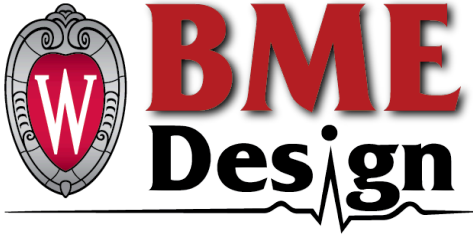


Progress Report: March 1st - March 7th



Computed Tomography (CT) Circulation Phantom to Assess Hyperdynamic Contrast Flow Rates

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Problem statement

A CT phantom is a device used to calibrate Computed Tomography machines by acting as a “stand in” for human tissues [1]. Most phantoms currently in use are static; they do not allow for dynamic flow. Some patients obtaining a CT scan may need a circulatory support device, such as a VA-ECMO (veno-arterial extracorporeal membrane oxygenation) [2] device. There is a clinical need for a CT phantom with dynamic flow capabilities to study the correct ways to conduct CT vascular imaging for patients on ECMO devices. This phantom should model the inflow and outflow of an ECMO patient and have capabilities to simulate the addition of contrast media into the vascular system. Ultimately, this device will help medical personnel to better understand the flow of CT contrast through a patient on an ECMO machine, as the circulation flow rate of an ECMO patient differs from a patient not on ECMO.

Brief status update

The team is currently working on finding the right pump for the system and was provided a few options by the BME teaching lab. There was a roller pump that will not be able to output the required amount but there is a centrifugal pump that the team is going to further evaluate the ability to use. The team hopes to test this centrifugal pump soon. Additionally, the team presented their preliminary presentation including design last Friday, and received useful feedback from peers and advisors. The team also presented initial findings in the preliminary report. Next week, the team will meet with a CT technician to better understand the CT scans that will be performed and how to create a phantom that closely resembles the heart in CT. The team also hopes to get a reference from this meeting to compare our own phantom to.

Difficulties / advice requests

Previous design

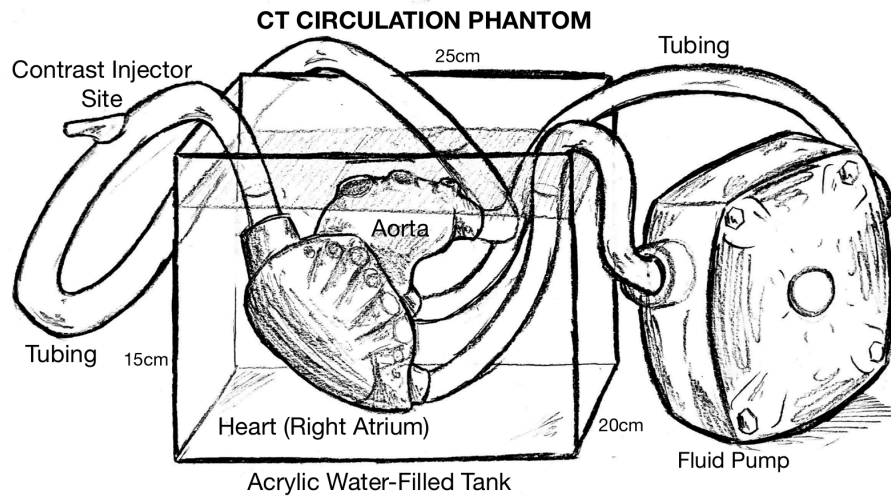


Figure 1: Final design sketch.

