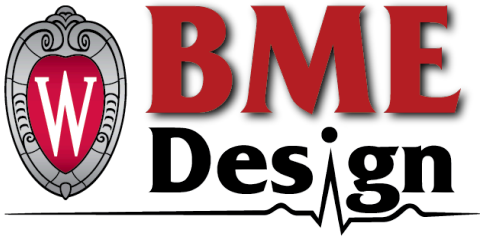
Progress Report: February 23rd - February 29th



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

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Team:

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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

Difficulties / advice requests

Previous design

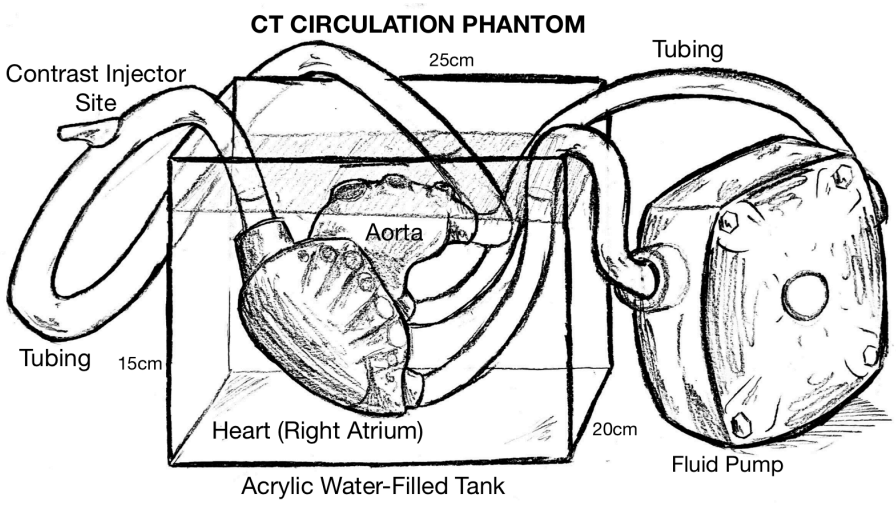

Figure 1: *Final design sketch.*

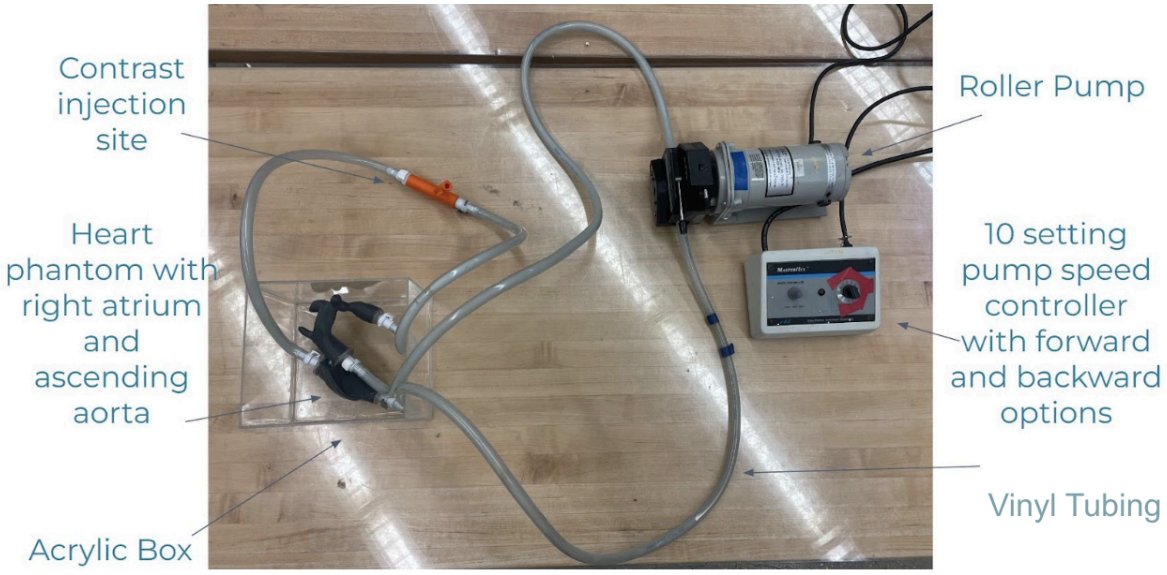

Figure 2: *Final fabricated circulation phantom prototype with acrylic box, heart phantom, injection site, roller pump, speed controller, tubing, and connectors*

