

Team 19

CNT Reinforced Ceramics 3D Printer

Midterm II Presentation

SPONSORS

Dr. Cheryl Xu, FSU

Dr. Wei Guo, FSU

Dr. Yong Huang, UF

Team Members

Ernest Etienne, M.E.

Basak Simal, M.E.

Cody Evans, I.E.

Sam Yang, M.E.

Daphne Solis, I.E.

Sonya Peterson, M.E.

COURSE

PROFESSORS

Dr. James Dobbs

Dr. Nikhil Gupta

Dr. Scott Helzer

Dr. Okenwa Okoli

Dr. Chiang Shih



Presentation Contents

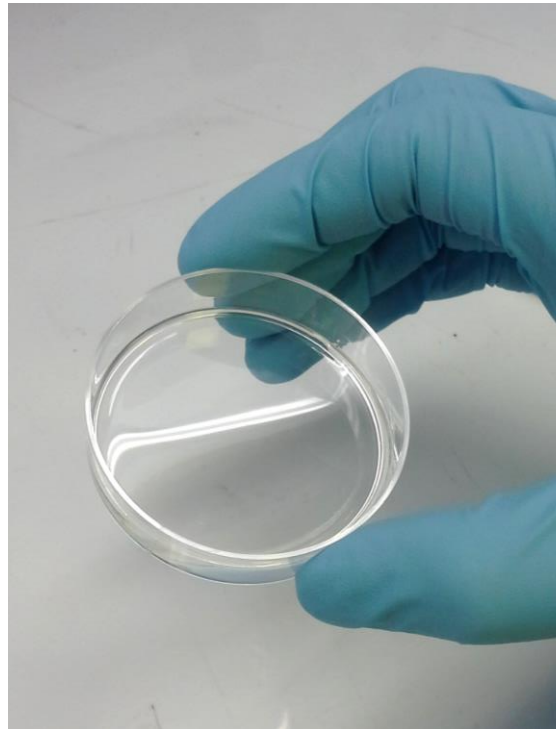
- Project Overview & Background
- Materials
- Design Concepts
- Design Evaluations
- Budget
- Future Plans

Project Overview

- To have a functioning 3D printer
- The printer design will be experimenting with carbon nanotube reinforced ceramic composites.
- Our team is
 - Understanding on the unique properties of materials involved
 - Modeling 3D CAD designs
 - Structuring decision matrices
 - Creating cost-benefit analysis

Project Background

- Print Material
 - Polymer precursor
 - CNT's
- 3D printing
 - FDM
- Electromagnetic field



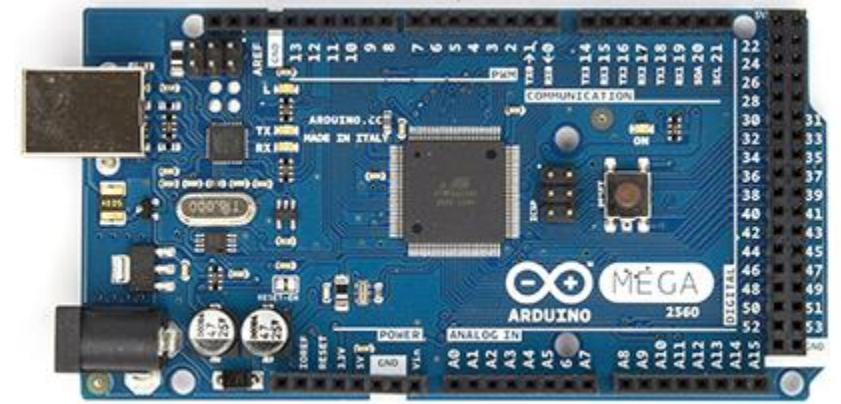
Pure Polymer

Material	Viscosity
Water	1
Blood	10
Antifreeze	15
SAE 10 motor oil	50 - 100
SAE 60 motor oil	1,000 – 2,000
Peanut Butter	150,000 – 250,000

