

Computational Final

Megan Dalton

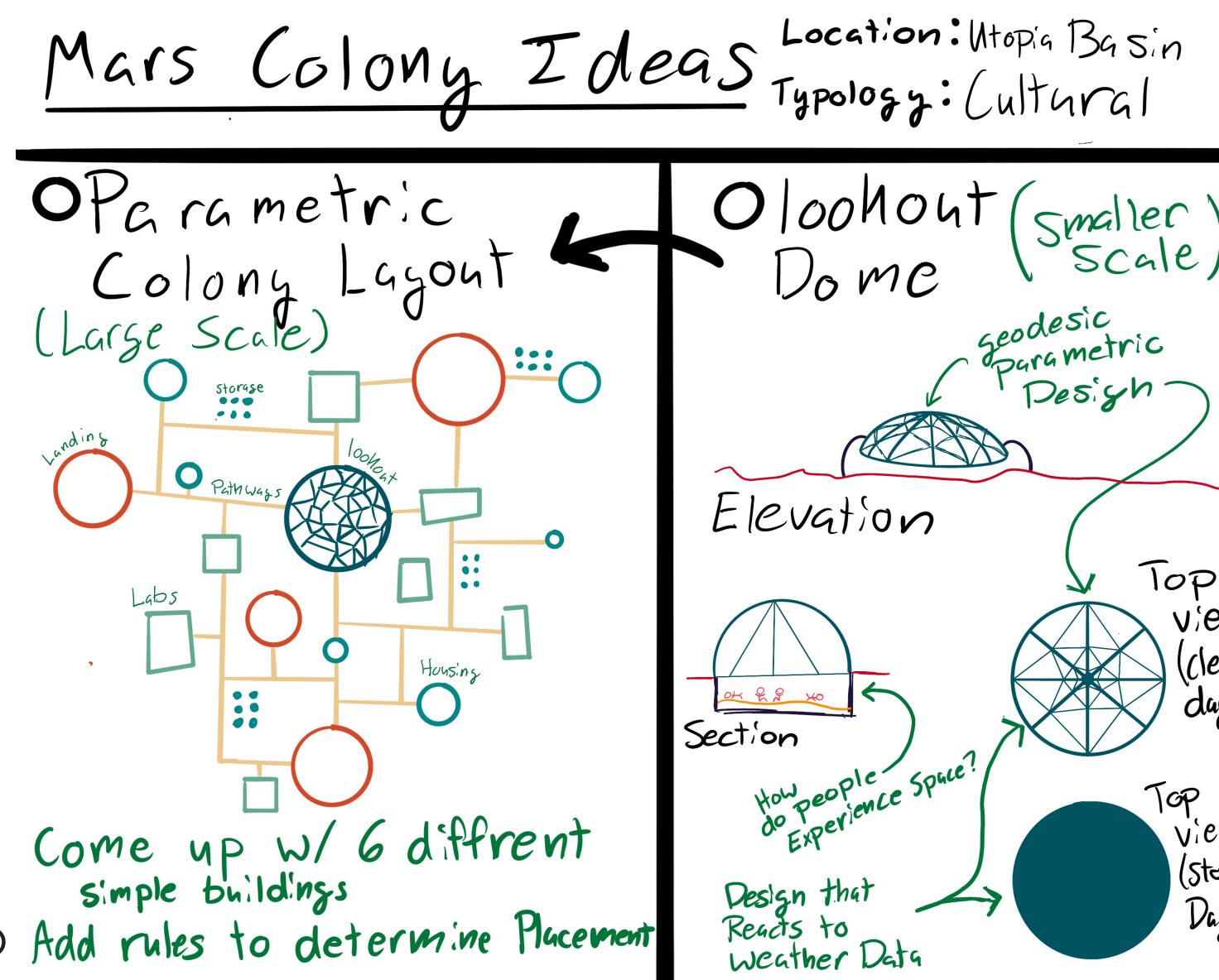
Arch 575

Spring 2025

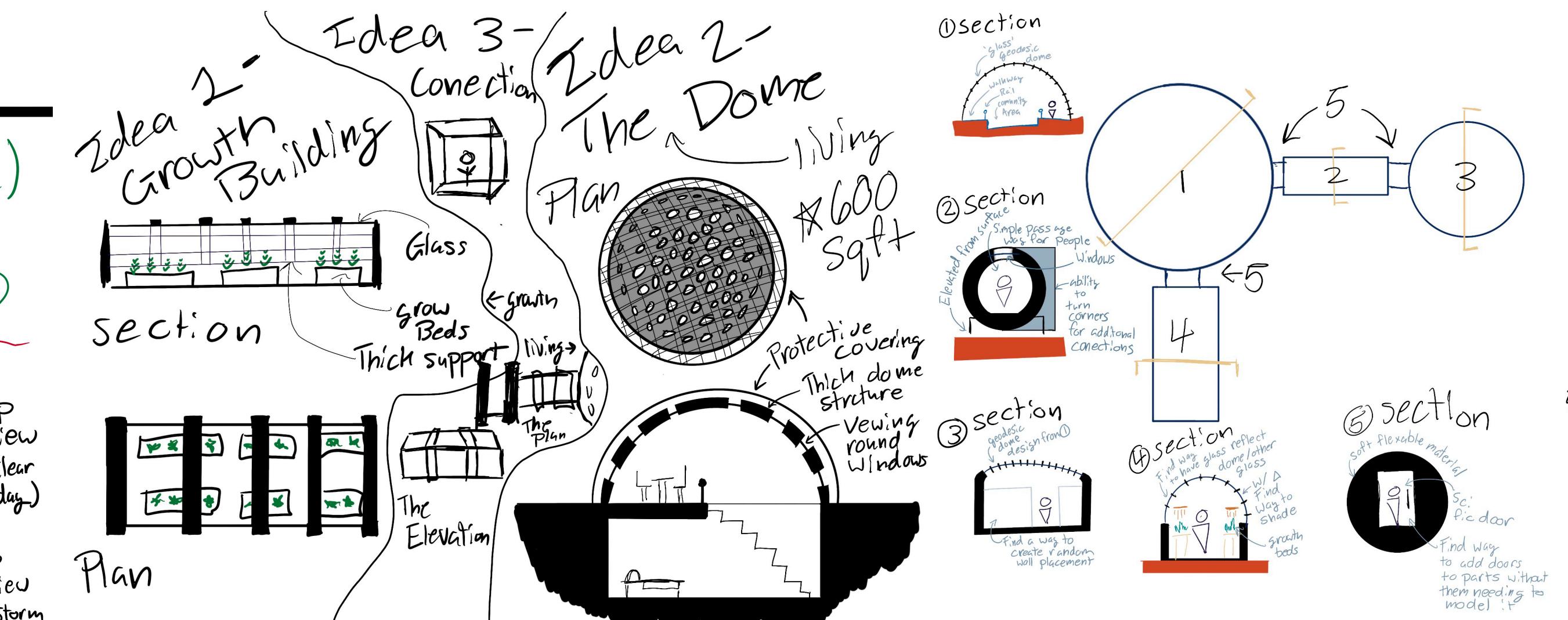
Design Development

I knew early on in the design process that I wanted to create a design that could work in space. Specifically I settled on a Mars colony idea. The modular nature of the class seemed like it would lend itself well to creating several modules that would connect with one another. It quickly became apparent that this was likely too lofty of a goal for the time period of the class. This led to the second iteration of sketches where I chose to focus in on a domed living area and a greenhouse space. The hope was to find a way to connect these two ideas to speak back to the modular nature of the original idea. Through several iterations of design I decided to focus in on just designing each part. This led to the third iteration of sketches. These sketches tried to further develop several of the ideas I had. The scale of the design was still large than I could tackle. I plan on continuing to iterate on this design till I can achieve a similar design.

From the third sketch the biggest take away I had was to focus in on a domed space that acts as a connecting space. When it came to rendering this space, I utilized TwinMotion and its unique tools. The customization features available in the program allowed me to mimic what the exterior of the dome would look like in the Mars setting. Through several experiments, I was able to get it so the glass was opaque from the outside and transparent on the inside. When it came time to determine what went in the center of the dome, I decided to continue the growing trend and add a apple tree.



