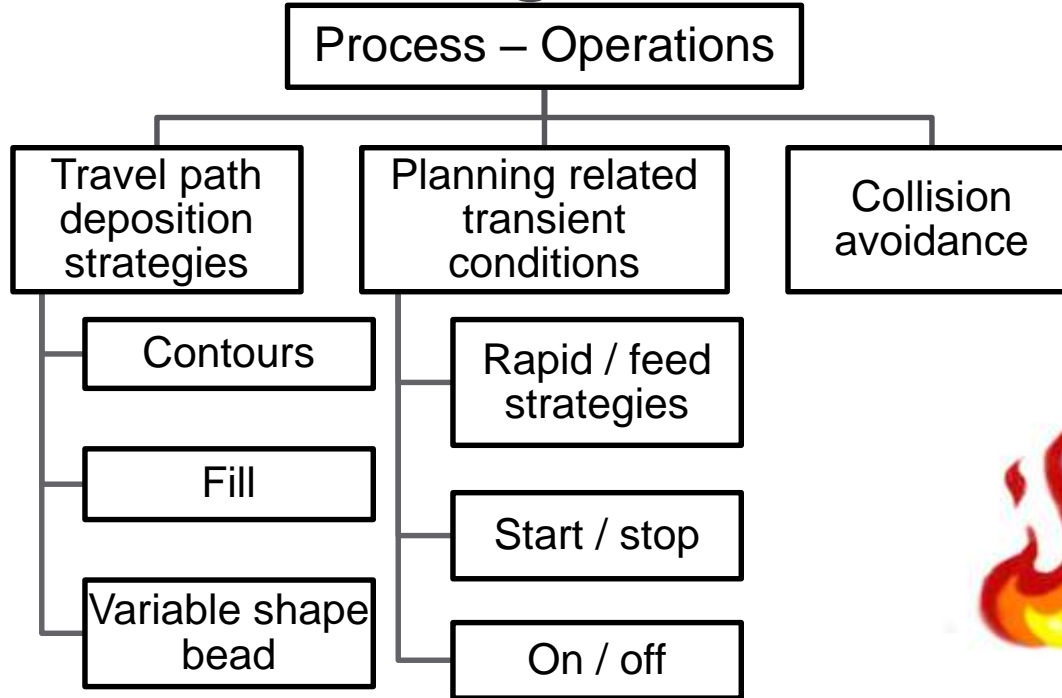
Machine



Materials



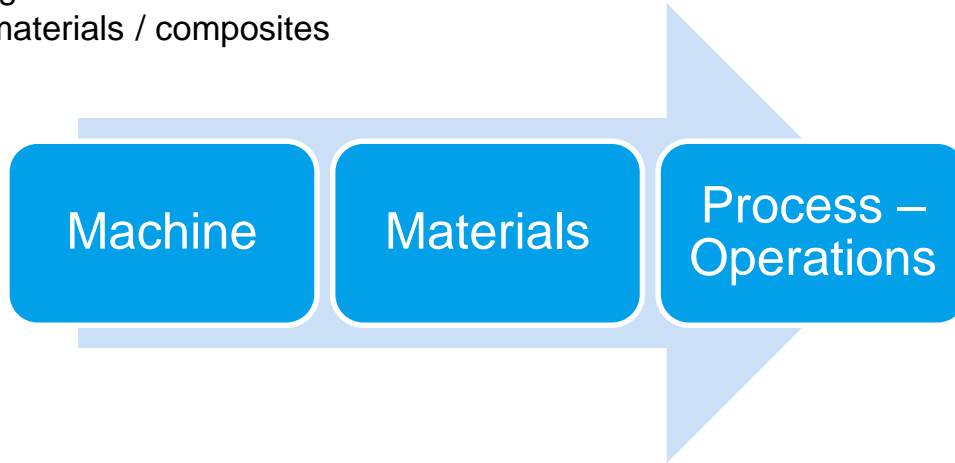
Process Planning



Additive + Subtractive

Research Questions

- **Design for AM**
- Mechanical and physical properties
- **Dimensional stability & surface finish**
- **Porosity & voids (discontinuities)**
- **Hardness**
- **Residual Stresses**
- Process planning
 - Bead shape characteristics → process parameter selection
 - Dealing with heat
 - Multi-materials / composites
 - Hybrid



Speeding
things up!

