

## Knee Arthroscopy Manikin

Client: Corinne Henak

Consultants: Corinne Henak, Russ Johnson

Team: Shrey Ramesh (leader) Delaney Reindl (leader)  
Jack Thurk (accountant) Connor Dokken (communicator)  
Sierra Reschke (admin) Rachel Dallet (admin)

### Status

Report Date: 04/25/2024

Next Milestone: Final Review

Deadline: 04/26/2024

Status: on schedule (green), deadline at risk (yellow), deadline unachievable (red)

### Technical Summary

Important aspects of this past week include meeting with Dr. Henak and Dr. Johnson to discuss updates on the prototype assembly and to receive feedback on the progress of each project division, as well as to work on/complete final deliverables – final poster and report. For the bone team, stress analysis test results were finalized. For the enclosure team, the enclosure design with dryer vent and epoxied femur to lid was completed. For the pump team, the new O-rings were tested with new leaks and the new joint locking system was tested. As the semester comes to an end, the team will be attending BME final poster presentations Friday 4/26 from 12-2:15 pm. The team will also be attending the ME final presentations both May 1st and May 2nd, and will have the ME final report completed and submitted Monday 04/29.

### New Tasks

#### *Bone Team*

| Task Name                    | Description and Concrete Outcome   | Owner | Est. Time |
|------------------------------|--|-------|-----------|
| Update BME and ME websites   | Add the progress reports to both the ME and BME websites. Update the project status as well.           | RD    | 0.5 hr    |
| Give BME poster presentation | This Friday we have the BME poster presentation. I need to practice running through my sections prior. | RD    | 3 hr      |

|                                      |   |     |        |
|--------------------------------------|---|-----|--------|
| Work on final report                 | Figure out who is completely which sections of the final report. Look at the rubric and fill out my section.  | RD  | 2.5 hr |
| Present poster at BME poster session | Present my assigned section at the BME poster presentation session this Friday. Work with the team to ensure our presentation is thoroughly practiced beforehand. | SGR | 2 hr   |
| Begin working on ME final report.    | Begin working on my assigned sections of the ME final report. Ask for feedback from my peers and review their work as well.                                       | SGR | 2 hr   |
| Assist with prototype assembly       | Work with the other teams on assembling the full prototype, specifically in terms of including and incorporating the bones.                                       | SGR | 2 hr   |

### ***Enclosure Team***

| <b>Task Name</b>                         | <b>Description and Concrete Outcome</b>   | <b>Owner</b> | <b>Est. Time</b> |
|--|---|--------------|------------------|
| Assist with prototype assembly           | Work with bone team, pump team, and enclosure team to assemble the final prototype. Specifically, my focus will be on incorporating the enclosure into the design. I want to see how well the dryer vent enables the flexion mechanism of the device.   | DR           | 2 hr             |
| Complete final deliverables – ME Report  | I will work on and complete (by 04/29 11:59pm) the ME final report. The sections I will specifically work on will be the conclusion, functionality, and future work aspects/sections of the report. I will also help revise/edit the report once my group mates are finished with their sections. | DR           | 2 hr             |
| Attend/give BME poster presentation      | Friday 04/26 I will attend BME final poster presentations 12-2:15pm. I will be presenting the functionality and conclusion sections of the poster.  | DR           | 2 hr             |
| Refine dryer vent solution for enclosure | We currently have the dryer vent in place, but it moves quite a bit and can shift to let light into the enclosure. There are also a couple of   | SKR          | 2 hr             |

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|---|--|-----|------|
|   | sharp edges with the potential to tear the bag. I will work this week to refine the design and solve the current issues  |     |      |
| Complete deliverables, presentations, and peer review | I will attend the BME and ME poster presentations, finish my section on the ME report, finish my section and present the ME slideshow, and attend the ME peer review | SKR | 5 hr |