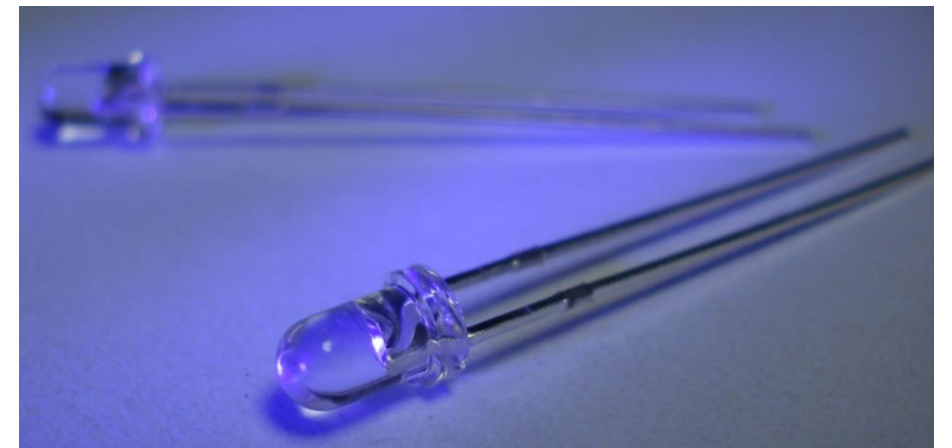
Sample Viscosity Examples

Materials

- Mechatronics components
 - Arduino Mega 2560
 - Ordered, waiting on delivery
 - Testing apparatus microcontroller coupled with an inkjet printer cartridge and nozzle
- Testing apparatus
 - Laser borrowed
 - UV LED ordered
 - Heat tested



Arduino Mega 2560



UV LED (3mm)

Potential Risks and Challenges

- Print material has not been used for 3d printing
- Inkjet heating
- Experimental testing
 - Class IV Laser
 - CNT percentage aligned
- Clashing characteristics between CNTs and polymer

Design Concepts

- Customer requests
 - Desired material properties
 - User safety
 - Environment
 - Repeatability
 - Comparable printing time
 - Sensors
 - Display



Temperature Sensor



Camera

Design Concepts

- Extruder head decision
 - Nozzle
 - Syringe
 - Pipette
 - Cartridge
- Curing Method
 - UV
 - Laser
 - Heated environment



Syringe and needle



Laser

Design Evaluations

	Variable Flow	Fluid Viscosity	Material Capacity	Min Shot Size	Temperature Resistance	Cleanability	Total
Weights	.15	.25	.2	.2	.1	.1	1
Syringe	5	4	4	5	5	5	4.55
Nozzle	4	5	5	4	5	3	4.45
Pipette	3	3	2	1	3	4	2.5
Cartridge	4	1	4	3	1	2	2.55



Extrusion Head Decision Matrix (Possible Selection and Criteria)

Design Evaluations

	Cure Time	Placement Flexibility	Availability & Cost	Area of Effect	Envelope Size	Safety & Containment	Total
Weights	0.25	0.1	0.1	0.2	0.2	0.15	1
UV LED	3.5	5	4	3	5	4	3.375
UV Lamp	3.5	2	3	3.5	3	5	2.675
Laser	4	4	3	1	4	2	2.7
Heat	3	3	3.5	4	2.5	3	2.7

Curing Method Decision Matrix (Possible Selection and Criteria)

Design Evaluations

	Sponsor Preference	Open Source Software	Availability & Lead Time		Extruder	Total
W	.10		5			
Lulzbot Kittaz	5		4			1
Re	4		4			55
A	2		5			.9
MakerGear	3		4			.2
3D Printer Decision Matrix (Possible Selection and Criteria)						

Lulzbot Kittaz

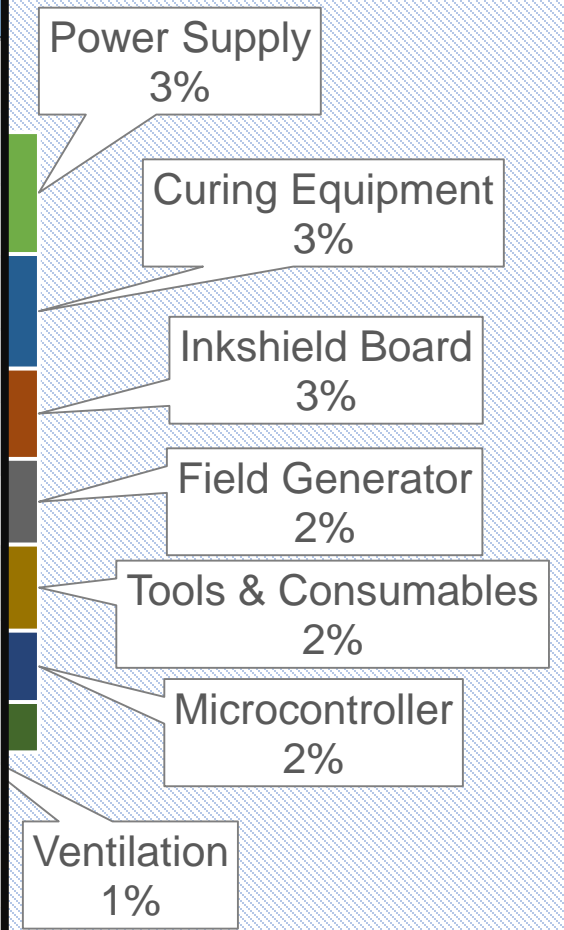
Aurora

Mini Kossel

Maker Gear

Expenses

Team 19 Project Budget		
Item	Cost	Percent of Total Costs
3D Printer - LB Kittaz	\$ 1,595.00	60%
Housing	\$ 180.00	7%
Camera	\$ 160.00	6%
LCD Screen	\$ 120.00	5%
Sensors	\$ 120.00	5%
Power Supply	\$ 85.00	3%
Curing	\$ 80.00	3%
Inkshield Board	\$ 63.00	2%
Field Generator	\$ 60.00	2%
Tools & Consumables	\$ 60.00	2%
Microcontroller	\$ 49.95	2%
Ventilation	\$ 35.00	1%
Safety Equipment	\$ 35.00	1%
Total	\$ 2,642.95	53%



