

Midpoint Presentation

2019 GORE CAPSTONE TEAM:
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Project Description

Aneurysm: Abnormal bulge on blood vessel caused by localized weak spot

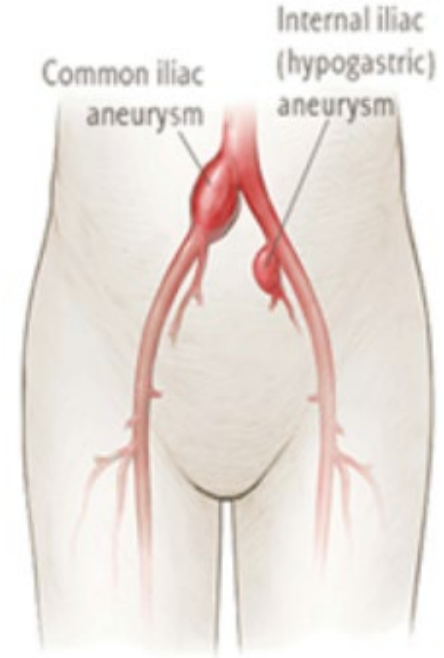
Aortic-Common Iliac Bifurcation: Location in which aortic artery bifurcates into two common iliac arteries

Rate of occurrence: 2-4% in U.S. Adult Population

Rate of Mortality: 50-70% if rupture occurs

Risk Factors:

- Age 50+
- Tobacco use
- Gender (male)
- Coronary artery disease



Project Description

Problem

Create a Realistic Model of the Human Iliac Bifurcation for Peripheral Endovascular Device Testing

Sponsor

WL Gore and Associates



Faculty advisor

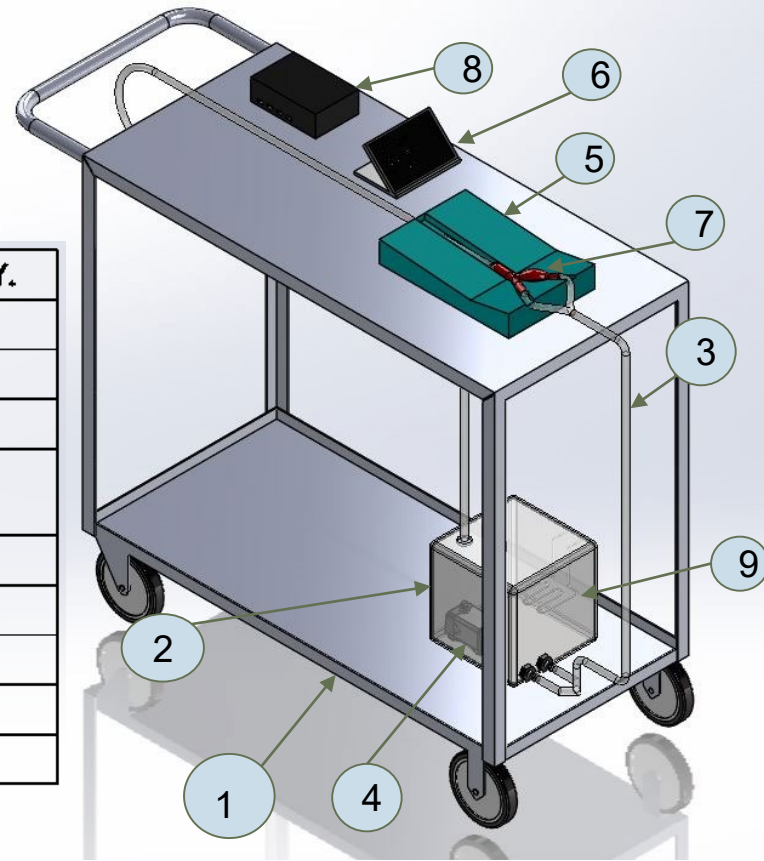
Dr. Tim Becker

Importance

Advance medical device technology, Ethical considerations, Ultimately save lives

Design Description

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	CART	Transport device	1
2	Tank	Fluid storage	1
3	Silicone Tubing	Water transport	2
4	Aqua One Maxi 106 Submersible Fountain Pump	AQUA ONE MAXI 106 SUBMERSIBLE PUMP	1
5	BOX	stabilize device	1
6	GUI	Visual data display	1
7	Bifurcation	Anatomical model	1
8	DAC	data acquisition control	1
9	Water Heater	Heat fluid 37degree C	1