### ***Pump Team***

| <b>Task Name</b>                          | <b>Description and Concrete Outcome</b>   | <b>Owner</b> | <b>Est. Time</b> |
|---|---|--------------|------------------|
| Finish procedure                          | Finishing procedure on how to assemble enclosure and set up system for use.   | CD           | 1 hr             |
| Finish and present all final deliverables | Finalize, practice, and present all final deliverables this week. Need to focus on finishing the final report and the final ME presentation. Also attend peer review for ME final presentation on Monday. | CD           | 5 hr             |
| Present BME and ME poster presentation    | Friday the 26th of April and May 2nd, the posters will be presented showing the progress Team JAM has made and our most recent prototype.   | JT           | 3 hr             |
| Write section of ME report                | The final report, due Monday the 29th of April, will be written over the weekend. The section I am assigned is the pump system section so I will need to make sure the report is written clearly.         | JT           | 2 hr             |
| Attend Peer Review                        | The peer review I am attending for the final presentation is on Monday, the 29th of April and so I will be sure to be attentive and ask questions at the end.   | JT           | 0.5 hr           |
| Finish and present final ME presentation  | The final presentation will be presented Wednesday, May 1st and will need to be completed well before then to practice and perfect and make sure that the presentation falls within the time limit.       | JT           | 2 hr             |

## Old Tasks

### *Bone Team*

| Task Name                                  | Description and Concrete Outcome   | Owner | Est. Time |
|--|--|-------|-----------|
| Update BME and ME websites                 | Add the progress reports to both the ME and BME websites. Update the project status as well.   | RD    | 0.5 hr    |
| Work on assigned section of the poster     | Our group set a goal to have a poster draft by Friday. I need to complete the Bone Team section of that.   | RD    | 3 hr      |
| Begin working on final report              | Discuss with the team which section everyone will cover in the final report. Start writing my section.   | RD    | 1.5 hr    |
| Read over outreach deliverables and submit | Outreach deliverables are due this Friday. I want to check over everyones sections before submitting.  | RD    | 1 hr      |
| Assist with prototype assembly             | Work with the other teams on thinking through the assembly of the full prototype, if this is the decided path.   | SGR   | 2 hrs     |
| Finalize stress analysis results           | Determine which outputs are best to analyze for the enclosure stress analysis in FEBio. Analyze these results and convey them in a clear and legible way.                    | SGR   | 2 hrs     |
| Complete poster draft by Friday.           | Complete a first draft of my assigned sections of our report by Friday. Review received feedback and make improvements on the draft prior to poster presentations next week. | SGR   | 2 hrs     |
| Begin working on ME final report.          | Begin working on my assigned sections of the ME final report. Ask for feedback from my peers and review their work as well.  | SGR   | 1 hrs     |

### *Enclosure Team*

| <b>Task Name</b>  | <b>Description and Concrete Outcome</b>  | <b>Owner</b> | <b>Est. Time</b> |
|---|--|--------------|------------------|
| Assist/test with prototype assembly – Implement dryer vent to flexion point of prototype. | Assist with enclosure prototype assembly and test with reservoir/pump team using rigid enclosure design. Using the dryer vent, test to see if the prototype leaks and lets any light in when the prototype is in bent configuration. | DR           | 3 hrs            |
| Brainstorm/begin working on final deliverables.   | Begin working on final report/poster sections. I will be handling the conclusion/future direction sections of both the report and poster.  | DR           | 3 hrs            |
| Finish assigned poster section  | I have been tasked with completing the enclosure section of the poster. After receiving feedback from Dr. Henak and Russ this Friday, I will finalize and print the poster early next week.  | SKR          | 3 hrs            |
| Finish enclosure design with dryer vent and epoxying femur to lid                         | Once the dryer vent arrives, we will attach it to the enclosure and determine the best method of aligning premade holes with the fluid flow ports and scope ports.   | SKR          | 3 hrs            |

### *Pump Team*

| <b>Task Name</b>                     | <b>Description and Concrete Outcome</b>   | <b>Owner</b> | <b>Est. Time</b> |
|--------------------------------------|---|--------------|------------------|
| Complete and practice poster section | I will complete the testing section of the poster before Friday to get feedback during our advisor meeting, then make all necessary changes before the presentation next Friday.  | CD           | 3 hr             |
| Test new enclosure components        | O-rings and new screws/nuts were acquired at the makerspace. The dryer vent material has been ordered as well. The enclosure needs to be tested with the new screws/nuts to see if it will be able to hold set angles, the o-rings to potentially seal leakage at the ports, and the dryer vent material around the midsection of | CD           | 3 hr             |