Current Design

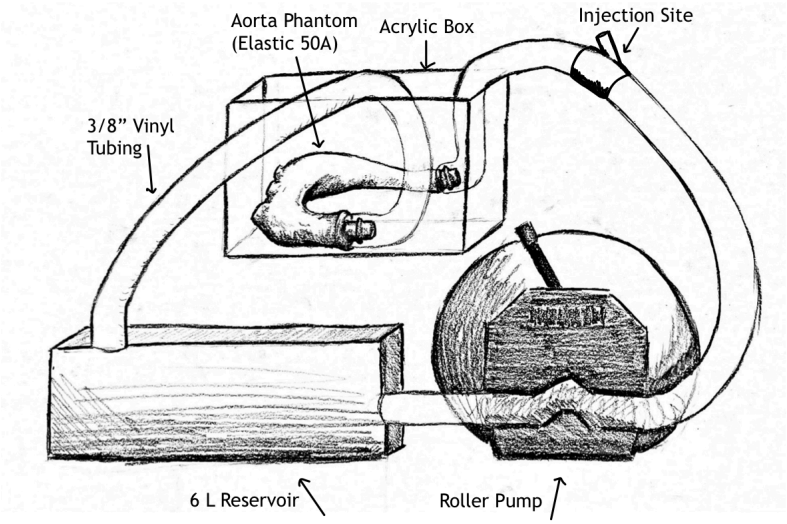

Figure 3: *Current circulation phantom design including large reservoir, roller pump with flow capabilities up to 8 L/min, injection site, and aortic arch phantom*

Materials and expenses

Item	Description	Manufac-turer	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-F2-ELCL-02	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. Obtain a pump and tubing

Next week's individual goals

- Lucy O'Cull
    - Get in contact with CT techs to obtain patient data
    - Talk to CT techs about what the injection piece needs to improve our connection from the previous semester.
- Emma Flemmer
    - Contact client about obtaining a pump
    - Begin assembly of the circuit
- Sophie Speece
    - Finish 3D modeling the aortic arch phantom with connecters attached
    - Print aorta phantom once connectors are attached
- Lizzie Maly
    - Explore options for 3D printing the aortic arch with Elastic50A and plans to remove supports
    - Continue working to obtain a pump
- Shriya Kaushik
    - Work on choosing the pump option
    - Get in contact with client and seek advice

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												
Prelim presentation																
Final Poster																
Meetings																
Client			X													
Advisor	X	X	X	X												
Website																
Update	X	X	X	X												

Filled boxes = projected timeline
X = task was worked on or completed

Previous week's goals and accomplishments

- Lucy O'Cull
    - Worked on background for preliminary presentation
- Emma Flemmer
    - Worked on phantom material design slides for preliminary presentation
- Sophie Speece
    - Found 4 3D models of hearts (specifically aorta) to use in 3D Modeling
    - Used SOLIDWORKS to create 2 different connections for the aortic arch to suit the project's needs
    - Printed aforementioned connector pieces for size testing
    - Used Meshlab, Meshmixer and Blender to manipulate/smooth 3D aorta model, then began adding the connections to the 3D model
    - Finished assigned slides of the preliminary design presentation.
- Lizzie Maly
    - Explored different piston pump options to find an alternative more useful for our project.
    - Worked on preliminary design presentation
- Shriya Kaushik

- Researched sustainability and compatibility of materials
- Worked on preliminary design presentation

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	11.00
Sophie Speece	2/28/24	Worked on writing and editing slides of the preliminary presentation	1	4.5	12.00
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