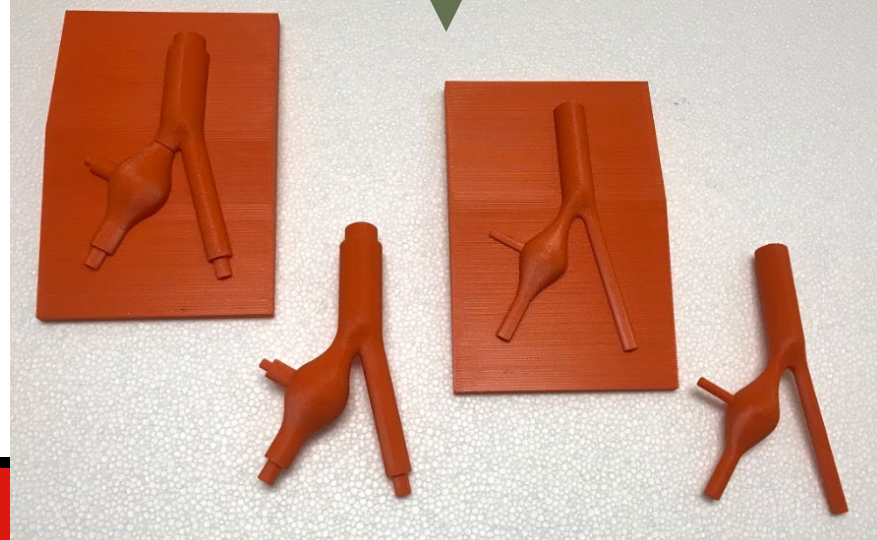
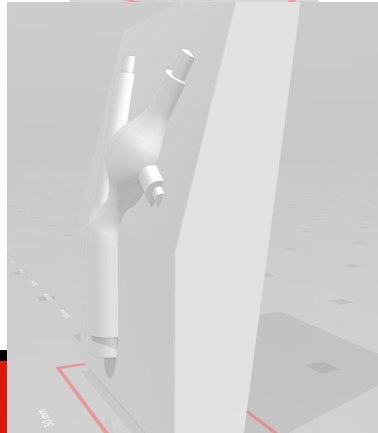
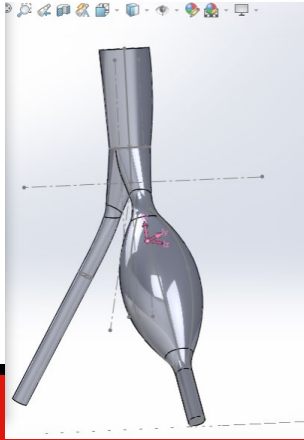
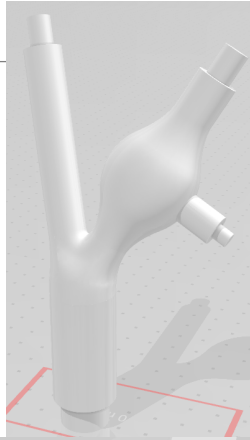
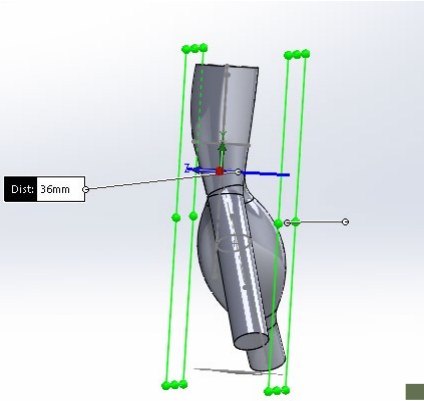


Updates

Updates will include:

- CAD
- Surface Treatment of 3D printed models
- Silicone molds poured
- Polyurethane selected
- Arduino progress