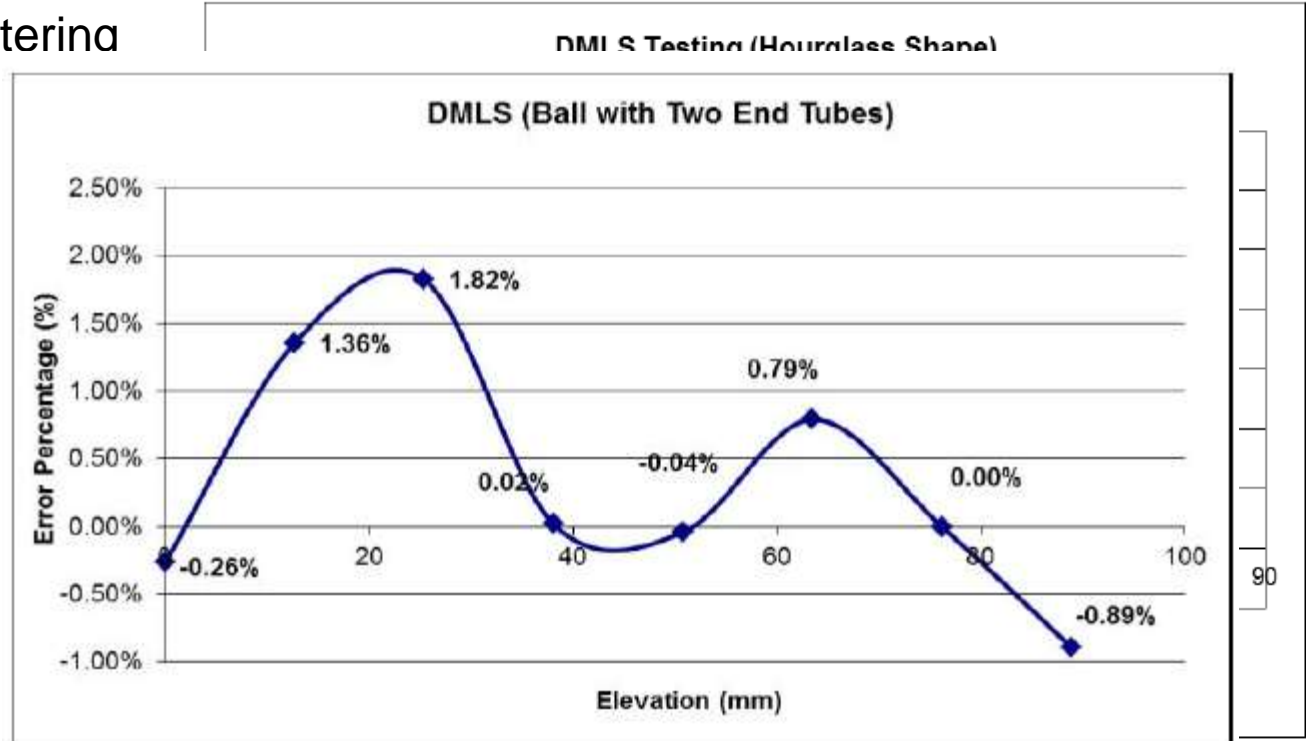


Additive Manufacturing: DMLS

- Direct metal laser sintering

