Final Design Notebook

3D Modeling of Metal Whiskers || MECH 4240 Team 3

Summer 2024

Manager: Kurt Knudsen
Scribe: Shawn Eom
Spencer Hurst
Nathan Nichols
Carson Reams

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Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 1:30 pm   **Actual Start Time:** 1:30 pm
Scheduled End Time: 2:30 pm   **Actual End Time:** 2:45 pm

Meeting Agenda:

The goal of this meeting was to meet with the Metal Whisker Team 1 (MECH 4250 Group) to discuss where they are at in the project, discuss what we know about the project, and learn general information about the project requirements, constraints, as well as points of contact regarding our customers, subject expert, the teaching assistant, and the advisor. From there, we will discuss how we should proceed from this point forth, and areas of focus to consider regarding the future of the project

Notes:

- Sponsor/Customer: Donna (donna.harvisik@mde.mil), Errol Reid (mediator role) (erreid.ctr@nsin.mil)
- Advisor: Dr. Flowers
- Expert: Jay Brusse (jay.a.brusse@nasa.gov)
- TA: David Edmonson (dae0014@auburn.edu)
- Suggestions:
  - Meet with Donna and Jay (Tag-up) every week for project info and give progress updates
  - Meet with Dr. Flowers for info on next steps and give progress updates (~30 mins)
  - Meet with Edmonson every week for class related questions or concerns
    - Questions about PDR, CDR, class assignments/presentation, etc.
- Background info:
  - CCA = circuit card assemblies
  - Whiskers in Tin, Cadmium, and Zinc
  - Monte Carlo Simulation (MCS)
    - Statistical technique for lognormal distribution of random variables
  - Acting forces:
    - Vibration as simple sine pulse
    - Shock as a half sine pulse
    - Input amplitude, frequency, duration modified by user
  - Unity
  - Altium
    - Free software to create circuit boards
- Recommendations:
  - Start PDC and CDR 3 weeks out, submit rough draft to David for review
  - Assign people to specific programs/focuses
- Ask David about how to carry on with Background Information section of CDR

Entry Number: 2   **Date: 5/30/2024**

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:30 pm   **Actual Start Time: 3:30 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 4:15 pm**

Meeting Agenda:

The goal of this meeting was to meet with the Metal Whisker Team 1 (MECH 4250 Group) with the sponsors and customers to discuss the project's current standing. This includes the scope and goal of the overall project and the applications in which this simulation will be used. A very loose idea of what Metal Whisker Team 2 (MECH 4240 Group) will be accomplishing this semester will also be outlined

Notes:
- To-do:
    - Set up meeting with Sponsors to figure out what we need to do in a more in-depth manner (i.e. specific deliverable, specific objectives/outcomes)
    - Talk to David about how our project will be able to fit into the PDR and CDR scheme (Meeting 5/30 at 1 pm).
    - Divvy up program/process focus among group members to set up "roles" of what each member is in charge of for the project.
    - If Jay sends resources, go over material and brush up on information
    - Get into contact with team 1
- Detailed Info:
    - Jay Brusse:
        - Available for 1 or 2 tag-ups per week, subject matter expert for tin whiskers
        - Set up meeting with Jay at 2:00 pm on 5/31, Friday for Whiskers 101 meeting
    - Scope of our project, next steps, etc.,
        - Start in 2D with additional forces as compared to previous semester team (rotational, electrostatic, gravitational)
        - Learn background information from previous team report, understand process, and pick up from there.
        - Given links from Bill on resources for learning C## and understanding Unity and coding.
        - Look at documentation (coding, report, mathematical analysis) from team 1 to understand and refine/improve/correct/fill in their process (modeling, coding)
        - 4 Phases of Tin Whisker Project
            - 1: Simulating interactions between whiskers and circuit board and generating statistical analysis of whisker contact. Inputs to phase 2
              2: What happens to circuit board after contact (short circuit, resistance/voltage changes, etc.)
              3: How a specific electrical component is used in a system, and how a change in that component will affect the overall system
              4: If that system misbehaves, what will happen? (Engine shutoff, mis-steering || Consequences)
        - Our scope is phase 1
            - Randomly generated whiskers and where it will interact with circuit board.
    - What we will be doing (specifics)
        - Be introduced to Unity and how to implement at least one more force (electrostatic, rotational, G-forces, etc.,) tied to mass and movement (improve or add to current physics package) in either 2D or 3D (already existing) simulation to get an output.
        - Quality control process for team 1
            - See if they were missing any important specs in their process

- Improve upon their implementation whilst learning how they implemented their program
- See how well team 2 extrapolates ideas/concepts from team 1's documentation
  - Refine current program team 1 has built to ease of use, better simulation, etc.
- Set up a meeting with Jay Brusse on 5/31/2024 at 2pm CST for around an hour to get an in-depth lesson in whiskers and their behavior.

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 1:00 pm   **Actual Start Time: 1:00 pm**
Scheduled End Time: 1:30 pm   **Actual End Time: 1:45 pm**

Meeting Agenda:

        The goal of this meeting was to meet with David Edmonson (TA) to discuss our progress up to this point and clarify questions about how we should move forward with the PDR and CDR, as well as what we should include, how we should go about structuring our PDR, and how we should utilize the information that has been given to us thus far by both Metal Whiskers Team 1 (MECH 4250) as well as the customers and sponsors

Notes:

- Explained to David our progress and what we had done up until meeting with him. We asked questions about the PDR and CDR and how we should structure ours, and how we should proceed with the given information we have at our disposal. Finally, set up a weekly meeting time with David in order to discuss future progress.

- PDR
    - We should add to what they have (background, forces)
    - Subtract/condense their info as some of it might not be pertinent to our project
    - Overall, our background info section will essentially be their CDR + relevant information about our forces/whatever sponsors decide we should proceed with
- CDR
    - What we did, how we built the code, does our simulation work or not?
- Set up a weekly meeting with David

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 2:00 pm   **Actual Start Time: 2:00 pm**
Scheduled End Time: 3:00 pm   **Actual End Time: 3:30 pm**

Meeting Agenda:

The goal of this meeting was to meet with Jay Brusse (Expert) to learn about the history of whiskers, what we know about whiskers up to this point, and what information will be relevant to us as we move forward with the project. Essentially a "Whiskers 101"

Notes:

- Jay gave an hour long "Whiskers 101" meeting. We asked questions regarding what information will be pertinent in understanding to create a good simulation
- Whiskers can be composed of any metals
  - The one's most pertinent to us will be Tin, Zinc, and Copper
- There is not a solid reason or knowledge on why or how whiskers are formed, but the growth characteristics, and the conditions in which growth is exacerbated is well documented.
- Distribution of whisker lengths/widths are based on a lognormal distribution with factors nu and sigma.
- Refer to slide 53 for width/length distribution curve of whisker (ppt files in email)
- Refer to slides 56 and 67 for a probability of current flow and at which voltage current will begin to flow between whiskers

Entry Number: 5   **Date: 6/4/2024**

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 2:30 pm   **Actual Start Time: 2:30 pm**
Scheduled End Time: 3:00 pm   **Actual End Time: 3:15 pm**

Meeting Agenda:

      The goal of this meeting was to meet with the team to check on progress that we have made so far. A discussion on how to proceed with the PDR as well as how we should go about making progress on it without a list of deliverables or goals was also discussed.

