Title: Radiographic Radiomics Phantom Progress Report 8

Date: 10/22 - 10/29

Client: Dr. Jennie Crosby
Advisor: Yang Lu

Team:

Last Name	First Name	Role	E-mail	Phone	Office Room/Building
Trapskin	Pierson	Leader	Pierson Trapskin	(608) 335-7986	
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Stellflue	Presley	BSAC	Presley Stellflue	(847) 224-7803	
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Problem Statement

The goal of this project is to design and construct a radiomics benchmarking phantom for radiographic imaging systems that includes multiple clinically relevant textures, accommodates both small- and large-anatomy imaging protocols via a removable core or

interchangeable sizing, and uses materials stable enough for repeated use over multiple years.

Brief Status Update

This week the team focused on planning our fabrication process which will continue over the next few weeks before show and tell. We are still waiting for our client to provide us with confirmation of the grant proposal so we can accurately plan based of our budget.

Difficulties / Advice Requests

Do you have an updated budget from the grant committee?

Current Design

The phantom features a removable core, allowing the same shell to represent both large and small anatomy by swapping in modular phantom texture inserts. Phantom materials and textures are still undecided, but shall mimic either the physical texture or electron density of anatomical tissues.

Materials and Expenses

Item	Description	Vendor	Part #	Qty	Cost each [$]	Total [$]
Cast acrylic blank, shell	Clear cast PMMA, 410 × 310 × 165 mm (or bonded slabs)	[TBD]	[TBD]	1	$440-1,130 est.	600
Cast acrylic blank, core	Clear cast PMMA, 190 × 190 × 165 mm	[TBD]	[TBD]	1	130-320 est.	200
Weld-On 40 cement	Two-part reactive acrylic cement, 1 pt kit (only if slabs are bonded)	ePlastics	IPS40-PT	1	46.71	46.71

PLA filament	1.75 mm, 1 kg, single lot	[TBD]	[TBD]	[3]	70	210
ABS filament (optional)	1.75 mm, 1 kg	[TBD]	[TBD]	[1]	50	50
Machine shop and annealing	CNC mill or router, lathe, and oven time	ECB Lab or Wendt Lab	N/A	1	$0	$0
Miscellaneous	-	[TBD]	N/A	[TBD]	$300	$300
					Total	1406.71

Goals

Major Team Goals for the Next Week (10/29-11/5)

1. Take show and tell feedback and adjust our plan accordingly.
2. Start manufacturing based on fully defined CAD models

Next Week's Individual Goals (10/29-11/5)

- Pierson Trapskin: Develop fully accurate CAD models for CNC purposes and overall accuracy.
- Ava Hodgson: Create/edit cylindrical texture inserts based on the client's first round of testing.
- Presley Stellflue: Complete research, help test cylinders, and work on getting CNC training to fabricate the phantom base.
- Matthew Casas: Continue individual research on CT phantom fabrication and testing methods. Help evaluate the initial texture inserts and assist with improving the phantom design based on testing results and client feedback.
- Sonja Pionek: Use client feedback from the inserts I developed this week to improve/finalize/reprint if needed. Ensure consistency with the inserts and acrylic body models before cutting the acrylic in the CNC machine.
- Allie Ma: Help test texture inserts

PDS: Completed

Timeline

Task	Sep				October					November				December	
	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11

Project R&D															
Empathize	x	x	x	x											
Background…			x	x	x	x									
Prototyping						x	xx	x							
Testings															
Deliverables															
Progress Reports	NA	x	x	x	x	x	x	x							
Prelim presentation					x										
PDS			x												
Design Matrix				x											
Preliminary report						x									
Decide on final design						x									
Final Poster															
Meetings															
Client			x	x			x	x							
Advisor	x	x		x	x	x	x	x							
Website															
Update	x	x	x	x	x	x	x	x							

Filled boxes = projected timeline

X = task was worked on or completed

Detailed accomplishments

Previous week's goals and accomplishments by individual

Pierson Trapskin: Met with staff at the ECB shop to discuss manufacturing plans, as well as measuring the dimensions of our free acrylic to maximize yield.

Ava Hodgson: Completed research in best ways of testing the textural inserts in medical imaging machines, created variations of cylindrical texture inserts for initial printing and testing at client's workplace environment.

Presley Stellflue: Met with staff at ECB to discuss possible machining plans. Began downloading Mastercam for CNC fabrication.

Sonja Pionek: This week, I CAD modeled inserts and 3D printed them for our client to image and to bring to show-and-tell on Friday.

Matthew Casas: This week, I researched low-cost CT phantom designs and radiomic reproducibility across different scanners. This research will help guide our fabrication and testing procedures.