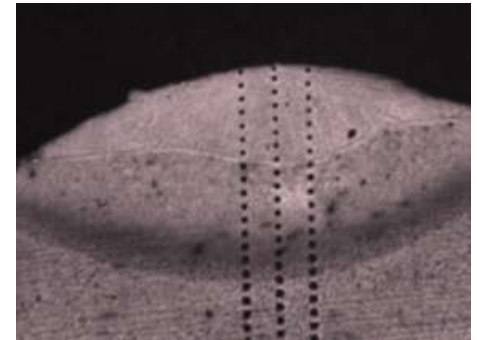
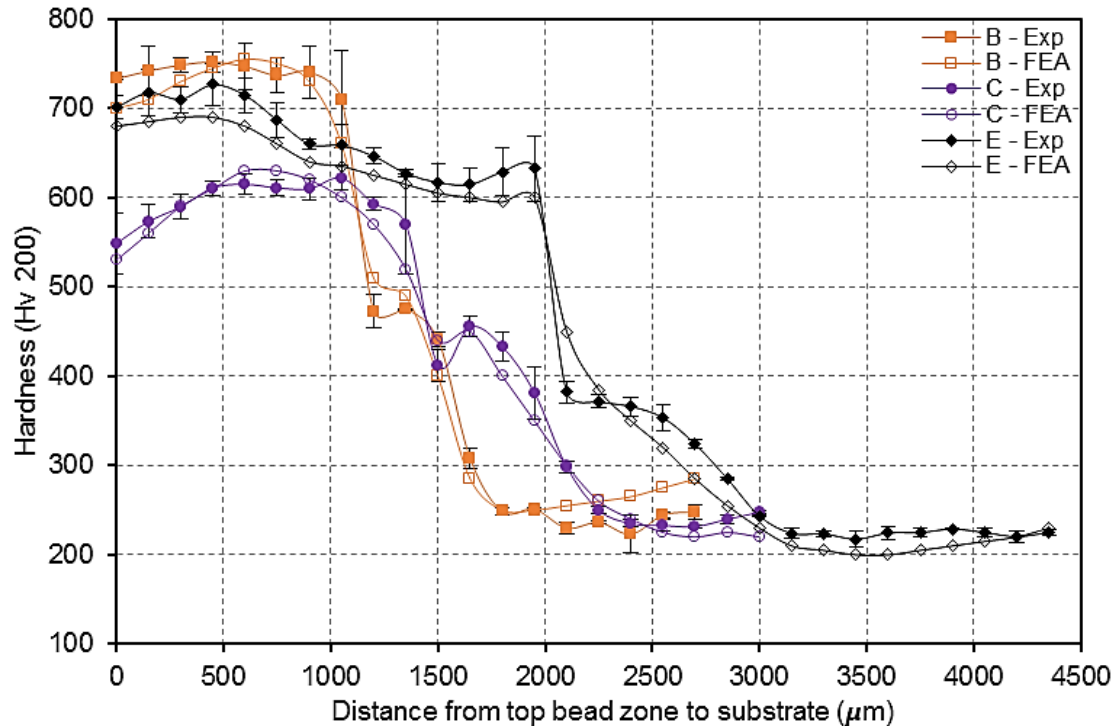