Notes:

- What we should do about deliverables
  - Email Dr. Roberts or Schulze preemptively about lack of deliverables
- Discussed Unity and Visual Studios
  - Mac access ends August
  - Meeting with Connor on Thursday to discuss his methodology and train of thought when coding
- PDR
  - Working on it together through Box as well as creating a shared Word document to collaborate on it.
  - Familiarize ourselves with the previous team's PDR and CDR so we can write our own PDR

Entry Number: 6   <u>**Date:** 6/6/2024</u>

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

<u>**Scheduled Start Time: 10:00 am**</u>   <u>**Actual Start Time: 10:00 am**</u>
<u>**Scheduled End Time: 10:30 am**</u>   <u>**Actual End Time: 10:35 am**</u>

Meeting Agenda:

The goal of this meeting was to update David on the standing of deliverable receipt from the sponsors/customers, as well as what we should plan to do in case the sponsors/customers decided they want use to refine previous code or start fresh. We also want to discuss the format of the PDR and CDR as well as what information is allowed to be transferred over to our PDR from the previous team's CDR.

Notes:

- Updated David on standing of Deliverables, where customers are at in what they want of us.
- Bill wanted us to start from scratch, Donna wanted us to work from what they already had.
  - If they ask us to refine:
    - Understand problem statement thoroughly
    - Conversation with previous group on what they thought needed improving
    - On the other hand, come to them with questions about why they did what they did with their code
- Format of PDR/CDR
  - Refer to them as Team 1 or previous team. Avoid pronouns in general (they/them., etc.)
  - Bulk of content will be displaying our knowledge, what the previous team/customer wants us to do, how we understood their assignment, and what we will be doing to implement our ideas and their ideas about refinement

Group Members Present: Shawn Eom, Nathan Nichols
Group Members Absent: No others were necessary for this meeting

Scheduled Start Time: 1:30 pm   **Actual Start Time: 1:30 pm**
Scheduled End Time: 2:00 pm   **Actual End Time: 2:30 pm**

Meeting Agenda:

The goal of this meeting was to meet with the previous team's main coder to learn about his approach to coding for the project, as well as get insight on how to better learn Unity and C#

Notes:

Unity & C# Intro
- Use ChatGPT to learn Unity and C# (mostly code)
  - Try test prompts to understand nomenclature
- YouTube
  - To learn Unity, its interface, etc.
- Contact Jacob Botello
  - Text is fine
- Setting up Collision between Object and Platform
  - Add component > Box Collider 2D (for CCA/Platform)
  - Add component > Capsule Collider > Rigid Body (gives physics to whisker i.e. makes it kinematic, can adjust gravity, etc.)
  - Don't use tilemap
  - Only need Empty, 2D/3D, and UI objects
- Scripting > Assets, Right Click > Create > C# script > Name it
- Need to drag object scripting to Game Object in hierarchy
- UI > Script > "using TMPro" > Drag input field to Unity UI in right sidebar
- Split scripts for each function (maybe divvy each script between members)

- What they would've done differently
  - Add external forces
  - Clean up code for efficiency
  - Split script writing
  - Bounce ideas off each other, have each other check
  - Utilize Jacob

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:30 pm   **Actual Start Time: 3:30 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 4:15 pm**

Meeting Agenda:

The goal of this meeting was to meet with customers/sponsors and discuss the progress we have made on our end of the project, and get a definitive problem statement as to what our goals should be this semester

Notes:

- Explain what we have done up to this point
  - Learning background information about whiskers, Unity, etc.
- Got goals from Donna and Bill
  - What we got from Donna
    - Look at what WSU had done up to this point and work it further
    - Previous teams' progress report received by us to inform our future progress
    - Use component level l tool to see where we can hop in, see where previous team lacked/left off on.
    - Look at PowerPoints to get more information about previous teams' work
  - What we got from Bill
    - Connections between conductors should be investigated
    - Understand what we do with information about connections, inputs, and outputs to feed next portion of simulation work
    - Identify what standards we should be using
      - Altium, databases
      - Properly document sources, what databases/data tables, and translate that information into something that can be utilized in the next step
    - Prevent unnecessary duplication of effort i.e. make refinements but don't recode everything.
      - Take geometric information about connections made in 3d program, have the program identify what is copper, and allow user to identify what other surfaces are conductive to better feed information about connections, have user information feed into future uses of the program to grow database (more material information, what surfaces tend to be conductive, etc.)
    - Document and understand how we are doing what we are doing so that future teams can build upon what we have.
  - Essentially, see what team 1 has done, build from it as well as document and capture what they have done as far as coding, what they did, and how they did it.
  - Step by step process of how previous team used Unity, Altium, Blender, etc. to get the simulation to where it is now/how they manipulated these programs to get to simulate what customers want properly and how they got the visuals to work.
  - Work from previous code to understand and refine their code (may include commenting previous code), and possibly add another input (other external forces).

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 2:00 pm   **Scheduled Start Time: 2:10 pm**
Scheduled End Time: 3:00 pm   **Scheduled End Time: 4:35 pm**

Meeting Agenda:

The goal of this meeting was to meet with the team to discuss the progress report Metal Whisker Team 1 (MECH 4250) had sent to us as well as come up with ideas about the objective we can pursue. The team agreed to work on a write-up about project objectives we decided to pursue to ensure we understood the problem statement of said objectives and planned on how/what we should do to fulfill those objectives to feed into the introduction and design portion of the PDR. We also organized the split the work required for the PDR amongst team members.

Notes:

- Discuss presentation time and date
- Discuss progress report sent by Graham
    - See what Team 1 has done up to this point in a more in-depth fashion and take that knowledge to inform us about decisions about what we make our objectives
- Discuss revised problem statement sent by Donna
    - What the revised problem statement means for us as a team to try and pursue
- Made decisions about what aspects of the project we will be starting work on
    - Came up with questions about what scope they want us to work in
        - Are the objectives we chose to pursue adding to the project progress in a meaningful manner?
        - Are the objectives we chose within the scope of our abilities?
        - Are the objectives we chose able to be completed?
        - In addition to the objectives we chose, are there any others that are inherently built in them, or are there any additional objectives sponsors/customers could be or should be done simultaneously?
    - Questions about terminology
        - Pad
        - Nodes
        - Database
        - Output
- Things we are planning on doing
    - Units:
        - Work between standard units (milli, micro, etc.)
        - Create dropdowns to go between units of interest
        - Make sure all inputs and outputs are scaled properly
    - Text file:
        - What do customers want in the output text file
        - We're thinking:
            - Whisker ID touching Node (with ID)
            - Probability based on whisker length
            - Chart??
    - Graphic Display
        - Creating an output window of all possible whisker/node pair connections
        - Highlighting node pairs that may create a short
        - From output window, be able to "click" on node pair and have camera pan to that node pair

- For 2D: have it so the camera zooms into the whisker in question
  - No 3rd axis of rotation but panning left/right, up/down enabled
- For 3D: have camera zoom in on whisker/node connection at an isometric angle and allow pan left/right, up/down, as well as enable camera rotation centered about the connection.

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 2:00 pm   **Actual Start Time: 2:15 pm**
Scheduled End Time: 3:00 pm   **Actual End Time: 2:51 pm**

Meeting Agenda:

Look over objectives and problem statements to decide on questions to ask customers about them, and if they like or dislike our choices.

Notes:

- Came up with questions regarding objectives:
  - What type of units do you want? We are assuming like micro or millimeter, etc. Things more to scale
  - A physical interactive box or a visual box?
  - Do you want us to take a physical structure and model that in unity? Or how do you want us to implement the structures?
  - What specific outputs do customers want?
  - What format do you want it in? .txt, or .csv, etc.
  - What specifically do you mean by node pairs?
  - How do you want us to identify and label things? Should they be labeled as a specific part such as a capacitor, or just a list of numbers.
  - A display box that has various information. Do you want it in like a table or other format?
  - For the graphic display do you want the user to be able to click on certain whiskers and the camera will zoom in on it?
  - What nomenclature do you want for this ID? (Whiskers)
  - What is Pad ID?
  - Do you want us to store whisker ID for each simulation or just for one final simulation? If you want us to store the output of every simulation is there a certain way you want us to store it? Such as in excel.
  - Do you want this to be exactly repeatable? Or do you want just the inputs and outputs to be stored and saved?