Allie Ma: Began testing plans, completed individual research

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Pierson Trapskin	9/14 and 9/15	Individual research on existing designs and materials.	2	2	4
Pierson Trapskin	9/16	Notebook update and progress report 2.	1	3	5
Presley Stellflue	9/16	Research on possible materials and dimensions. Began drafting PDS	3	3	4
Ava Hodgson	9/14-9/16	Research on competing designs, pre-existing patents, and standards used to create previous competing designs	5	5	5
Ava Hodgson	9/17	Adding to draft of PDS	1	6	6

Matthew Casas	9/17	Added progress report to website. Individual research on existing radiomics phantom designs and potential materials/textures.	2	2	4
Allie Ma	9/11-9/17	Began filling PDS information. Researched on standards for phantom development.	1.5	1.5	1.5
Presley Stellflue	9/17-23	Worked on and edited PDS, completed individual research, and created a SolidWorks model for a design idea.	7	7	11
Pierson Trapskin	9/18	Developed an appropriate CAD model for both full size and small scale model size of our front-running design. Researched appropriate sizing based of competing design and client recommendations.	6	6	10
Allie Ma	9/18	Finished editing PDS. Uploaded PDS under "Project Information >> Team Activities >> Design Process". Any further updates to the PDS will be uploaded in that folder too.	1	1	2.5
Allie Ma	9/18-9/24	Wrote up design matrix template. Began editing design matrix grades and reasoning. Annotated key literature provided by client.	3	4	5.5

Ava Hodgson	9/21	Individual research on biological components of CT scans, possible materials and/or texture ideas for phantom	2	2	8
Ava Hodgson	9/18-9/23	Developed CAD design as preliminary design idea for presentation, uploaded to design matrix	6	8	14
Matthew Casas	9/18-9/24	Individual research on 3D-printed materials for CT phantoms and the effects of texture patterns on radiomic features. I also added the progress report to the website.	2	2	6
Ava Hodgson	9/29-10/01	Individual research on CT physics, attenuation & the possibility of 3D printing tissue like materials to gain better understanding of the machine the phantom will be used on.	4	4	18
Pierson Trapskin	9/29	3D printed our model making use of the Design and Innovations Lab at Wendt.	1	1	11
Ava Hodgson	9/29-9/30	Created slides and notes for Preliminary Design presentation for the Background and Competing Designs.	2	2	20

Pierson Trapskin	9/30	Continued research and brainstorming on materials and costs. Specifically on what materials could help eliminate airgaps and grey matter from scans.	3	4	15
Presley Stellflue	9/29-10/1	Worked on preliminary presentation and edited slides. Conducted individual research on fabrication processes of phantoms and gathered information on competing designs.	4	4	15
Matthew Casas	9/28-10/1	Completed individual research on CT phantom designs and radiomic texture features. Created slides and prepared for the Preliminary Design Presentation. Uploaded the progress report and preliminary presentation slideshow to Canvas and the team website.	4	4	10
Pierson Trapskin	10/3-10/6	For the preliminary report, I researched and wrote the Introduction and Background sections.	6	6	21
Pierson Trapskin	10/4-10/5	I built up a big part of the report's reference list, and researched the team's choice to focus on physical texture and use an acrylic body with PLA inserts.	3	9	24

Presley Stellflue	10/5-10/7	I wrote the design specifications, client description, design 1, HU, and the preliminary report conclusion. I also made final edits on grammar and to the cost table. conducted additional and topic-specific research to cite in the report.	7	7	23
Matthew Casas	10/7	Conducted individual research on CT phantom materials, tissue-equivalent properties, and alternative fabrication methods. Reviewed studies involving PLA, plaster, castable materials, and iodine-ink printing. Updated project research documentation.	3	3	13
Pierson Trapskin	10/12	Conducted research regarding infill percentage and how the CBCT will read the data.	2	2	26
Ava Hodgson	10/08-10/13	Individual research on what textures, densities, etc affect t eh features extracted from CT scans, what ones produce the best results, etc	4	4	24
Ava Hodgson	10/13-10/15	Rough AutoCAD designs for textural inserts	4	8	28

Matthew Casas	10/13-10/15	Conducted individual research on CT phantom materials, texture patterns, and fabrication methods to help evaluate potential designs for our phantom.	2	2	15
Ava Hodgson	10/19-10/21	Individual research for how to 3D print phantoms for medical imaging (compatibility)	2	2	30
Ava Hodgson	10/18-10/22	Created preliminary texture inserts for phantom in OnShape AutoCAD	6	8	36
Presley Stellflue	10/21	Completed research, planning fabrication	2	2	25
Pierson Trapskin	10/18 and 10/20	Created texture models in SolidWorks	3	3	29
Matthew Casas	10/22	Conducted individual research on CT radiomics reproducibility, imaging parameters, and 3D-printed liver phantom designs to help guide texture selection and testing procedures.	2	2	17
Pierson Trapskin	10/23	Talked through prototyping plans to maximize yield of our materials.	2	2	31
Presley Stellflue	10/23	Inquired about fabrication plans with ECB staff and began downloading software	2	2	27

Matthew Casas	10/28	Conducted individual research on low-cost CT phantom fabrication methods and radiomic feature reproducibility across different CT scanners to help guide our design and testing procedures.	2	2	19