Updates - CAD



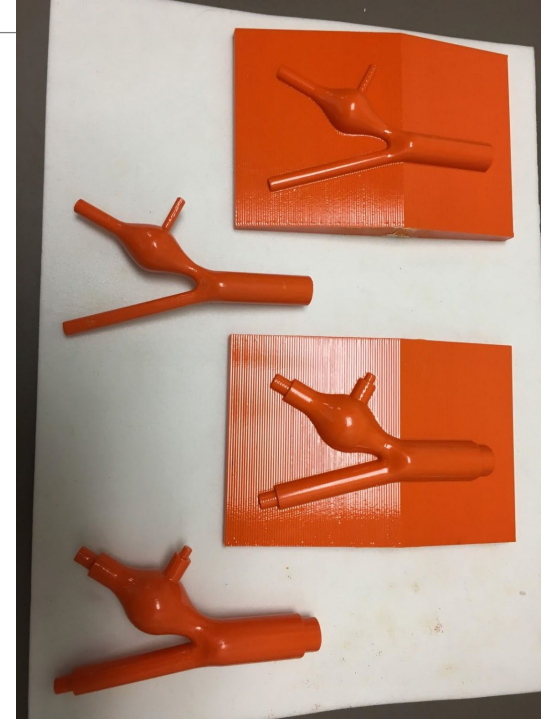
Updates - Vapor Bath



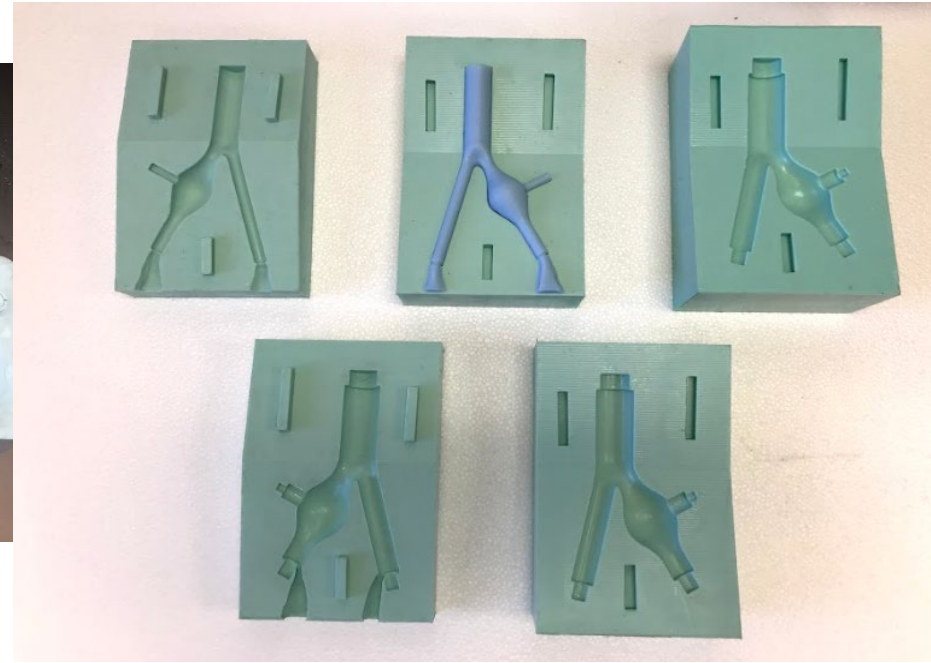
Chemical Vapor Treatment

Vapor Bath Successful

- PLA vs ABS Results
- Smooth ABS Masters for Final Molds



Updates - Silicone Molds



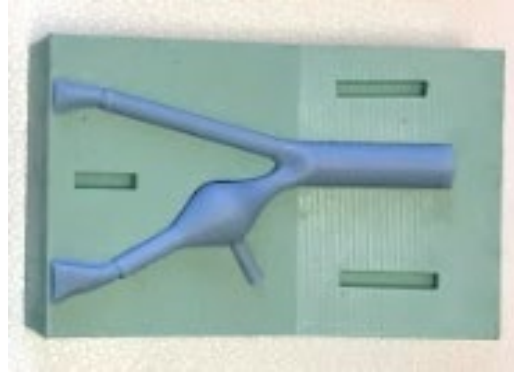
Update - Polyurethane



Polyurethane Model Casting

Casting was slightly behind schedule

- Several failed casts
- Challenges with wax cores
- CNC/Paraffin blend
- 75% vs 100% Softener



Second mold

- Double Production Rate
- Back on Schedule



Moving Forward

Full system to be set up by November 1st:

- New Analytical reports
- Moving forward on GUI
- Manufacturing process to be replicated for X more models
- Purchasing tubing and fittings
- Future testing