Group Members Present: Shawn Eom, Spencer Hurst, Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:30 pm   **Actual Start Time: 3:30 pm**
Scheduled End Time: 4:30 pm   **Actual End Time: 4:27 pm**

Meeting Agenda:

Tag-up meeting with customers/sponsors to update them on our progress so far. We will inform them on what objectives we have decided to work on as well as discuss questions we have about objectives to get a better understanding of them.

Notes:

- Team 1 shared progress updates on their side of the project
    - Donna mentioned that all relative files should be located within the main GitHub
- Progress update on Team 2 Activities
    - Gave contact information to Errol Reid, Julie Nguyen, Stephen Wells, and Curtis Ballard
    - Shared updates on what objectives we plan to work on with our customers.
        - Units
            - Whisker sizes can get lost in simulation (too small makes the engine act funny)
            - Jay would make us work in micrometers for standard deviation, etc.
            - Need to be able to make .stp files work with Unity to make the units/dimensions work together correctly.
            - Unity allows units based on pixels
            - Connor
                - Whiskers are spawned in at coordinates
                - Unity is unitless
                - Base boundary of whisker drop area on CCA size in Unity.
            - Make sure sizing is appropriate to allow proper simulation and to ensure the sizing metric is robust enough to ensure the physics engine work as expected.
            - Units can be either metric or English but work with one or the other.
                - After finding the dimensions of the CCA, let it be the deciding factor of the units for whisker size
                - Make everything scale correctly in one unit system and transfer that working code to different unit scales.
            - Think of it as working in one common, standard unit after correcting real world units (metric/English) to something that is readable by Unity.
        - System Container (Figure 1-18)
            - Make box transparent, maybe outlined
            - Make it have collision physics in the program
            - No standard as to what the shape of the system container should be.
                - For simplicity, we can model the bounds as a simple rectangle outlining the circuit card.
        - Text file
            - What specific outputs are desired in this file. Format?
                - Want to be able to take results of whisker drop and contacts made from simulations
                - Acts as a transfer mechanism between modules for simulation vs assessing
                - Want output of contact area 1, 2, … n between which whisker and pad
                    - Document order of contact

- ID and Label Node Pairs
  - Node Pairs
    - 2 exposed surface areas independently acting in the circuit where whiskers can make contact between the two.
    - Eventually want file of coordinates of the nodes and the actual electronics that are working within that CCA (resistor, capacitor, etc.) to be able to describe if there will be a short or other unwanted behaviors
  - Nomenclature for ID
    - Number to track where it is on CCA and the general shape of it to be able to identify it physically and electronically
    - Numerical sequence (assign number to each node)
    - Naming node pairs can quite literally be Node1 – Node2 to ID connections
- Graphical Interface
  - Have a 2D view of the circuit board, be able to select nodes that have connections and have a visual indication of connections (blinking light on node connection) and be able to store that in a database.
  - Takes geometry of CCA and be able to select ID of pairs that will allow the user to add that information to the database of what type of connection it is (Module 2 stuff, not necessarily related to us)
- Create ID number for each whisker generated
  - No nomenclature standard
  - Be able to link length, diameter, resistance of said whiskers to ID #.
  - Each simulation has its own file for ease of access to information
  - Sort through files as subfolders
- Stored ID and Pad ID
  - Pad ID: surface area that is contacted.
- Storable results file
  - Do we want this stored file to be able to repeat that specific simulation or just have the same inputs and outputs rather than have the exact, repeated simulation.
- Include the people on this Teams meeting to our PDR presentation meeting
  - Errol Reid and Julie Nguyen

Group Members Present: Shawn Eom, Spencer Hurst
Group Members Absent: No others were necessary for this meeting

Scheduled Start Time: 12:30 pm　　　　　　　**Actual Start Time: 12:30 pm**
Scheduled End Time: 2:00 pm　　　　　　　　**Actual End Time: 1:34 pm**

Meeting Agenda:

The goal of this meeting was to work on the design concepts portion of the PDR

Notes:

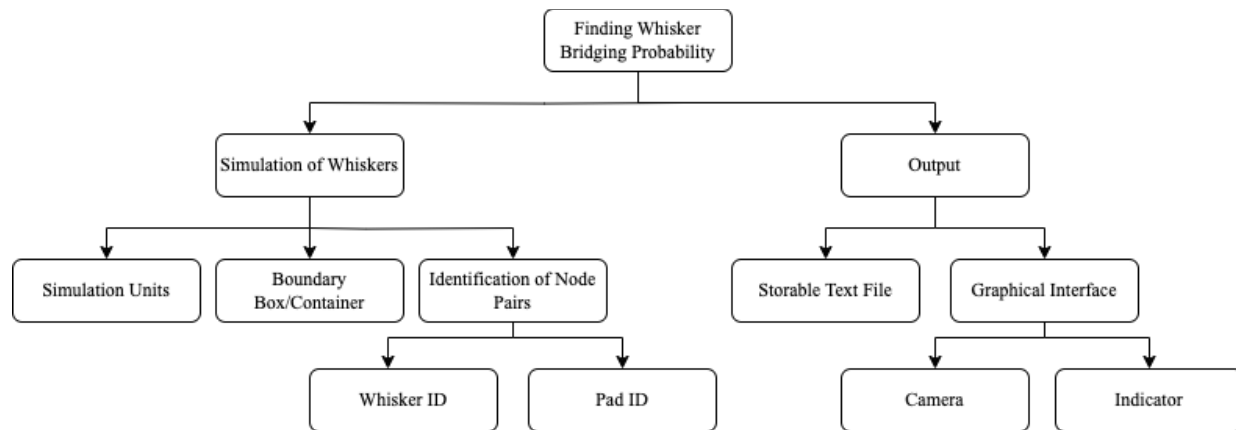- Functional decomposition created

Figure 1: Functional Decomposition

- Morphological Matrix created from functional decomposition
  - ○ Images were made to go with each working principle for each subfunction

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams
Group Members Absent: Shawn Eom, Spencer Hurst (Scheduling Conflicts)

Scheduled Start Time: 2:50 pm   **Actual Start Time: 2:50 pm**
Scheduled End Time: 3:30 pm   **Actual End Time: 3:40 pm**

Meeting Agenda:

    The goal of this meeting was to go over the PDR feedback as well as check in on progress made and deciding how to move forward with the project.

Notes:

- Nathan Nichols will contact Shawn Eom and work together in Unity to have something ready for Thursday.
- Plan on setting up priority list, but first Jay's notes on the PDR
- Carson Reams joins the Unity team
- Kurt Knudsen will start researching Monty Carlo and possibly external forces
- Jay's notes on the PDR
    o   Research STEP files and how Unity interacts with them
    o   For future presentations email to Jay before presentation for his input
- Focus on annotating code before next meeting
- Continue research into whisker/node identification

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 3:30 pm   **Actual Start Time: 3:30 pm**
Scheduled End Time: 4:30 pm   **Actual End Time: 4:07 pm**

Meeting Agenda:

This meeting was a tag-up meeting between Team 1, Team 2, sponsors, customers, and advisor to discuss team progress

Notes:

- Team 2 stated to customers/sponsors about progress on annotating the code and creating documentation for the 2D simulation
- Team 2 was given another objective of creating a top-down 2D simulation of whisker bridging
    - Top-down view
    - Gravity might be difficult to simulate in this view
        - Can do 3D sim with a locked POV to represent a 2D angle
        - Don't deal with gravity, but rather spawn whiskers in randomly on the board
    - Main idea is to check for bridges

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 3:00 pm   **Actual Start Time: 3:00 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 4:01 pm**

Meeting Agenda:

This meeting was a tag-up meeting between Team 1, Team 2, sponsors, customers, and advisor to discuss team progress

Notes:

- Team 1 presented their progress
- Team 2
    - Got CCA base to spawn in the "top-down" view
    - Got whiskers to spawn in an area in the "top-down" view in varying x-z locations
    - Got conductors to spawn at random in varying x-z locations.
    - Jay (NASA representative) stated the following:
        - Don't include gravity in the simulation
        - Meet with Connor to implement standard distribution and lognormal distribution in whisker size spawning.

