Additive Manufacturing Education through The IAM3D Challenge at South Dakota State University

Todd Letcher
Assistant Professor
Mechanical Engineering
South Dakota State University

Manufacturing Education at South Dakota State University

We are in the middle of a curriculum change

Older Students

- GE 225 (1 credit) – Traditional Manufacturing (mostly lathe/mill)
- GE 123 (1 credit) – 2D AutoCad and Solidworks
- ME 240 (3 credits) – 3d printing with IAM3D Challenge
- ME 478 (3 credits) – Senior Capstone Design

New Students (started Fall 2015)

- ME 121 (2 credits) – Modern Traditional Manufacturing Processes for Mechanical Engineers (manual and CNC mill/lathe, welding, basic mold making, casting)
- ME 212 (2 credits) – Solidworks and Matlab
- ME 230 (2 credits) – 3d printing with IAM3D Challenge
- ME 478 – (3 credits) Senior Capstone Design

The ASME IAM3D Challenge

The ASME Innovative Additive Manufacturing 3D (IAM3D) Challenge is designed to give mechanical and multi-disciplinary undergraduate students around the world an opportunity to **re-engineer existing products** or **create new designs** that minimize energy consumption and/or improve energy efficiency. Students will showcase their creativity by demonstrating the value added through their ingenuity, application of sound engineering design principles, and leveraging Additive Manufacturing technology to address a broad spectrum of industrial, manufacturing, and humanitarian challenges.

<u>Teams create and submit:</u>

- 3 minute video introducing the idea and the team
- STL files and source files from any CAD program
- An image of the current product design and a detailed description of the changes
- Business case report (5 pages or less):
  - justification of the product redesign,
  - value added as measured by
    - reduced time to produce,
    - cost impact,
    - sustainability,
    - energy consumption or renewable energy generation,
    - reduced materials and
    - promoting green design

Method for successful projects

1. Introduce AM and the variety of AM processes available to designers and talk about what makes AM different from traditional manufacturing

2. Get all of the bad ideas out quickly and focus on the few good initial ideas

3. Re-think project topics
   a) 2-3 minute project pitch to find group members
      a) Why is the project interesting?
      b) What makes the project a good candidate for AM?
   b) Allow groups to form around project topics, not friends
   c) Groups tweak ideas further with input from all members

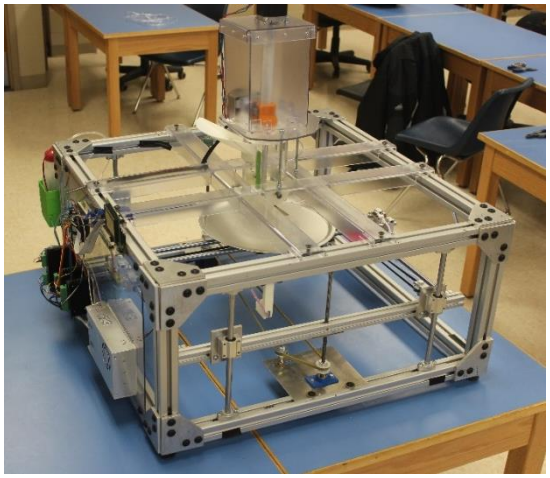
4. Large project with a distant deadline is too tempting to procrastinate – help by setting intermediate goals
   a) How is the product (or similar products) currently manufactured?
   b) How much does current manufacturing cost and how much energy required?
   c) Preliminary designs printed
   d) Modify designs to make more AM friendly