|  |  |    |      |
|--|--|----|------|
|  | the joint. These three changes will potentially address the three major issues the design is facing.   |    |      |
| Test new O-rings with new leaks                  | Test new O-rings purchased to see if the leakage from the ports is less than before. If they work like they should, the leakage should be less and hopefully create more of a seal around the ports.   | JT | 2 hr |
| Create a more final pump team part of the poster | After feedback from this upcoming Friday meeting, aspects of the poster will need to be altered to create the best possible poster for presentation for next Friday.   | JT | 2 hr |
| Test the new joint locking system                | Now with the right materials purchased, the bolts and nuts, the joints will need to be tested to see if this locking system will be able to hold the weight of the femur enclosure at various different angles. It will also need to be tested to see if the nut and bolt could damage the PLA if tightened too much. Perhaps, after testing, washers might need to be purchased to help protect the enclosure from permanent deformation. | JT | 2 hr |

## Technical Section

Author: Rachel Dallet

|  |  |    |      |
|--|--|----|------|
| Work on assigned section of the poster | Our group set a goal to have a poster draft by Friday. I need to complete the Bone Team section of that. | RD | 3 hr |
|--|--|----|------|

I completed my section of the poster: Background, Design Criteria, and System Concept. I also helped with the Bone Team section of the poster. We will present in front of the BMEs this Friday.

|  |   |    |      |
|--|---|----|------|
| Read over outreach deliverables and submit | Outreach deliverables are due this Friday. I want to check over everyones sections before submitting. | RD | 1 hr |
|--|---|----|------|

I submitted all outreach deliverables to the online dropbox after checking them over. You can find them in the outreach folder of the shared drive.

Author: Sierra Reschke

|                                  |   |     |       |
|----------------------------------|---|-----|-------|
| Finalize stress analysis results | Determine which outputs are best to analyze for the enclosure stress analysis in FEBio. Analyze these results and convey them in a clear and legible way. | SGR | 2 hrs |
|----------------------------------|---|-----|-------|

Dr. Henak assisted me with determining which stress to analyze and was very helpful with tips on how to display this information and data. I also asked Connor to also run the simulation to double check we were getting the same values and he did.

|                                  |  |     |       |
|----------------------------------|--|-----|-------|
| Complete poster draft by Friday. | Complete a first draft of my assigned sections of our report by Friday. Review received feedback and make improvements on the draft prior to poster presentations next week. | SGR | 2 hrs |
|----------------------------------|--|-----|-------|

I successfully completed a draft of my assigned poster section (bones) by Friday and took notes at our meeting on how each section and the overall poster could be improved. I then implemented these improvements, specifically focusing on including more images rather than text. We will present this poster at BME poster presentations on Friday and then at ME poster presentations next week.

|                                      |  |    |      |
|--------------------------------------|--|----|------|
| Complete and practice poster section | I will complete the testing section of the poster before Friday to get feedback during out advisor meeting, then make all necessary changes before the presentation next Friday. | CD | 3 hr |
|--------------------------------------|--|----|------|

Rough draft was completed, changes have been made based on feedback from last Friday's meeting and from Russ's feedback yesterday.

|                               |  |    |      |
|-------------------------------|--|----|------|
| Test new enclosure components | O-rings and new screws/nuts were acquired at the makerspace. The dryer vent material has been ordered as well. The enclosure needs to be tested with the new screws/nuts to see if it will be able to hold set angles, the o-rings to potentially seal leakage at the ports, and the dryer vent material around the midsection of the joint. These three changes will potentially address the three major issues the design is facing. | CD | 3 hr |
|-------------------------------|--|----|------|

O-rings sealed all leakage from the ports during testing. New screws/nuts can tighten enough to hold the enclosure at a desired angle. Small strips of silicon and foam were used only underneath the clamps to protect the bags, not over the entire enclosure. Dryer vent material was obtained.

|                                 |  |    |      |
|---------------------------------|--|----|------|
| Test new O-rings with new leaks | Test new O-rings purchased to see if the leakage from the ports is less than before. If they work like they should, the leakage should be less and hopefully create more of a seal around the ports. | JT | 2 hr |
|---------------------------------|--|----|------|

The new O-rings from the makerspace were purchased and tested. They have helped to minimize the leaks in the enclosure.