Moving Forward - Analytical Reports

Chadrick - Arduino code for GUI display and pump control

Seth - Waveform matching of anatomical flow rate data

Nicholas - Arduino Code for pressure transducer implementation

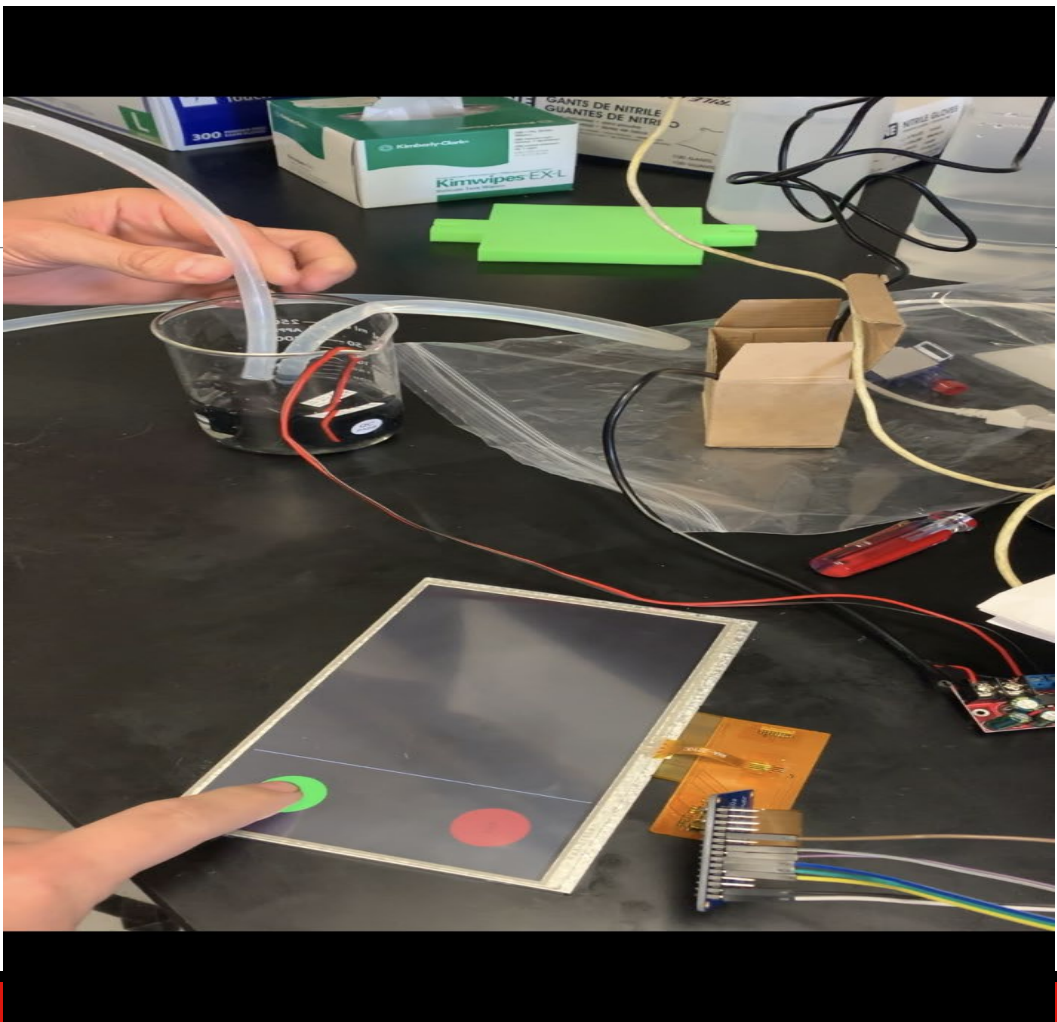
Noah - Manufacturing process documentation

Moving Forward - GUI

GUI is about half completed.

Things to complete in future:

- Pressure reading using Nicholas' analytical report
- Displaying pressure and flow rate on GUI
- Creating a flow rate control for more versatility
- Matching anatomical flow rate using Seth's analytical report



Moving Forward - Manufacturing

Currently in the process of casting remainder of 13 models

Also creating mold to hold models while they're being used in system

Purchasing fittings and tubing for complete system

Compilation of all components to create complete system.