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 2:00 pm   **Actual Start Time: 2:15 pm**
Scheduled End Time: 3:00 pm   **Actual End Time: 4:01 pm**

Meeting Agenda:

This meeting was to catch up on progress from individual team members

Notes:

- Unity Team:
  - No progress
  - Design decisions made
    - Writing to Excel files
      - There are paid and free-use options to read and write data to excel files
    - Will create a template of Excel file for output
- Other members will work on lognormal distribution math for whisker sizing
  - Will also continue working on Altium and Annotation as well as CDR

Entry Number: 17

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 1:30 pm   **Actual Start Time: 1:27 pm**
Scheduled End Time: 2:00 pm   **Actual End Time: 2:06 pm**

Meeting Agenda:

This meeting was to catch up on progress from individual team members

Notes:

- Unity Team
    - Showed output window functionality
    - Showed conductor labeling functionality
    - Currently working on whisker labeling
    - Send a list of changes made for CDR team to present to Jay
- CDR
    - Want to finish setting up presentation by Friday (7/19)
    - Get access to Jay for feedback on the presentation

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 3:30 pm   **Actual Start Time: 3:30 pm**
Scheduled End Time: 4:30 pm   **Actual End Time: 4:38 pm**

Meeting Agenda:

This meeting was to show our progress to our sponsors and get feedback on the final CDR designs.

Notes:

- Unity Team
  - Showed whisker labeling
  - Showed whisker hovering number labeling
  - Only care about the big node blocks and not additional small nodes attached to it
  - Showed whisker connections
  - Add column of top display of results, first column (left most) is simulation # and displays bridges, continue columns down for simulations.
  - Show histograms of whiskers bridging and other probabilities.
  - Showed update data function
  - Showed screenshot addition
  - Output file using 1 decimal place is plenty, 4 & 5 decimal places is excessive.
  - Jay said all information in the same place is easier for the user and ideal.
  - Color coding bridged whiskers is adequate, but not a strong preference on the GUI for labeling
  - Conductors are hanging off the board, if we create a random board for use, and recalculate the location of nodes that leave the board boundary.
  - Might want to have different dimensions for the different nodes, rather than all the same size. Maybe save till next semester.
  - Random skyscraper dimensions, maybe not make it so random, maybe make it an integer value or multiplier, something simple.
- CDR
  - Mention in CDR presentation how it works and that the white whiskers are the bridged whiskers.
  - Want to complete CDR Presentation rough draft by Sunday (July 21st) and send to Jay Brusse for review.
  - Node 15 & 16 should be reported out that they bridged, etc.
- Other Notes
  - Jay wants a way for the designer of the CCA to easily identify the 2 bridging conductors/ nodes.
  - Ask Shulze if there will be another Metal Whiskers group after us
  - Donna & Jay want us to find the probability of bridges causing issues next semester in the 3D simulation.

<u>Group Members Present:</u> Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
<u>Group Members Absent:</u> None

<u>Scheduled Start Time:</u> 1:30 pm   **<u>Actual Start Time:</u> 1:55 pm**
<u>Scheduled End Time:</u> 2:30 pm   **<u>Actual End Time:</u> 2:18 pm**

<u>Meeting Agenda:</u>

This meeting was to discuss our plans for the CDR presentation and Report, as well as schedule meetings to work on everything.

<u>Notes:</u>

- Unity Team
    - Finish code tonight
- CDR Presentation
    - Assigned roles to work on this
    - Meet to work and finalize presentation Wednesday (July 24th @ 6:30-7PM)
    - Meet on Thursday (July 25th @ 1:30 -3:30 PM) to rehearse presentation.
- CDR Report
    - Assigned roles to work on this
    - Work on Report on Sunday (July 28th @ 6:30-7 pm)
- CDR Design Notebook
    - Scribe was tasked with finishing formatting

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:42 pm**
Scheduled End Time: 10:30 pm   **Actual End Time: 11:52 pm**

Meeting Agenda:

> This meeting was to work on the CDR presentation.

Notes:

- Insert relevant images to presentation
- Add information about how code/scripts work
- Relate code/script to the design descriptions/working principles chosen during PDR stage
- Ensure proper formatting and grammar of overall presentation
- Verify references for images
- Practice presentation, assign slides to members

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 5:30 pm**
Scheduled End Time: 10:30 pm   **Actual End Time: 11:22 pm**

Meeting Agenda:

       This meeting was to work on the CDR report.

Notes:

- Update all relative information
- Make changes based on PDR report feedback.
- Insert new figures

Final Design Notebook

3D Modeling of Metal Whiskers || MECH 4250 Team 3

Fall 2024

Manager: Kurt Knudsen
Scribe: Kurt Knudsen/ Shawn Eom
Spencer Hurst
Nathan Nichols
Carson Reams

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 5:00 pm   **Actual Start Time: 5:06 pm**
Scheduled End Time: 6:00 pm   **Actual End Time: 6:17 pm**

Meeting Agenda:

This meeting was to discuss plans for this semester and schedule tag-up meetings.

Notes:

- Tag-up meetings tentatively Tuesday at 3 CST
    - Will check with sponsors for confirmation
- Team meeting at 5 pm on Tuesdays for now
- Next week on Friday, need to submit Gantt Chart
    - Shawn will work on it after Tag-Up meeting and module/task list is finalized
- MPCOD
    - Contract of Deliverables between our sponsors and the team
    - Kurt will work on MPCOD and send to sponsors
        - Will be finalized in tag-up meeting
- Carson will be out of country from September 18th – 27th
- Update User Manual as semester progresses
    - Keep separate data of what we have done
    - Decide who will update it
- Component Model Assessment Tool || Choose modules/tasks to complete for this semester
    - Units
        - Previous team did it with gridlines, and already had a standardized unit system for the simulation
        - Will investigate what has been done and possibly finalize this semester
    - Tin Whisker Definition, input data specifying the characteristics of the whiskers
        - Team 1 started, but didn't complete this objective?? Will investigate
    - Source Location: Where the tin whiskers may be generated from… (Objective 1. 9)
        - Re-evaluate later due to complexity of finishing the objective
        - Will start/continue but will not finish this semester
    - Initial Condition: the location of the whiskers at the beginning of the simulation such as: 12, 13. 14 (Obj 1.11)
        - 13, 14 was stated to disregard
    - Physical Component Definition: the physical components and bounds the whiskers will be subjected to (Obj 1.15)
        - Will be marked as in progress but not completing
    - System container/Bounding box: The physical space designed to constrain the simulation (1.18)
        - Ask for example container to start modeling and implementing in simulation
    - Physical environment including 20-23 (1.19)
        - Can finish Orientation and Acceleration
    - Specify Output Data (1.24)
        - Ask what exactly this means
        - Have users to be able to select the output data they want? Etc.
    - Save input data for future reuse (1.27)
        - Can complete this semester
        - Create save states, output the inputted data
    - Text file (1.26)

