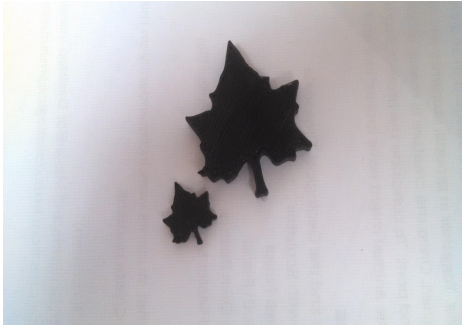
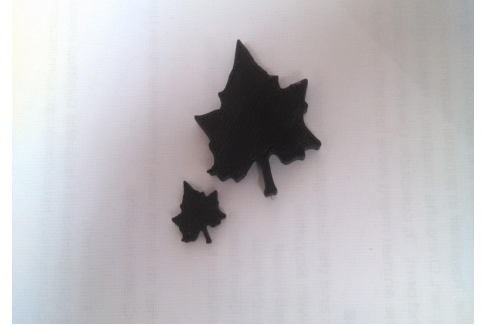




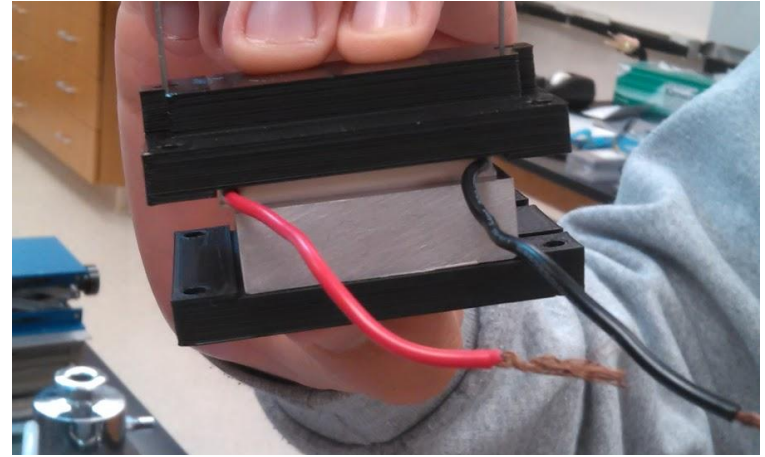
# Project 3D

Presented by Amy Watts and Gage  
Golish



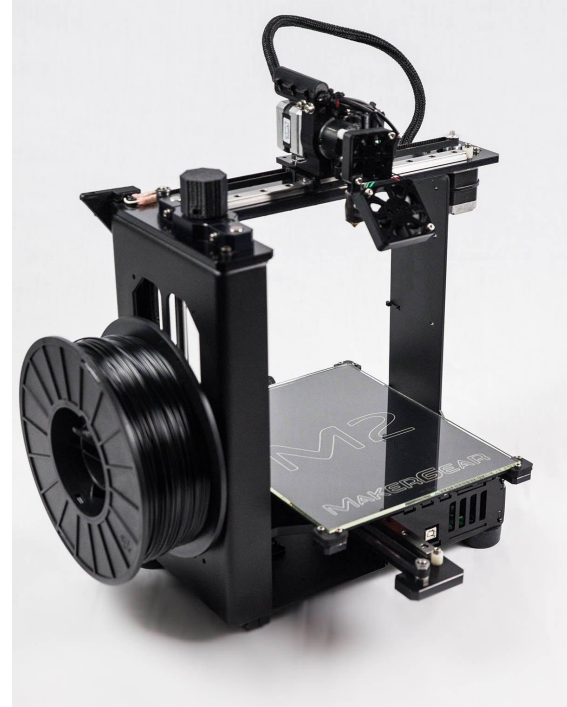
# Purpose

- Setup 3-D Printers
  - Software
  - Hardware
- Troubleshoot & Configure
  - First layer
  - Curled corners
- Assess Printer Applications
- Chemical and stress testing
- Designs for other projects



# Printers and Software

- Two MakerGear M2 printers
  - ABS, PLA, and exotic materials
- Software and Resources
  - Simplify3D
  - Slic3r
  - AutoDesk 123D Design
  - TinkerCAD



<http://i0.wp.com/3dforged.com/wp-content/uploads/2014/12/MakerGear-M2.jpg>

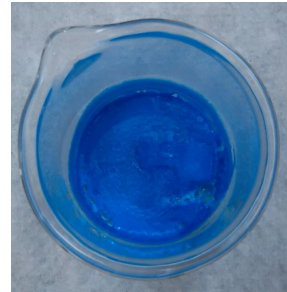
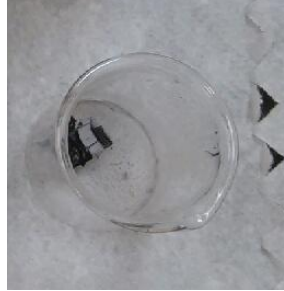
# Troubleshooting