Moving Forward - Future Testing

Once the complete system is assembled, testing will begin on:

Lubricity

- Testing Using Hybrid Rheometer

Compliance/Creep

- Pressurize System
- Measure Growth Rate

Durometer

- Material Samples

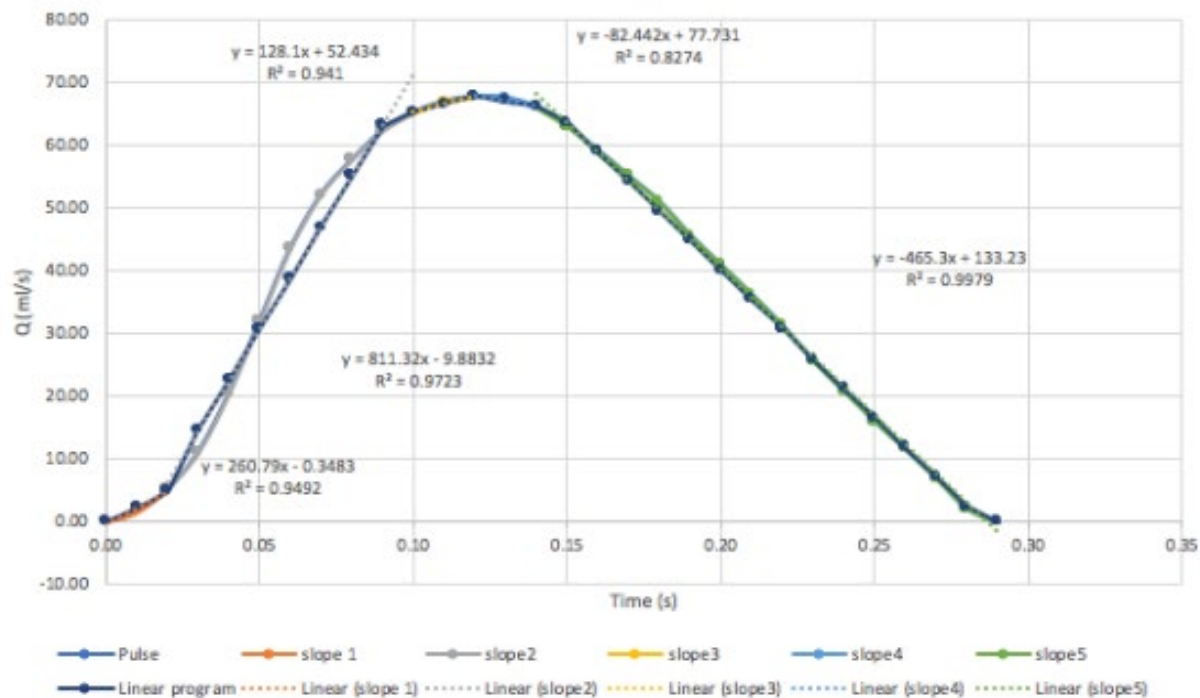
Flow Rate

- Bucket/Timer

Pressure

- Validation of pressure sensors
- Known pressure vs sensor readings

Abdominal aorta flow rate linear a approx.



Schedule & Budget

Budget is up to date

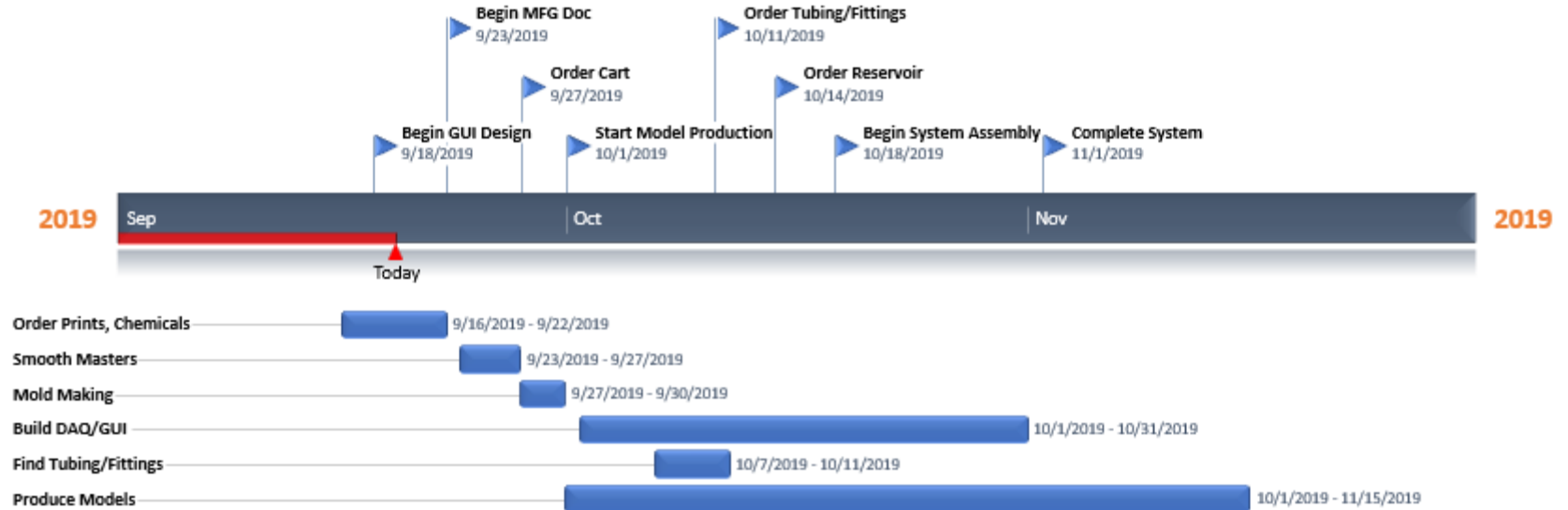
Still have significant amount of the budget left for future spending