- - - Will continue, might not finish
  - ID and label node pairs (2.1)
    - Will investigate previous teams project and attempt to finish
  - Label ID pad number (2.5)
    - Will continue and finish this semester
  - Graphic Display (2.6)
    - Will need to research interface possibilities to decide if it can be completed
  - ID number for whisker (2.10)
    - Should be done already
  - Bounding box, keep whiskers inside (2.12)
    - Already doing
  - Circuit and physical enclosure (3.4)
    - Will continue
  - ID where whisker touches pad (3.6)
    - Skip working on for now
  - Store whisker ID and pad ID of bridged nodes (3.10)
    - Continue Working
  - Storable results file (4.5)
    - We can continue to include all the information we work with this semester
  - Inputs: store inputs (4.7)
    - Can do, will complete this semester
  - Screen capture
    - Screen recording feature (look into it)
    - Screen capture at the end of each iteration/simulation
    - Ask sponsors exactly what they want
      - Angles, when and where, etc.
- Schedule Excel Sheet
  - Each member will update availability by Friday night the previous week
- Member's Loads
  - Kurt
    - Working all day MTWF
    - R free except for 1 class at 9:30-10
    - Best times to reach 1 pm – 3 pm MW and after 11 am R
  - Carson
    - Typically, busier TR, MW busier around
    - Mostly available
  - Spencer
    - Work MWF from 7:30 – 4 coming from Montgomery
    - TR, class at 9:30, work right after, end at 5 pm
    - Lenient on taking days off, etc.
  - Nathan
    - Mostly free
    - Changes day to day
  - Shawn
    - Need to work T at 10-12, can't change WR work times, can't be reached
    - Working about 30 hours a week generally 9-3

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 3:00 pm   **Actual Start Time: 2:58 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 4:22 pm**

Meeting Agenda:

This meeting was a tag-up meeting with Donna, Jay, Errol and the Senior Design Team to discuss MPCOD, and the plans and expectations going forward with this semester.

Notes:

- Beef up output section
    - Come up with a better understanding of the metrics of the output and apply better understanding of the outcome.
    - Report bridging frequency, probability, other relevant statistics
    - Report out possible critical failures, relevance of simulation to important data, come up with more valuable metrics/data about the simulation/outcome to Customer.
        - Perform more data analytics
- Create user input for highlighting nodes of interest for reporting statistics
- Monte Carlo Simulation
- Overall
    - Report bridging (which nodes) statistics, highlight high # of occurrences, the frequency at which they are being bridged
- MPCOD
    - Task 1: GTG
    - Task 2: GTG || with changing density of spawn, spawning location in x-y-z location relative to CCA and WRT gravity and CCA
    - Task 3: GTG || Simple Box, don't go out of our way to implement complex structure
    - Task 4: GTG || Introduce orientation and acceleration (in x-y-z direction) || Could even go as simple as orthogonal or parallel) to whiskers
    - Task 5: GTG || Text file, implement using .csv (already did)
    - Task 6: GTG (is a "nice to have") || Previous input files; Carson already implemented something, planning on adding a directory to save inputs in a .csv file to save for future use and reuse
    - Task 7: GTG || ID and label node pairs; Explore a "bare-board CCA" without components to try and label nodes for ease
    - Task 8: GTG || Pad ID; Ties in with task 7. Bare-board CCA where components will be installed or even where circuit paths (trace) will be on the board to be named pads.
    - Task 9: GTG || Graphic display; highlighting whisker bridges visually; flash nodes as well as whiskers
    - Task 10: GTG || Unique whisker ID with stored geometrical data
    - Task 11: GTG || Bounding Box; make the dimensions corresponding to size of CCA (ie CCA is 6x6, make x and y of box = 6x6)
    - Task 12: GTG || Circuit and physical enclosure; don't have whiskers fall through bounds
    - Task 13: GTG (must have) || Store Whisker and Pad ID of bridged nodes; important for whisker resistance values
    - Task 14: GTG || Storable results file; output stores all user inputs (shock, whisker distribution etc.) as the header as well any output values (bridging etc.)
    - Task 15: GTG
    - Task 16: GTG || Screen capture: carry on; Screen recording; store recording from user POV, add hotkeys to get to a specific view (orthogonal, top, etc.)
    - Product will generate quantitative metrics

- o Will edit MPCOD to align with what was discussed in this meeting
- o 14 and 15 is the main focus of our semester
- o Will add to user manual as we progress throughout semester
- o Create Beta for Technical advisors to use.
  - ▪ Don't allow changes to code, just allow run access
  - ▪ Explore an online porting option??
- o Ensure we use "FREQUENCY" of bridging as a statistic in output metrics
- Shawn will generate Gantt Chart

Entry Number: 24   <u>**Date: 9/9/2024**</u>

<u>**Group Members Present:**</u> **Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst**
<u>**Group Members Absent:**</u> **None**

<u>**Scheduled Start Time: 6:30 pm**</u>   <u>**Actual Start Time: 6:32 pm**</u>
<u>**Scheduled End Time: 7:30 pm**</u>   <u>**Actual End Time: 7:46 pm**</u>

<u>**Meeting Agenda:**</u>

This meeting was a team meeting to discuss updates on the project from the Unity Team as well as an in-group confirmation of MPCOD changes that were made since the last meeting.

<u>**Notes:**</u>

- Created an in-team priority list of tasks
  - Detailed the necessary components to consider the task finished
  - Ordered tasks in order of priority for completion by end of semester

Group Members Present: Kurt Knudsen, Nathan Nichols, Carson Reams, Shawn Eom, Spencer Hurst
Group Members Absent: None

Scheduled Start Time: 3:00 pm   **Actual Start Time: 3:15 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 3:43 pm**

Meeting Agenda:

This meeting was a tag-up meeting with Jay, Errol and the Senior Design Team to discuss current team progress with Beta versions as well as new implementations within the simulation. A new UI idea was also introduced.

Notes:

- Produce both html and .exe file for beta tests. Html will be more important for usability throughout the semester
- In output file, make it so data goes out to just one decimal point
- New UI comments
- Showed the screenshot feature with the new flash
- Showed the walls and the togglable ceiling
- Showed whisker ID and Excel file of bridged whisker
- Showed Beta website
- Donna wants us to visually display whisker bridges and nodes
    - Have it flashing or blow-up size or display number or change color, etc.
- Altium Team
    - Work on expediting the Altium process
    - Look to see if blender is needed to clean up geometric data
    - Try sending bare CCA with a STEP file without blender straight from Altium
- Beta
    - Kurt will send out Beta version to everyone
- Shawn will investigate interface when clicking on selected node/ part

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst
Group Members Absent: Carson Reams (prior engagement)

Scheduled Start Time: 3:00 pm   **Actual Start Time: 2:54 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 3:29 pm**

Meeting Agenda:

This meeting was a tag-up meeting with Jay, Stephen and the Senior Design Team to discuss current team progress with Beta versions as well as new UI implementations and progress on spawning mechanics

Notes:

- Make sure text and background in new UI is accessible/legible
- Whisker Spawn Location
    - Added visual indicator, trying to very center to change whisker spawn concentration
- Screenshot
    - Allow for file name writing and where to save
- Screen Recording
    - Unity plugins are sparse, will need to investigate more options
    - If a plugin is found contact Julie Nguyen (julie.nguyen@mda.mil) to make sure it passes security measures

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:30 pm**
Scheduled End Time: 7:30 pm   **Actual End Time: 7:15 pm**

Meeting Agenda:

This meeting was a progress meeting with the team to discuss showcasing the beta for Donna tomorrow (10/1, Tuesday), as well as other general updates on the Unity simulation.

Notes:

- Discussed what we would show our sponsors
- Decided that Shawn would run through the Beta version for everyone
- Decided we would all answer any questions our sponsors had and have separate time for questions.
- Planned to show our sponsors how to do it on their own device
- Kurt sent out an email with the Beta link again to everyone for the purpose of using the Beta on their device.

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Carson Reams
Group Members Absent: Spencer Hurst

Scheduled Start Time: 3:30 pm   **Actual Start Time: 3:26 pm**
Scheduled End Time: 5:00 pm   **Actual End Time: 4:42 pm**

Meeting Agenda:

This meeting was to display our progress and the Beta to our main sponsor Donna, and our technical advisor Dr. Flowers and other students. This showed them a hands-on approach to the Beta simulation.