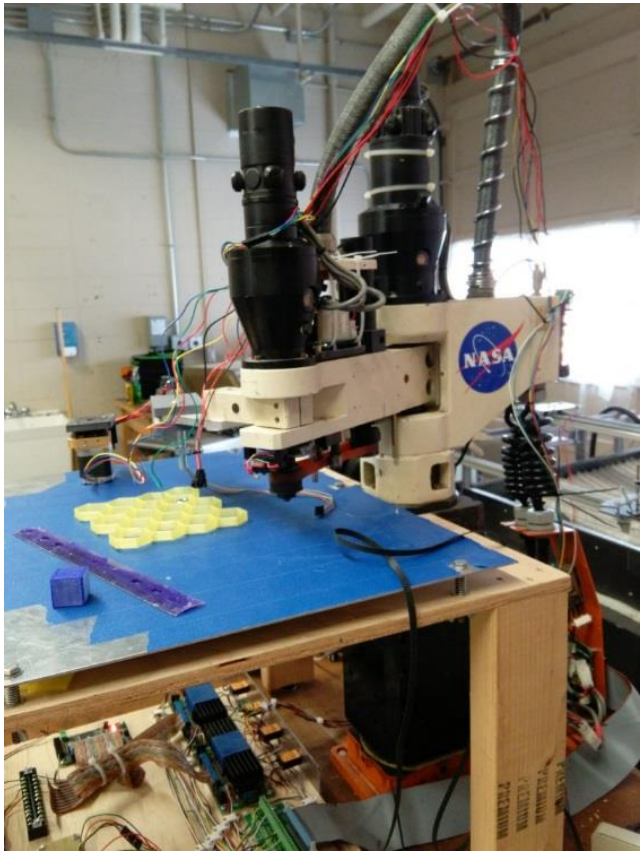
Benefits of the IAM3D Finals

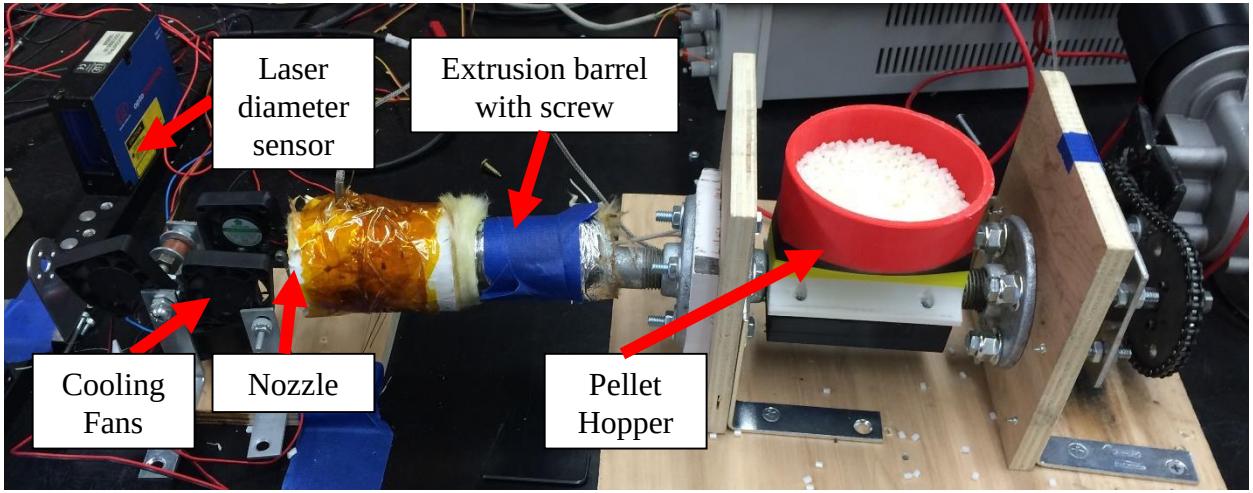
- Incredibly inspirational to see the various ideas from other students
- Judges questions and comments really help to develop the ideas further
- Extreme excitement about continuing their projects, or starting new projects
- Become more entrepreneurial

What happens after ME 240 and IAM3D

- About 6-8 people per semester join my lab as undergrad researchers
  - Not all purely AM projects, some are indirectly related
- Several senior capstone projects per year related to AM equipment







AM Training Challenges

- Finding real-world problems that are challenging and interesting
- Finding the funding to keep equipment running and supplies flowing
- Keeping up with all the new developments in AM