|  |  |    |      |
|--|--|----|------|
| Create a more final pump team part of the poster | After feedback from this upcoming Friday meeting, aspects of the poster will need to be altered to create the best possible poster for presentation for next Friday. | JT | 2 hr |
|--|--|----|------|

The poster has been updated and is currently printing. Pictures of the graphs from testing were added and most bullet points were replaced with pictures so the poster is more visually appealing to look at.



|                                   |  |    |      |
|-----------------------------------|--|----|------|
| Test the new joint locking system | Now with the right materials purchased, the bolts and nuts, the joints will need to be tested to see if this locking system will be able to hold the weight of the femur enclosure at various different angles. It will also need to be tested to see if the nut and bolt could damage the PLA if tightened too much. Perhaps, after testing, washers might need to be purchased to help protect the enclosure from permanent deformation. | JT | 2 hr |
|-----------------------------------|--|----|------|

The new bolt and nut locking system has worked well. When the nut is tightened enough, the enclosure can sit in the right position without the top falling over from the weight. The tightened nut also does not show signs of any visible damage on the plastic when investigated after a test.

|                                |   |     |       |
|--------------------------------|---|-----|-------|
| Finish assigned poster section | I have been tasked with completing the enclosure section of the poster. After receiving feedback from Dr. Henak and Russ this Friday, I will finalize and print the poster early next week. | SKR | 3 hrs |
|--------------------------------|---|-----|-------|

My poster section is finished and the poster has been printed.

|   |  |     |       |
|---|--|-----|-------|
| Finish enclosure design with dryer vent and epoxying femur to lid | Once the dryer vent arrives, we will attach it to the enclosure and determine the best method of aligning premade holes with the fluid flow ports and scope ports. | SKR | 3 hrs |
|---|--|-----|-------|

The dryer vent has arrived and been modified to fit the enclosure. It was too narrow to fit over the design when it arrived, so we made a cut up the middle and put the cut area over a hinge so no light would enter the enclosure. It works, but is relatively crude and will require some refinement.

|   |   |    |       |
|---|---|----|-------|
| Brainstorm/begin working on final deliverables. | Begin working on final report/poster sections. I will be handling the conclusion/future direction sections of both the report and poster. | DR | 3 hrs |
|---|---|----|-------|

I finished my section of the final poster – functionality and conclusion section. I am still in the process of completing my section of the ME final report.

## Gantt Chart

| Week                                   | 1   | 2 | 3  | 4  | 5   | 6 | 7  | 8  | 9  | 10  | 11 | 12 | 13  | 14 | 15 |
|--|-----|---|----|----|-----|---|----|----|----|-----|----|----|-----|----|----|
|  | Feb |   |    |    | Mar |   |    |    |    | Apr |    |    | May |    |    |
| Task                                   | 2   | 9 | 16 | 23 | 1   | 8 | 15 | 22 | 29 | 5   | 12 | 19 | 26  | 3  | 10 |
| <b>Individual Presentations</b>        |     |   |    | O  |     |   |    |    |    |     |    |    |     |    |    |
| Testing                                | X   |   |    |    |     |   |    |    |    |     |    |    |     |    |    |
| Redesign and Fabrication               | X   | X | X  | X  |     |   |    |    |    |     |    |    |     |    |    |
| Presentations                          |     |   |    | X  |     |   |    |    |    |     |    |    |     |    |    |
| <b>Working Prototype Demonstration</b> |     |   |    |    |     |   |    |    | O  |     |    |    |     |    |    |
| Redesign                               |     |   |    |    |     | X | X  | X  | X  |     |    |    |     |    |    |
| Fabrication                            |     |   |    |    |     | X | X  | X  | X  |     |    |    |     |    |    |
| Presentation and Demonstration         |     |   |    |    |     |   |    |    | X  |     |    |    |     |    |    |
| <b>Final Presentation</b>              |     |   |    |    |     |   |    |    |    |     |    |    |     |    | O  |
| Testing                                |     |   |    |    |     |   |    |    |    | X   | X  | X  |     |    |    |
| Report                                 |     |   |    |    |     |   |    |    |    |     |    | X  |     |    |    |
| Presentation                           |     |   |    |    |     |   |    |    |    |     |    | X  |     |    |    |

X = Completed Tasks, O = Milestone Deadlines