Porosity, hardness,
residue stresses

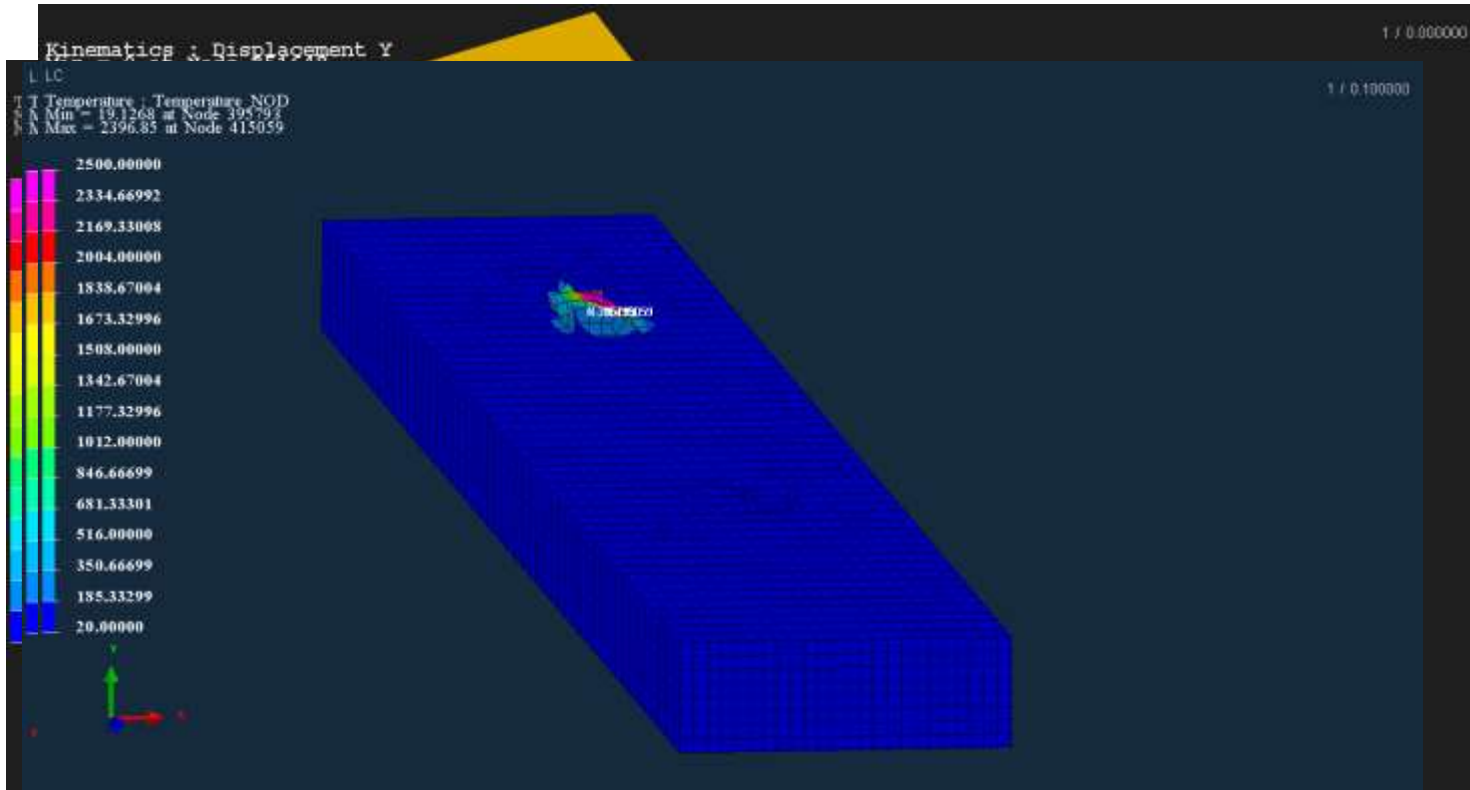


Additive Manufacturing: Laser Cladding

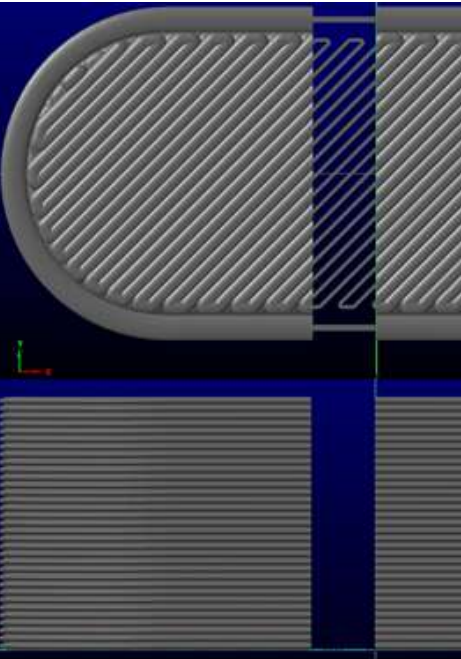
- Predictive bead shape modelling and develop process planning



