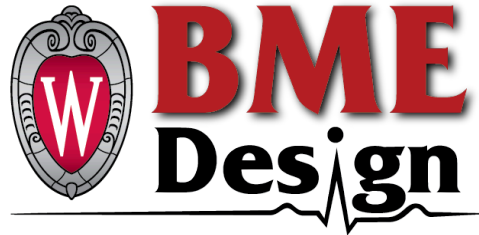


Progress Report: February 16th - February 22nd



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

Current design

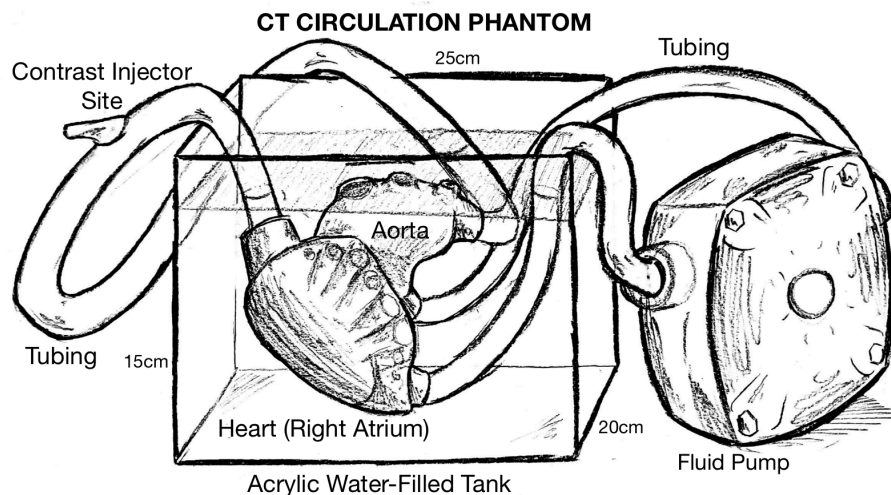


Figure 1: Final design sketch.

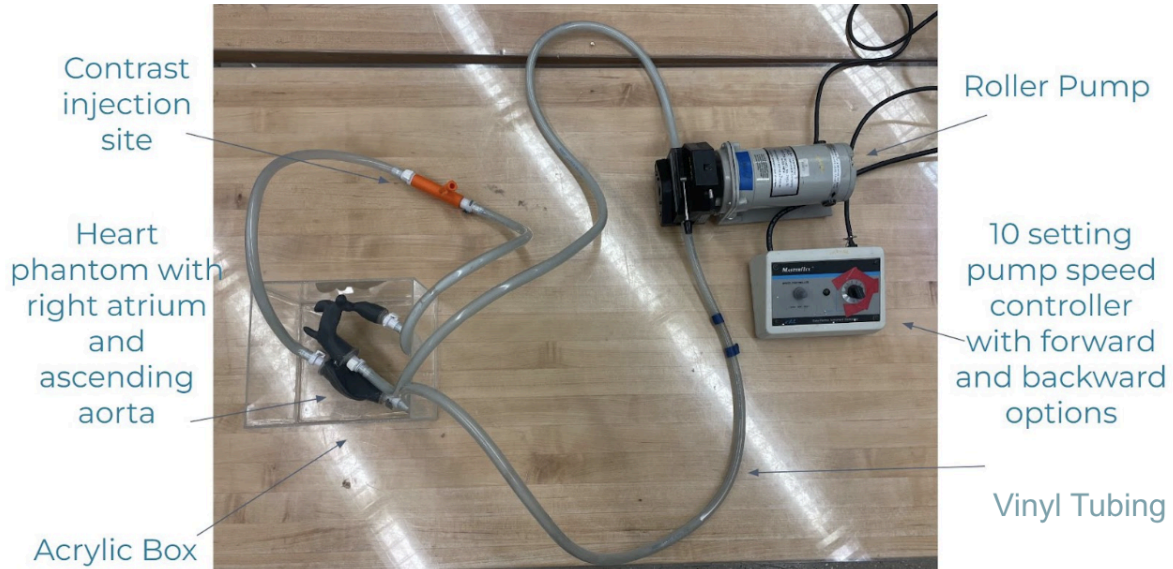


Figure 2: Final fabricated circulation phantom prototype with acrylic box, heart phantom, injection site, roller pump, speed controller, tubing, and connectors

Materials and expenses

| Item | Description | Manufacturer | Mft Pt# | Vendor | Vendor Cat# | Date | # | Cost Each | Total | Link |
|-------------------|-------------|--------------|---------|--------|-------------|------|---|--------------|---------------|------|
| Category 1 | | | | | | | | | | |
| | | | | | | | | | \$0.00 | |
| | | | | | | | | | \$0.00 | |
| Category 2 | | | | | | | | | | |
| | | | | | | | | | \$0.00 | |
| | | | | | | | | | \$0.00 | |
| | | | | | | | | TOTAL | \$0.00 | |
| | | | | | | | | : | | |

Major team goals for the next week

1. Decide on a final design

Next week's individual goals

- Lucy O'Cull
 - Contact CT techs to meet up and look at PACS
 - Order some of the peripheral equipment that we need (tubing, connectors, luer lock for contrast injection)
 - Complete design matrix and decide on final design
- Emma Flemmer
 - Contact Stratasys to determine if TangoPlus is a realistic phantom material option
 - Continue research on TangoPlus, pump prices, and pump operation to complete the design matrix
- Sophie Speece
 - 3D Model connections to the 3D heart (aorta) files
 - Print aforementioned connections and test fit with $\frac{3}{8}$ " tubing connectors
- Lizzie Maly
 - Work to model phantom to be printed
 - Explore pump options at WIMR or ECB to determine what may be the best option for our project
- Shriya Kaushik
 - Prepare preliminary presentation slides and refine design matrix
 - Compare pump options between the ones at WIMR and potential pumps in ECB

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

Filled boxes = projected timeline

X = task was worked on or completed

Previous week's goals and accomplishments

- Lucy O'Cull
 - Performed research on mathematical modeling of blood flow in arteries
 - Performed calculations to develop more metrics for analyzing our current design ideas
- Emma Flemmer
 - Arranged meeting time with Cristel at WIMR
 - Researched materials for preliminary presentation
- Sophie Speece
 - Found several (4) 3D files of the heart and aorta to use and further manipulate to fit the project's needs
- Lizzie Maly
 - Performed research on material properties relating to leakage of water out of our system.
 - Contributed to sections of design matrix.
- Shriya Kaushik
 - Complete design matrix and the descriptions and explanations associated

- Meet with Cristel Baiu at WIMR and learn about different pumps that could potentially be successful.

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 |