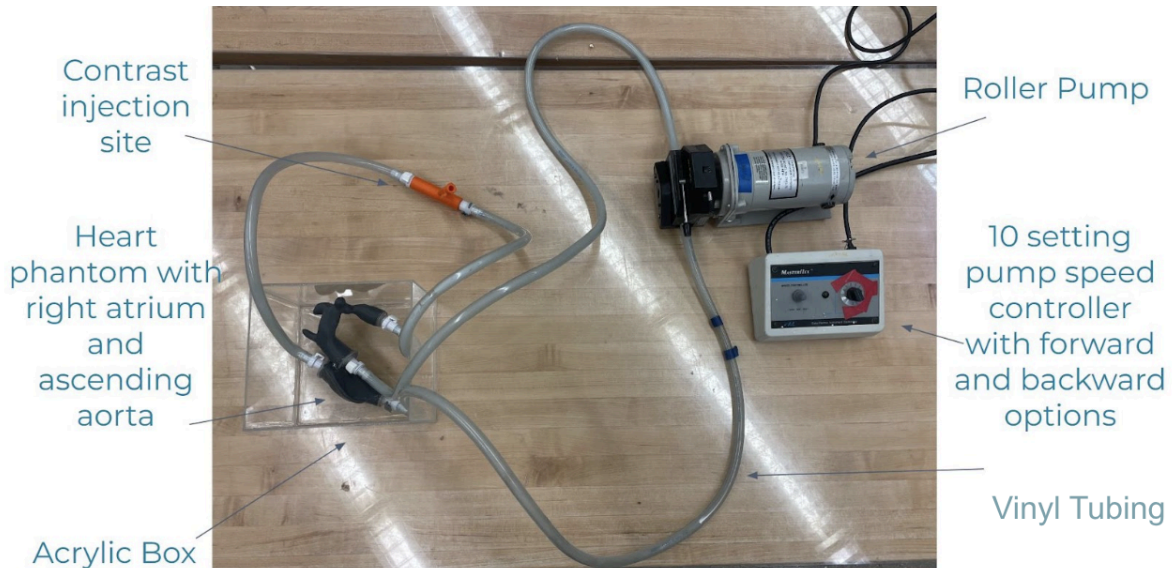


Figure 2: Final fabricated circulation phantom prototype with acrylic box, heart phantom, injection site, roller pump, speed controller, tubing, and connectors

Current Design

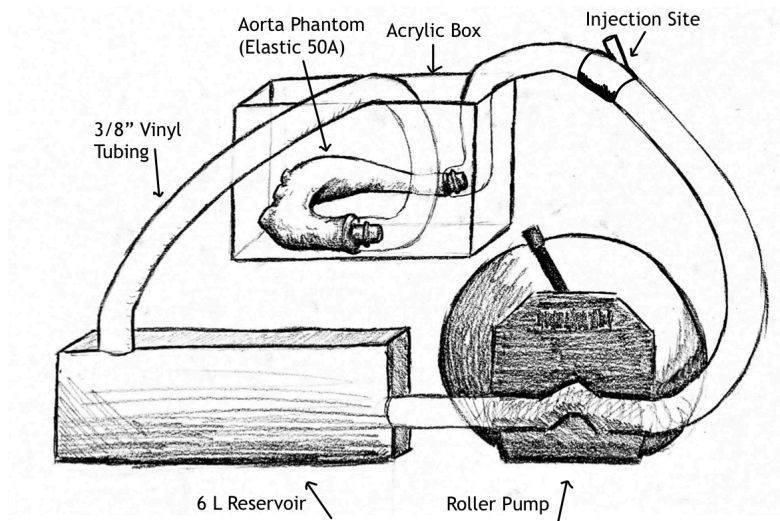


Figure 3: Current circulation phantom design including large reservoir, roller pump with flow capabilities up to 8 L/min, injection site, and aortic arch phantom

Materials and expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Category 1- Materials										
Elastic 50A Resin	Elastic used for printing connector 3D print 5.41 mL	FormLabs	RS-F 2-EL CL-0 2	UW Makerspace	Elastic	2/28/2024	1	1.63	\$1.63	Makerspace
									\$1.63	
Category 2										
									\$0.00	
									\$0.00	
								TOTAL	\$1.63	
								:		

Major team goals for the next week

1. Begin fabricating the phantom

2. Begin testing on the pump
3. Meet with Rachel from WIMR to get more information on CT imaging

Next week's individual goals

- Lucy O'Cull
 - Determine pump to move forward with
 - Make a plan for replicating chosen patient with data obtained from Rachel
- Emma Flemmer
 - Determine which pump to move forward with in the design
 - Obtain proper tubing for the circuit
- Sophie Speece
 - Once the team has the green light for purchases, print the aorta phantom out of Elastic 50A Resin
- Lizzie Maly
 - Determine pump to move forward with and test that pump
 - Explore connector options for tubing/phantom setup
- Shriya Kaushik
 - Start the testing of pump and obtain all materials needed for testing

Timeline

Task	Jan	Feb				March					April				May	
	26	2	9	16	23	1	8	15	22	29	5	12	19	26	3	10
Project R&D																
Empathize																
Background...	X	X														
Prototyping																
Testings																
Deliverables																
Progress Reports	X	X	X	X	X	X	X									
Prelim presentation					X											
Final Poster																
Meetings																
Client			X													
Advisor	X	X	X	X	X											
Website																
Update	X	X	X	X	X	X	X									

Filled boxes = projected timeline

X = task was worked on or completed

Previous week's goals and accomplishments

- Lucy O'Cull
 - Met with Lucy and Emma to assess options for pumps available for BME projects
 - Contributed to preliminary report
 - Helped Emma contact connection with CT technicians
- Emma Flemmer
 - Met with Lucy and Lizzie to assess the pumps
 - Worked on assigned sections of the Preliminary report
 - Contacted CT techs about obtaining patient data
- Sophie Speece
 - Complete assigned sections of the Preliminary Report
- Lizzie Maly
 - Met with Lucy and Emma to assess options for pumps available for BME projects
 - Contributed to preliminary report
- Shriya Kaushik
 - Preliminary report sections