- Clogged Extruder
  - Special materials
  - Membrane
- Not Sticking
  - First layer
  - Cellulose molecule
- Curled Corners
  - Print speed
  - Platonic solids



# Chemical Testing Results

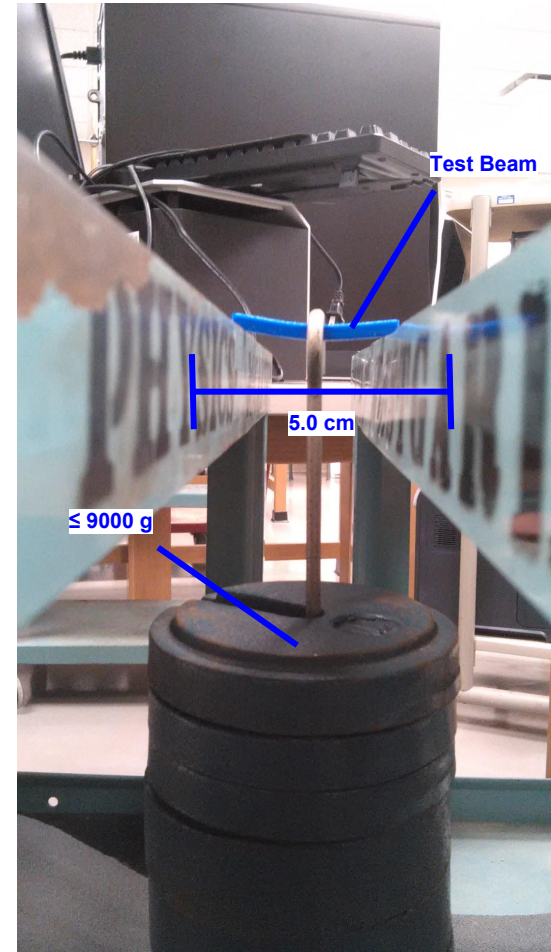
- Chemicals
  - Water
  - Absolute Ethanol
  - Dichloromethane  
(melted)
  - Acetone (melted)
  - Hexanes
  - Acetonitrile (melted)





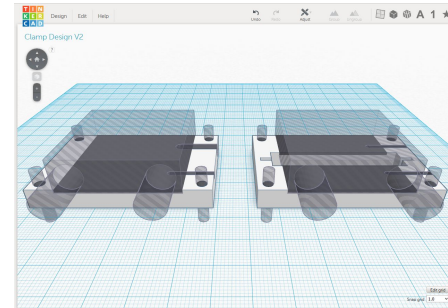
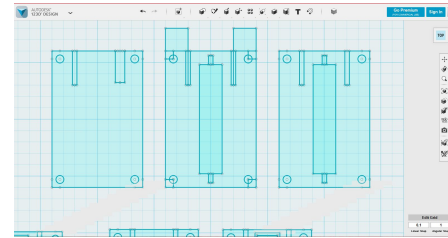
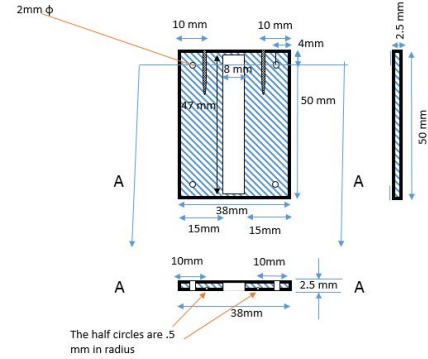
# Stress Testing of ABS and PLA

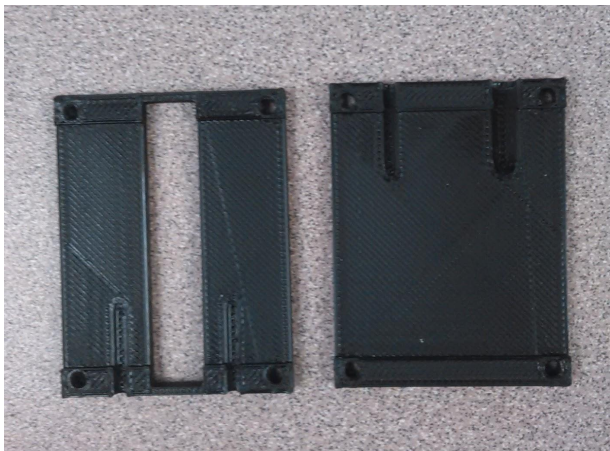
- Test Beams
  - 0.5 cm and 1 cm edges
  - 6 cm in length
  - Horizontal and vertical
  - I-Beams
- Setup
  - 5 cm gap
  - Up to 9 kg hanging mass