Temperature, Hardnesses & Residual Stress

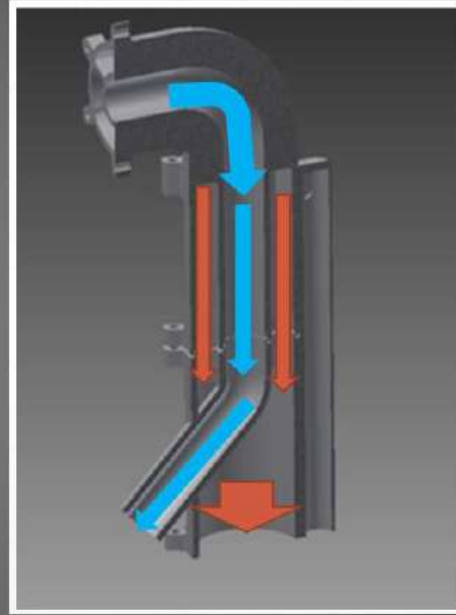


Process



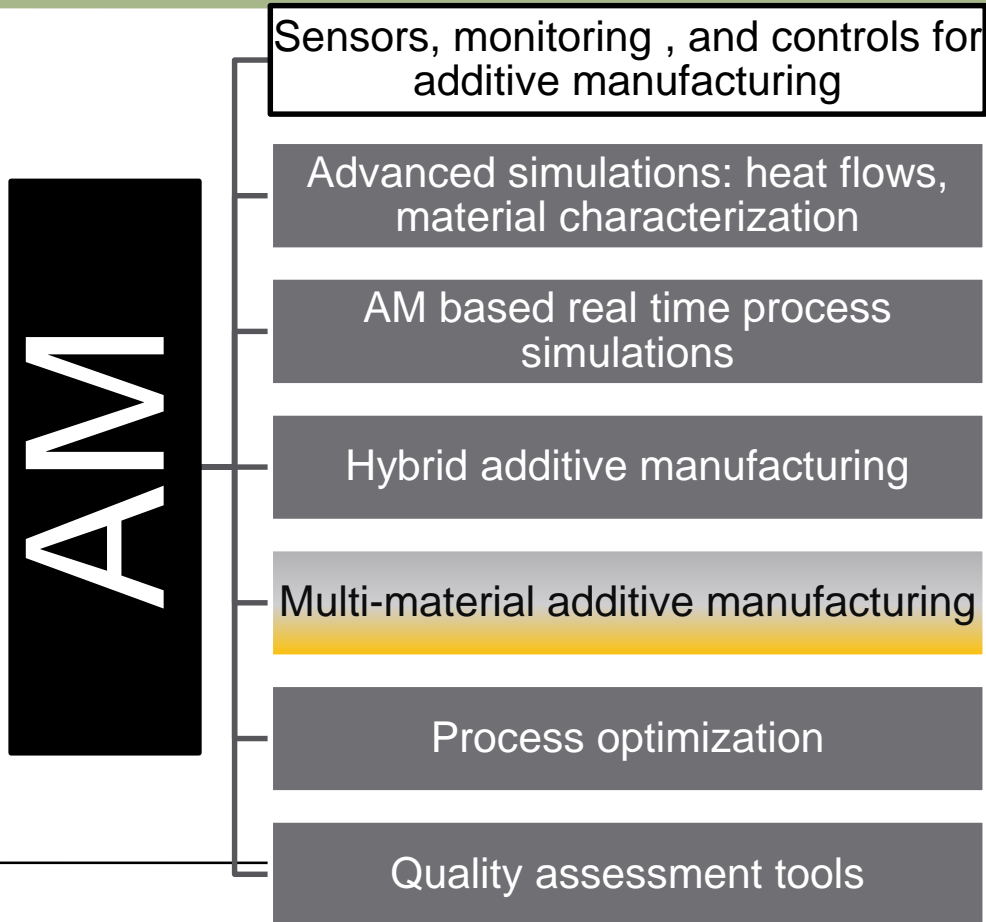
Engine Air Particle Separator (EAPS): University of Arkansas

Wind Tunnel



AM sped fabrication of the test fixture

FUTURE DIRECTIONS





Thank you