Notes:

- Dr. Flowers seemed to really like the simulation and wants useful metrics
- The team with Donna suggested changing the color of momentary bridged whiskers to orange
- Showed everyone there a hands-on experience of the Beta
- Helped Donna figure out the simulation on her own computer

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:35 pm**
Scheduled End Time: 7:30 pm   **Actual End Time: 7:22 pm**

Meeting Agenda:

Monday meeting to discuss senior design progress and our plan for implementing a CCA.

Notes:

- Discussed Spencer figuring out materials on the CCA
- Nathan is having issues with board rotation and UI and will continue to work on it
- Made small adjustments/ improvements to the UI design

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:00 pm   **Actual Start Time: 3:05 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 3:58 pm**

Meeting Agenda:

Weekly tag-up meeting to discuss our overall progress from the previous week. Wanted to discuss our changes to critical node pairs, custom gravity, Tim's board, and color changes

Notes:
- Showcased Beta features to everyone
  - Custom gravity
  - Color changes (Now changes to orange if it is a temporary bridge)
  - Critical node pairs (Can now select critical node pairs)
- Tim sent us bare boards to work with in order to try and get pads, traces, and materials to work in our simulation

Group Members Present: Kurt Knudsen, Nathan Nichols, Spencer Hurst, Carson Reams
Group Members Absent: Shawn Eom

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:30 pm**
Scheduled End Time: 7:30 pm   **Actual End Time: 8:00 pm**

Meeting Agenda:

Weekly team meeting to discuss our progress. Wanted to discuss the Washington State groups' board and give feedback.

Notes:
- Washington Feedback
  - Pros:
    - Likes how you can load in the board and materials
    - Like how they display all aspects of "Sim Results"
  - Cons:
    - Color of spawn point is not a good-looking color
    - Spawn box is not togglable (visible or invisible)
    - Do not like the background and want a new one (Grey doesn't look good)
  - Advice:
    - Add units to whisker details units
    - Add Shock and vibration units
    - Need a background to UI so they can always read it
    - Adding solder pads around each component (use a board with pads)
    - Monte Carlo report should have the whiskers for each iteration
    - Let there be contrast between lights and darks
    - Make visibility of all UI toggle button to disappear
    - Get Shock and vibration to work
    - Include an instruction manual
    - After you hit "Run Sim" whiskers should not disappear
    - Color change if you have bridging
    - Get component finder to work
    - When we input our board, it enters sideways, and scales weirdly

- Our Board Improvements:
  - Need to slow down starting rotation speed when viewing a whisker
  - Can now select which whisker you want to look at in the bottom right corner
  - When you go to whisker the only way to get out of the view is to hit the down arrow, but that is restrictive and want us to be able to look around the whisker through normal controls without going back to standard view

- Things to ask Donna, Jay, & Tim:
  - What do they want from rotation and spin module?
  - Ask Tim for the .PCB3DP or whatever file type

- Things we need to do:
  - Figure out materials and solder pads
  - Reach out to Meredith & WSU team for how to implement the board and material file.

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:00 pm   **Actual Start Time: 2:58 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 3:18 pm**

Meeting Agenda:

Weekly tag-up meeting to showcase our progress to sponsors. Wanted to go over our changes of orientation and selection of which whisker bridges.

Notes:
- Sponsor Notes & Comments:
    - Let them know when we have the next beta drop
    - Ask Jay if they want us to spawn things while it rotates
    - Have a joint team discussion at the end of the semester with WSU.
    - Will ask about software security
    - Julie will reach out to us about cyber security stuff needed

- Our Notes & Comments:
    - Need to get together at the end of the semester and come up with a UI

- Things we need to do:
    - Kurt will email Tim about Altium files
    - Kurt will email Meredith & WSU team
    - Errol wants to know when our ORR presentation will be, so Kurt will investigate it
    - Ask Washington Team:
        - How they import boards and what angle do they do this at
        - How they did the outputs in the simulation
        - How they did the material file and stuff
        - What programs did they use for board creation and implementation
    - Try to see if Altium or blender can tag components for naming purposes to try and tag it in unity with a conductor
    - Ask Jay about rotation and what exactly they are looking for

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:21 pm**
Scheduled End Time: 7:30 pm   **Actual End Time: 7:00 pm**

Meeting Agenda:

Weekly team meeting to discuss overall progress. Want to go over WSU Feedback, and prep for tag-up meeting tomorrow with questions about camera orbit, screen rotation, and board rotation.

Notes:
- WSU Feedback:
  - UI elements are scattered: already in the works
  - Monte Carlo: Need Clarification
  - Cannot access results/screenshots: That is the nature of the online beta
  - Certain buttons seem to do nothing: Didn't send instructions to use over to WSU team
  - Only able to run one MCS: will fix
  - No materials assigned to whiskers: user error
  - Sim walls can't be removed: will add remove button
  - Spawn region ambiguous: functionality is there already
  - Cannot load PCB into simulation: working on it
- Prep:
  - Does the camera orbit feature fulfill the module requirement?
    - Location of pads resulting in a short: Output of the location of the pads, including the pad ID. (Figure 4:4)
      - Connected nodes and the whisker(s) will be visually highlighted and displayed on the CCA with their ID number, and other relevant information. SMART Goal: Displayed Results of Key Metrics of Interest.
  - Screen Recording?
    - **(Shawn)** Screen capture: Ability to take screen shots or recordings of the circuit, including when the tin whiskers may be moving around.
      - At minimum a screenshot of either a top-down view or some predetermined view of the CCA after the simulation is completed
      - A screenshot at the end of each iteration
      - ~~A screen recording of the entire simulation~~

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:00 pm   **Actual Start Time: 3:00 pm**
Scheduled End Time: 4:30 pm   **Actual End Time: 3:34 pm**

Meeting Agenda:

Weekly tag-up meeting with Jay Brusse, Dr. Flowers, Tim Mondy, Errol Reid, and Donna Harvisik to ask questions about certain modules and discuss the Washington team's feedback we received.

Notes:
- Presented Board rotation and constant spin
  - Jay: Will the sim allow pausing of board rotation?
  - How should spin, rotation work?
    - Put board in any fixed orientation and spawn whiskers in default axis without board spinning

- Material and CCA export issues. Tim will send us more boards to work with

- Emails Kurt will send out:
  - Email to Julie Nguyen
    - Wondering if there is a way to run a .exe or .app file for Beta revisions through security checks so that sponsors/customers can use the Beta for output (.csv) file functions
      - They have to have access without downloading anything for security reasons
  - Email Donna, asking about if the orbit function fills the MPCOD requirements
  - Email the Washington team with updates
  - Email everyone about ORR presentation times

Entry Number: 35

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:45 pm**
Scheduled End Time: 8:00 pm   **Actual End Time: 7:34 pm**

Meeting Agenda:

Weekly team meeting to discuss ORR questions and discuss overall progress.

Notes:
- Worked on .CSV output window

- Working to fix constant gravity from team 1 into an acceleration

- Kurt will email David and others to ask about the second 5-minute presentation differences and ask what day it is

- Spencer has notes on the programmatic questions.

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:30 pm   **Actual Start Time: 3:30 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 4:23 pm**

Meeting Agenda:

Weekly tag-up meeting to go over quick progress. Then afterwards we have the Assurance Checks with the cybersecurity team from the MDA.