3D Printer
61%

Housing
7%

Power Supply
3%

Curing Equipment
3%

Inkshield Board
3%

Field Generator
2%

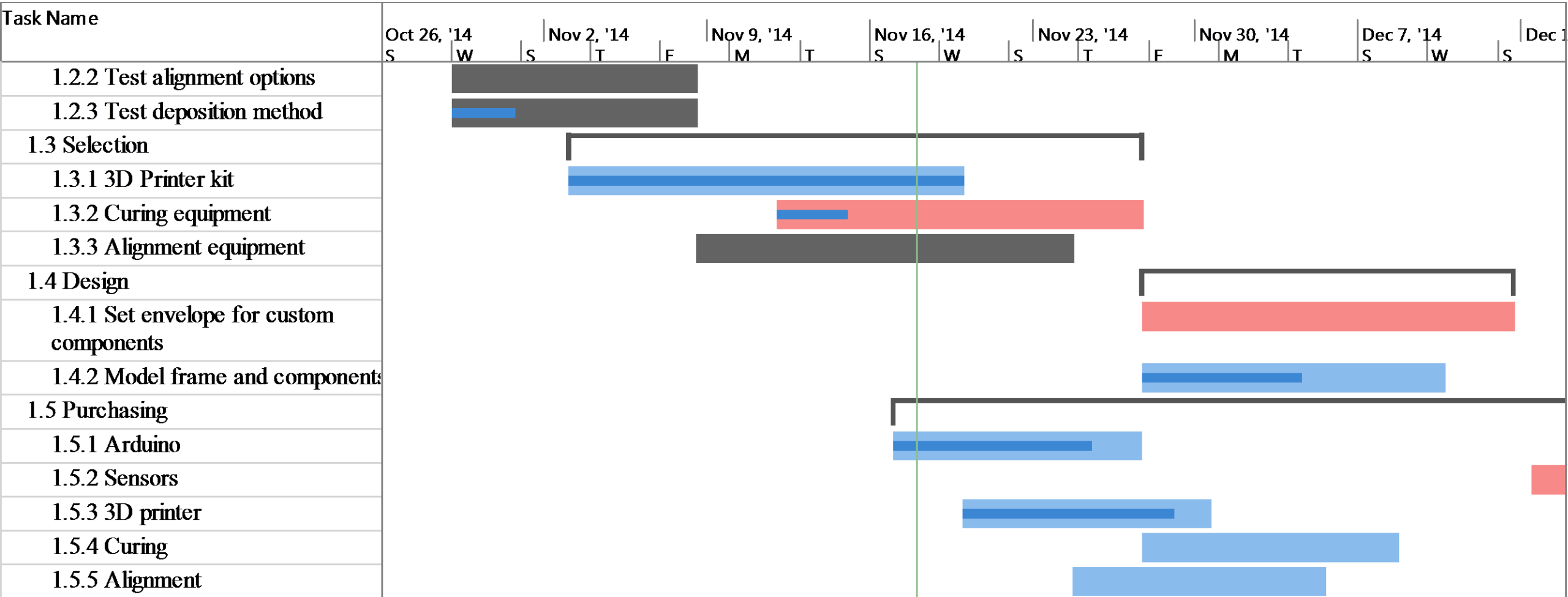
Tools & Consumables
2%

Microcontroller
2%

Ventilation
1%

Gantt Chart

Oct. 12th through Dec. 12th



In Summary

- Narrowed scope definition
- Highlighted primary design concepts
- Evaluated different designs
- Estimated project costs
- Updated project plan with clear goals and timelines

References

1. <http://arduino.cc/en/Main/ArduinoBoardMega2560>
2. <http://www.digikey.com/en/articles/techzone/2012/aug/next-generation-uv-led-technology-benefits-industrial-curing-coating>
3. http://www.medicalequipshop.com/media/com_hikashop/upload/syringe-2.jpg
4. Çengel, Yunus A., John M. Cimbala, and Robert H. Turner. "Mechanisms of Heat Transfer." *Fundamentals of Thermal-fluid Sciences*. Boston: McGraw-Hill Higher Education, 2012. 637. Print.
5. <https://www.lulzbot.com/products/lulzbot-kittaz-3d-printer>
6. <http://www.makergear.com/products/m-series-3d-printers>

Questions?