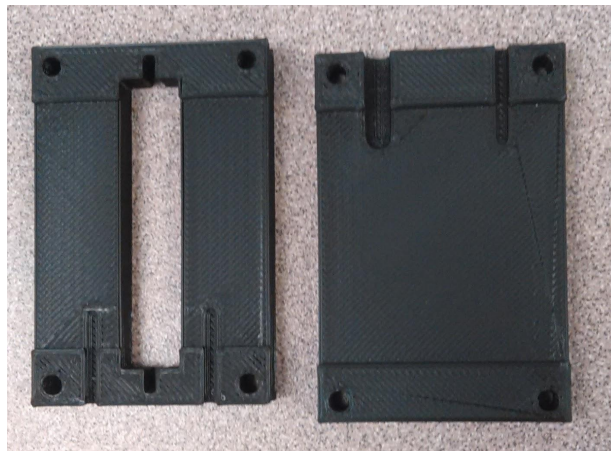
# Clamp Design

- Dr. Noll's student JR è Dr. Noll's Group
  - Thermal Electric Generators
  - Student's Design
- Modifications
  - 3D
  - Adjusted Measurements
  - Added Features
- TinkerCAD and 123D Design

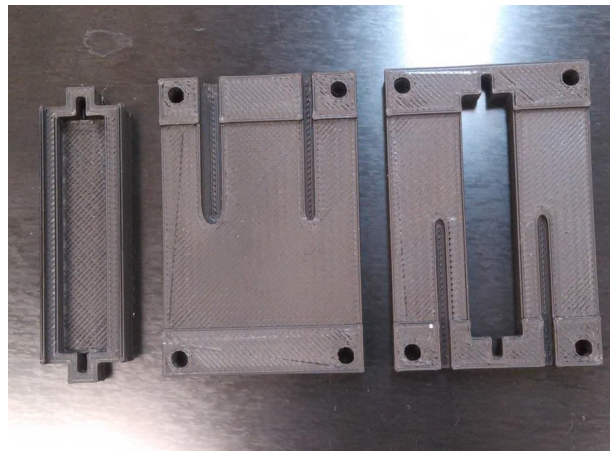




- Screw holes too small
- Resistor hole too small, ignored wires
- Probe slots too shallow



- Larger in size
- Screws fit
- Resistor hole includes space for wires
- Probe slots too shallow

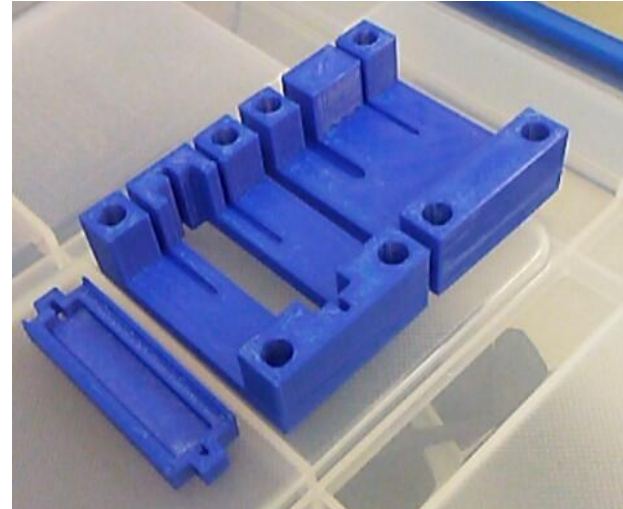
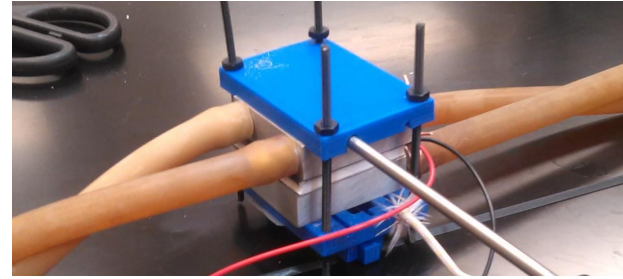


- Probe slots longer, correct depth
- Includes removable cover for resistor
- Heat warping occurred



# Clamp Design

- Heat warping
  - PLA: 190°C
  - ABS: 230°C
  - ABS reprint
- Version 4
  - Larger screw holes
  - Taller on each side
- Version 5
  - Resistor removed



# Conclusions

- Two printers fully tested, with full set of free design software installed
- Settings optimized for ABS and PLA materials
- ABS, PLA stress and chemical tests performed
- Clamp holder design completed and used
- Doppler project designed and tested
- Instruction book completed
- Electronic Print Cue developed and deployed

# Acknowledgments

- The ISU Center for Student Research and Creativity
- Earth and Environmental Systems (Dr. S. Brake)
- Chemistry and Physics Department
- University Research Committee
- Math and Computer Science Department
- Daniel Pigg (Director Business Engagement Center)
- Audie Spencer (Senior Project Manager in Innovation Lab)
- Dr. Noll
- Dr. West & Dr. Kinne

# Resources

- [simplify3d.com](https://simplify3d.com)
- [sculpteo.com](https://sculpteo.com)
- [3dprintingindustry.com](https://3dprintingindustry.com)
- [matterhackers.com](https://matterhackers.com)
- All resources available at [cs.indstate.edu/project3d](https://cs.indstate.edu/project3d)