Notes:
- Showed Sponsors:
  - new load CSV file and output window
  - Output window
    - Have relevant significant digits
    - Remove the header duplication and fix the headers to include both bridged and unbridged whiskers
  - Board Rotation
    - Accidentally removed a null in the code that needs to be fixed
    - What are the 3 input boxes under the spin and label them
  - Orbit function
    - Jay said that the .csv data and the orbit and a list of bridged components is enough to knock off the module regarding visual information of bridged whiskers and pads

- Assurance Check information:
  - This is an add on to the final report
  - Leah has a publicly available website for us to use, National Vulnerability Database website
  - Use the security requirement guides that DoD must follow for guidance on how things should be implemented
  - Application and security development stig used for source code or developing software
  - Stig documentation is uploaded through stig viewer on the cite, 286 rules
  - Some form of multifactor authentication, removes cookies after use
  - OWASP top 10 (top 10 application security risks)
  - We are responsible for a secure code used from other sources implemented into our project
  - If you don't need to know, you shouldn't have access to it
  - Online websites now have API to call other information or application. Can also search specific products
  - CVSS looks at the attack vector, complexity, confidentiality, shows advisories for the site, shows the weaknesses
  - Building software Bill of Materials
    - This is a tracker of all open source or tools integrated into the product
    - CycloneDX is a bill of materials
    - Capable of including vulnerability information as well
  - Security is not the focus of the application (functionality is), but it is much more difficult, time consuming and expensive to build in security after the product is completed
  - Sometimes security stuff stops product from working, but if there is no work around for our project we should track and document any deviation from security practices
  - Leah will send Donna a list of cites and resources for us to use
  - STIG:
    - CAT 1: most critical and immediate problems
    - CAT 2: medium security risk and potential to compromise
    - CAT 3:
    - STIG file name: The application security and development STIG (will send in email)

- Best way for us to provide next level documentation or body of evidence
  - Have scripts for functionality on top of unity engine
  - They will be looking at our STIG
  - Wants us to use code scanning tools either online or built into Unity
    - Most will tie back to vulnerabilities in the STIG
  - Go through STIG checklist and address body of evidence and provide this in the report
  - Fill out check list of the STIG (Most helpful Items)
    - Found on public.cyber.mil, button at top for SRG STIGs, once on STIG site, left navigation pane allows us to go into more detail. STIG viewer 3.x is under STIG viewer tools, latest release is STIG 3.4, user guide is pdf at the bottom.
    - We want one of the downloads, and not a MAC release of STIG viewer 3.x
    - Once inside STIG viewer 3 it will be blank, go into STIG viewer (nothing will be in library), to get application and security development STIG, go to application site, go to library, search for application and security development STIG (.zip file). When .zip is downloaded (don't need to extract), go back to application, select add to library, and then load. We can then open that STIG in the viewer or in checklist area(checkmark in navigation panel or create checklist from homepage), then select to fill the checklist. Can provide it as a CKLB file format or export it as either html or csv, but CKLB is best for them.
    - Mark as not a finding, open, not applicable,
    - After completing STIG checklist, and then invoke a scanning tool and providing source code or static code analysis tools and reports (automated tool, that would ingest the source code and identify dead code, or buffer flow code, SonarQube, verify)
  - Ask department head about funding and reimbursement for the Source code or static analysis stuff above.
  - And try to do the static code analysis

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:42 pm**
Scheduled End Time: 8:00 pm   **Actual End Time: 7:34 pm**

Meeting Agenda:

Weekly team meeting to discuss ORR questions and discuss overall progress.

Notes:
- Progress:
  - Fixed up acceleration and spin problem
  - Added critical bridges and simulation parameters to the excel file of output information
  - Nathan is currently working on making the default material as copper
  - Carson Updated the Simulation output to be only Bridged Whiskers
  - Mention that we will not be able to implement new boards because we cannot future proof it since the only true way to assign materials into Unity is to manually do it within Unity; which means we cannot make it future proof it. And Altium doesn't support traces and pad data/information for use in Unity.
  - Altium and Blender doesn't save, export or label a list of materials in the same manner that Unity reads them, so they may be reading different materials like material_1 vs copper

- UI Issues:
  - Shawn doesn't know if data is accurate, look into it
  - Trying to get conductors to display in the bottom corner
  - Sim control and Monte Carlo should be in first tab
  - Will add a new critical pair tab

- Team Assigned Tasks:
  - Spencer will work on Presentation and the Report
  - Carson and Nathan will look into updating the UI
  - Kurt needs to look into funding and reimbursement for source code or static analysis stuff, talk to Dr. Flowers
  - Kurt will send out last tag up meeting before thanksgiving break on Tuesday, November 19th
  - Kurt will send carson what math I want him to do in the excel

- To-Do List:
  - Transfer the Unity stuff using the personal license and not the educational license

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:00 pm   **Actual Start Time: 3:05 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 3:40 pm**

Meeting Agenda:

Weekly tag-up meeting to go over quick progress. And discussing CCA issues and our progress on the output/ excel file.

Notes:
- Showed new load CSV file and output window

- Board and Material Stuff:
    o Look into simple toggle of save copper or non-copper
    o Try to export only pads and no components – Tim
    o Export 3d model with a bunch of copper bricks on it with one being board material and one being other material

- Progress:
    o Output Simulation, show which whiskers or nodes have a higher probability of bridging than others.
    o Add node pair statistics, and in all simulations how often is the same pair bridging
    o Know a histogram, or number of known pairs in each simulation run, then histogram analysis gives a number of bridged pairs and expect frequency to decrease with more bridged pairs.

- Tasks to complete:
    o Carson needs to share data file with Jay
    o Trim down output file down to 1 decimal place
    o Please complete the STIG Write issues with Altium and Unity

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:35 pm**
Scheduled End Time: 7:30 pm   **Actual End Time: 7:04 pm**

Meeting Agenda:

This was a Sunday meeting to create and finalize our second 5-minute presentation of the semester.

Notes:
- Went over the 5-minute presentation and finalized it

- Practiced the 5-minute presentation

Entry Number: 40   **Date: 11/11/2024**

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:35 pm**
Scheduled End Time: 7:30 pm   **Actual End Time: 7:04 pm**

Meeting Agenda:

Weekly team meeting to discuss questions and discuss overall progress and feedback from our presentation.

Notes:
- Progress:
    - Updated UI layout
    - Had a presentation
    - Looked into fixing comments from the Washington State team
    - Carson has updated a lot of Excel stuff
    - Shawn and Nathan have changed and rearranged the UI and will make them more consistent and properly upsized

- Tasks to complete:
    - Nathan will investigate making the default material copper

- Questions to ask:
    - Ask Jay if they want a conversion to inches in the output file
    - Ask Jay and Donna if they want anything for the UI to be bigger or more prominently visible

- Inform Customers:
    - We are pretty much done with code changes and have started working on the STIG and final report stuff

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: None

Scheduled Start Time: 3:00 pm   **Actual Start Time: 3:01 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 3:33 pm**

Meeting Agenda:

Weekly tag-up meeting to go over quick progress. And discussing how we don't think we can future proof a board. Additionally discussed last tag up meeting date.

Notes:
- Show Beta stuff at the end of the semester and release it to everyone

- UI Suggestions:
    - Camera moves the top down
    - Move the tally results for bridges in the run to an out of view area

- Progress:
    - Showed output data files
    - Showed UI enlargement and organization. No other suggestions
    - Sponsors

- Units:
    - Talk about toggle button for switching between metric and imperial system within excel and not unity

- Unity Suggestions:
    - Carson: Make sure we do not have inverse critical bridge pairs that are the same

- Excel Suggestions:
    - Make sure to decide upon a number of whiskers that the statistics reference like statistic is out of 100 whiskers.
    - Add the mu and sigma data inputs used into the results file and other relevant information

- CCA Stuff:
    - No longer work to implement and upload a CCA into Unity. Add our knowledge to the Manual/ report and add to the next teams main to do list.

Group Members Present: Kurt Knudsen, Carson Reams
Group Members Absent: None

Scheduled Start Time: 2:00 pm   **Actual Start Time: 2:00 pm**
Scheduled End Time: 3:00 pm   **Actual End Time: 3:43 pm**

Meeting Agenda:

This meeting is with Jay (NASA) to discuss the excel file output information that is relevant to the simulation.