We are behind schedule on manufacturing of models, but on schedule for all other components.

Budget

Budget for Gore Capstone Thus Far					
		Budget		\$3,000	
Items Purchased and Received	Cost	Items Purchased but Not Received	Expected Purchases	Cost	Rational and Comments
Arduino UNO R3	\$35.00				Arduino for GUI
Elegoo Mega 250 R3	\$14.99				For GUI and pressure readings
Silicone Tubing	\$0.00				Donated from Client
KUCAM 12V submersible pump	\$8.99				Prototyping
3D Printing	\$113.38				For aneurysm model and base to hold model.
Polyurethane samples	\$0.00				Donated for testing from a manufacturer
			Flow Sensor	\$0.00	GUI or some visual reading (analytic measurement, no longer required)
Deltran 1 Pressure Trans	\$77.90				GUI or Pressure Gauge (relatively same price)
TC-5041 A/B (3 Gallons)	\$373.06				For making the wax core mold and vascular mold
WC-540 A/B (2 Quarts)	\$166.26				For making casts of the vasculature
Mold Making Kit	\$126.14				Complete kit with everything needed to create molds
SC-22 (1 Quart)	\$47.04				Polyurethane thinner to lower shore hardness
Lumbar	\$29.36				to make mold boxes
Fisher Scientific MaximaDry Vacuum Pump	\$0.00			\$0.00	Degassing Silicone and Poly, (Pump was donated for use from Bill Merritt and returned)
RA8875 Driver Board	\$34.95				
7" 40-pin TFT Display	\$57.63				
Mixing cups	\$9.57				for manufacturing
Modeling Clay (sulfur free)	\$7.47				Modeling clay will be used in casting.
Wax	\$5.34				For Lost Wax Casting
			Final Pump	\$60.00	could be piston pump. Price can vary
			Frame for Model	\$10.00	3D Print
Heavy Duty Flat Top Utility Cart	\$129.45				This will hold the entire system.
			3 gallon container	\$20.00	This will hold liquid for the system.
Time on Rheometer	\$75.00				Testing samples of polyurethane and silicone
Presto 0600 Kitchen Kettle Multi-Cooker	\$26.88				
Pyrex Measuring Cups	\$20.67				
Ethyl Acetate	\$19.95				
Acetone	\$8.70				
Digital Shore A Hardness Meter Tester	\$28.90				
Painters Primer	\$3.98				painting masters for smoothe non - reactive surface
Paint for models	\$4.27				painting masters for smoothe non - reactive surface
Multiplexor	\$8.59				
Amplifiers for Deltran 1 PTs	\$8.99				
5mL Pipettes for mixing	\$8.99				
			ABS Prints from the Rapid Lab	\$175.00	Higher resolution provided far better prints and acetone gave a cleaner surface finish
			Shipping	\$50.00	In case shipping is expensive
			Poster	\$100.00	For the most shiney poster
	Cost			\$415.00	
Current Budget Remaining for after All current and expected Expenses				\$1,133.56	
Actual Budget Remaining				\$1,548.56	

Schedule



Schedule

- Full System Completed Nov 1
 - Testing will Begin after
- Continued Casting Through Nov 15
- Refined System Completed Nov 30
- Poster and Final Report in November