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Lizzie Maly	01/31/2024	Literature Research	2	2	2
Shriya Kaushik	01/31/2024	Background and literature research	2	2	2
Sophie Speece	01/31/2024	Literature research	2	2	2
Lucy O’Cull	01/31/2024	Literature research	2	2	2
Emma Flemmer	02/01/2024	Literature research	2	2	2
Sophie Speece	02/02/2024	Literature research on VA-ECMO background information	2	2	2
Lucy O’Cull	02/05/2024	Group meeting planning and review PDS for delegation	0.5	0.5	2.5
Lucy O’Cull	02/08/2024	Contribution to PDS	1	1.5	4
Emma Flemmer	02/05/2024	Communication with client and advisor	0.5	0.5	2.5
Emma Flemmer	02/08/2024	Research and writing for the PDS	1.5	2	4
Sophie Speece	02/08/2024	Literature research focused on existing designs	2	2	4
Lizzie Maly	02/08/2024	Literature Research	1.5	2	4
Lizzie Maly	02/08/2024	Contribution to PDS	.5	2	4
Shriya Kaushik	02/08/2024	PDS sections	0.5	0.5	2.5
Shriya Kaushik	02/08/2024	Researching and reading old reports	1.5	1.5	4
Lucy O’Cull	02/12/2024	Worked on abstract	0.5	0.5	4.5
Lucy O’Cull	02/13/2024	Group design matrix discussion	1	1.5	6
Lucy O’Cull	02/15/2024	Literature research	1	2.5	7
Emma Flemmer	02/13/2024	Contributed to abstract	0.5	0.5	4.5
Emma Flemmer	02/14/2024	Team meeting to discuss designs	1	1.5	5.5
Emma Flemmer	02/15/2024	Materials research	1.5	3	7

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Sophie Speece	02/14/2024	Met with team and researched potential 3D printing materials	2.5	2.5	6.5
Lizzie Maly	2/14/2024	Team Meeting to Discuss	1	2	5
Lizzie Maly	2/14/2024	Pump Research and Material Research	1	2	6
Shriya Kaushik	2/14/2024	team meeting	1	1	5
Shriya Kaushik	2/14/2024	Researched pumps and materials	2	2	7
Lucy O'Cull	2/22/2023	Researched mathematical modeling	2	2	9
Emma Flemmer	2/21/2024	Worked on preliminary presentation	1	1	8
Emma Flemmer	2/20/2024	Communicated with client resources to arrange meeting times	0.5	1.5	8.5
Sophie Speece	2/22/24	Acquired heart and aorta 3D files online and began to augment them in Meshlab, Meshmixer and Blender to fit project needs	1	1	7.5
Shriya Kaushik	2/22/24	Worked on prelim presentation, continued research	1	1	8
Lizzie Maly	2/21/24	Worked on prelim presentation	1	1	7
Lizzie Maly	2/22/24	Research material options for design matrix	1	2	8
Sophie Speece	2/23/24	3D modeled two different connection designs so that the aorta can more seamlessly connect to the tubing and prevent leaks	1	1	8.5
Sophie Speece	2/24/24	Smoothed aortic arch and root model, then began attaching aforementioned connections	2	3	10.5
Sophie Speece	2/27/24	Sketched out Final Design	0.5	3.5	11
Sophie Speece	2/28/24	Worked on writing and editing slides of the preliminary presentation	1	4.5	12
Emma Flemmer	2/28/2024	Work on the preliminary presentation	1	1	9.5
Shriya Kaushik	2/28/2024	Work on the preliminary presentation	1	1	9
Lizzie Maly	2/28/2024	Worked on preliminary presentation	1	1	9
Lucy O'Cull	2/28/2024	Worked on preliminary presentation	0.5	0.5	9.5
Emma Flemmer	3/5/2024	Pump meeting	0.5	0.5	10
Emma Flemmer	3/6/2024	Worked on preliminary report	1	1.5	11

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Lucy O’Cull	3/5/2024	Pump meeting	0.5	0.5	10
Lizzie Maly	3/6/2024	Worked on preliminary report	1	1	10
Lizzie Maly	3/6/2024	Met to evaluate pumps	.5	1.5	10.5
Sophie Speece	3/7/2024	Worked on preliminary report	0.5	0.5	12.5
Shriya Kaushik	3/6/2024	Worked on preliminary report	1	1	10
Lucy O’Cull	3/7/2024	Worked on preliminary report	1	1.5	11