Notes:
- Jay's Problem Statement and what's important for data:
  - How many bridges are occurring on a module per run

- Real world risk, show as background stuff in our report:
  - Woman and car stall example
  - Policeman full throttle example

- Comments on Excel file/ sheet:
  - Why we do a certain number of iterations is to gather useful data

- What Jay wants us to include in statistics
  - Doesn't like the idea of the longest and shortest whisker length (as it is not representative of the sample), good to display but not use outlier values
  - More stable statistic is medium value of width and length for whiskers
  - Might be good to know the occurrence CDF % like with 95% certainty all whiskers will be below a certain value
  - Final detail, end data:
    - Frequency of occurrence (total count of bridges), critical pairs, and distinct count of occurrence (83% of simulations had this pair bridge at least once)
    - Probability: data in excel, the pair either has 0 bridges or at least 1 bridge.
    - If there is at least one bridge it counts as 1 fail for that iteration
    - 1. # of sims with zero bridges
    - 2. # of sims with at least 1 bridge or more
    - 3. # of bridges (N) (0-end value) vs # of iterations with N bridges (Adds up to total number of iterations), how many had no bridges
    - 4. Bridged pairs (use generic language
    - 5. Histogram
  - Recommended length and thicknesses to use:
    - Length: 5(mu) and 1.15(sigma)
    - Thickness: 1.17(mu) and 0.67(sigma)

Group Members Present: Kurt Knudsen, Nathan Nichols, Shawn Eom, Spencer Hurst
Group Members Absent: Carson Reams

Scheduled Start Time: 6:30 pm   **Actual Start Time: 6:32 pm**
Scheduled End Time: 7:30 pm   **Actual End Time: 7:12 pm**

Meeting Agenda:

Weekly team meeting to discuss questions and discuss overall progress. Go over end of semester plan with team and prepare for last tag-up meeting.

Notes:
- Manual Team:
    - Added onto Team 1's manual.
    - Need to read through everything for any changes
    - Update Team 1's photos

- UI Updates:
    - Fixed Conductor and simulation panel
    - Bottom right has new placement
    - Organized a bit better
    - Ask about .exe/ .app files

- STIG:
    - Ask about The IP Address, Host Name, etc. In STIG Viewer
    - Ask about Uploading or implementing code into this or the comments section
    - Ask what the key things are to pay attention to in the STIG checklist such as the "Check Text", or Key information they are wanting to be filled out in the checklist

- Excel Outputs:
    - Check if Carson has added the unit conversion and statistics

- ORR Presentation:
    - Try to finish the presentation early to send to Jay
    - Ask Jay what day he would need the presentation by to review it and get it back to us before our presentation.

Group Members Present: Kurt Knudsen, Shawn Eom, Spencer Hurst, Carson Reams
Group Members Absent: Nathan Nichols

Scheduled Start Time: 3:00 pm   **Actual Start Time: 3:07 pm**
Scheduled End Time: 4:00 pm   **Actual End Time: 3:34 pm**

Meeting Agenda:

Weekly tag-up meeting to go over quick progress. Check up with Cyber team at MDA for STIG checklist and questions.

Notes:
- Showed Progress:
    - Web Beta will close December 5th, download app file will be in the GitHub repository at hand-off
    - Excel
        - Implemented changes Jay, Kurt, and Carson went over; will need organization still
        - Future things to implement:
            - Slicers to give uses access to view exactly what they want (choose specific pads for analysis and statistics
- STIG:
    - Haven't made too much progress yet
    - Regarding far-right panel (host name, ip address, etc), do we have to fill it out each time
        - Not necessary to fill out (application doesn't change from computer to computer). In target comments, fill out that the STIG is just for our application
    - Uploading Code/Implementing Comments?
        - The comments box is for comments about that group ID (ie log on session limiting) describing how or why it is or isn't compliant. Can lead to things like "no we didn't fully address all requirement but if we did implement it, it would break XXX functionality"
    - Not a finding and open meaning:
        - Not a finding means it is good/compliant/meets the requirement as required in the STIG. Open means that is open/not compliant/don't meet the requirement. There are things that can be marked N/A (ie V-265634), depending on the application and what it's being used for. Explain in comments why it's N/A
    - Anything to pay more attention to?
        - Go by "Check Text:" to find what is most important to be compliant with a certain thing in checklist.
        - Static Analysis tools can help fill STIG checklist out.
    - Advice/Comments?
        - How to identify the most critical information
            - Check "Check Text:
            - Checklist "Cat I" are the most critical checklist items, then "Cat II", then "Cat III"
                - "Cat I": if there are findings, those are considered vulnerabilities, and will result in a loss of confidentiality, etc. **(FOCUS FIRST)**
                    - Github/Unity: they will have you change passwords, etc.
                - "Cat II": potential to result in a loss of confidentiality, etc.
                - "Cat III": degrade measures to insure confidentiality, etc.

- Presentation:
    - Send presentation to Jay for feedback any time before the 4th

- Other Notes:
    - Jay and Leah break Thursday and Friday (reachable from M-W)

Group Members Present: Carson Reams, Nathan Nichols, Shawn Eom, Spencer Hurst
Group Members Absent: Kurt Knudsen

Scheduled Start Time: 7:00 pm **Actual Start Time: 7:08 pm**
Scheduled End Time: 10:30 pm **Actual End Time: 10:17 pm**

Meeting Agenda:

Sunday meeting to work on final report, manual, and ORR presentation before the deadline on 12/02/2024.

Notes:

- Progress:
  - Organized the ORR presentation and report
  - Founds and added images to the ORR presentation
  - Captions for images were made
  - Began writing sections in the report

- Tasks to do:
  - Have Kurt send out ORR presentation draft to Jay for feedback

Entry Number: 46   **Date: 12/01/2024**

Group Members Present: Kurt Knudsen, Carson Reams, Nathan Nichols, Shawn Eom, Spencer Hurst
Group Members Absent:

Scheduled Start Time: 6:00 pm   **Actual Start Time: : pm**
Scheduled End Time: 11:59 pm   **Actual End Time: : pm**

Meeting Agenda:

Meeting to finalize and write the final report of the semester. Additionally, finalizing the design notebook and preparing for our upcoming ORR presentation on Thursday, December 5th.

Notes:

- Progress:
    - Organized the ORR presentation and report
    - Founds and added images to the ORR presentation
    - Captions for images were made
    - Began writing sections in the report

- Tasks to do:
    - Have Kurt send out ORR presentation draft to Jay for feedback

Entry Number: 47   **Date: 12/02/2024**

Group Members Present: Kurt Knudsen, Carson Reams, Nathan Nichols, Shawn Eom, Spencer Hurst
Group Members Absent:

Scheduled Start Time: 6:30 pm   **Actual Start Time: 5:24 pm**
Scheduled End Time: 11:59 pm   **Actual End Time: 10:33 pm**

Meeting Agenda:

Meeting to finalize and write the final report of the semester. Additionally, finalizing the design notebook and preparing for our upcoming ORR presentation on Thursday, December 5th.

Notes:

- ORR Report:
    - Written report finalized
    - Made sure reference tables (ie. List of Tables, List of Figures, and Table of Content) displayed all the information
    - Made sure all figures were labeled correctly
    - Made sure all tables were labeled correctly
    - Made sure references section was in the proper format (IEEE)

- Presentation:
    - Made sure images in presentation correlated with images in report
    - Made sure images were of good quality

- Design Notebook:
    - Added final entry
    - Made sure formatting was correct
    - Made sure entry information (date, times, entry #, etc.) was correct

- Made a list of tasks left to do:
    - ORR Presentation Finalization
    - User Manual Updates and printout before presentation
        - Add a functionality section for each script in the user manual
    - Upload all relevant project files to GitHub
    - GitHub ownership transfer
    - STIG security check