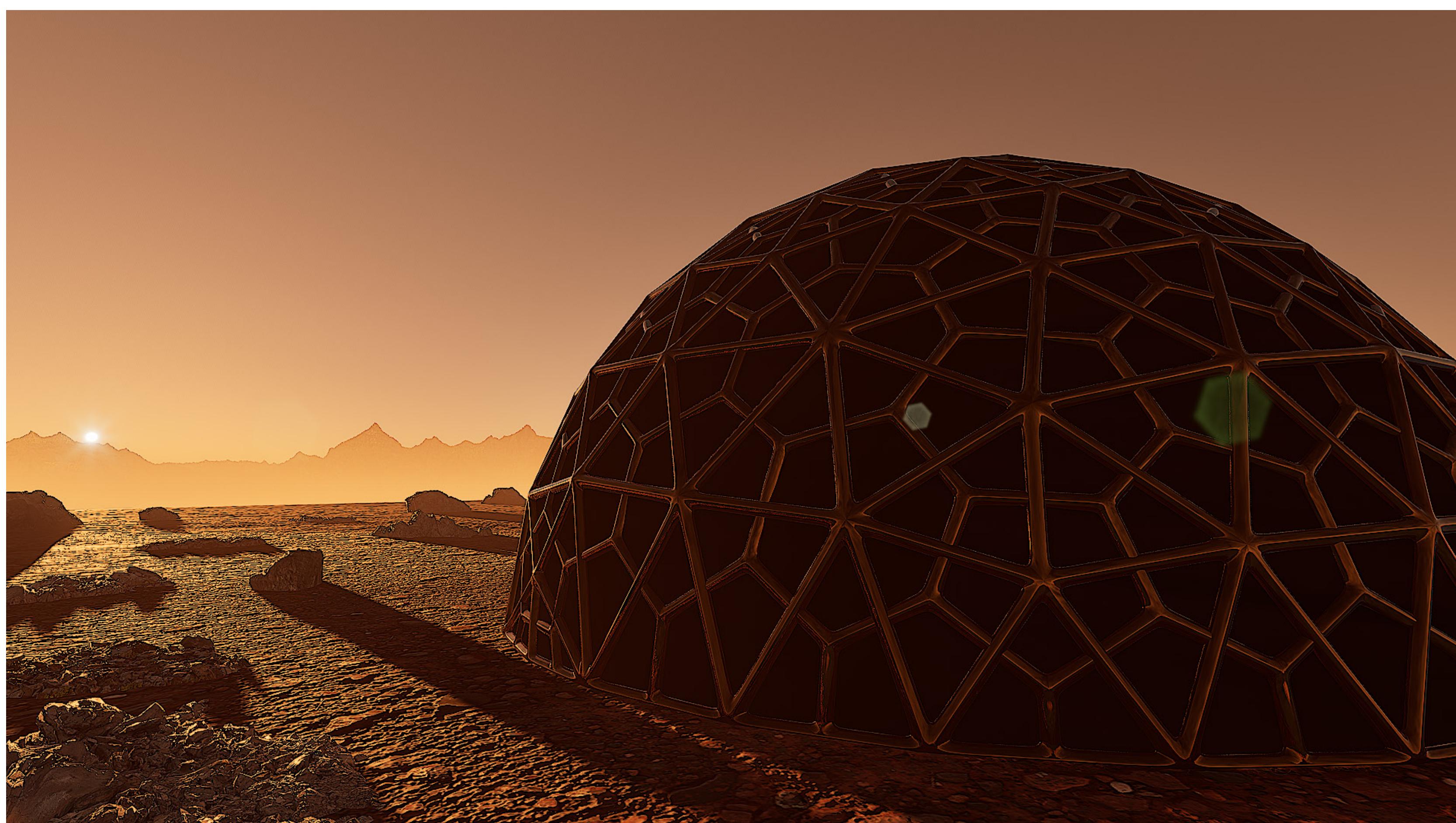
First Iteration Sketch



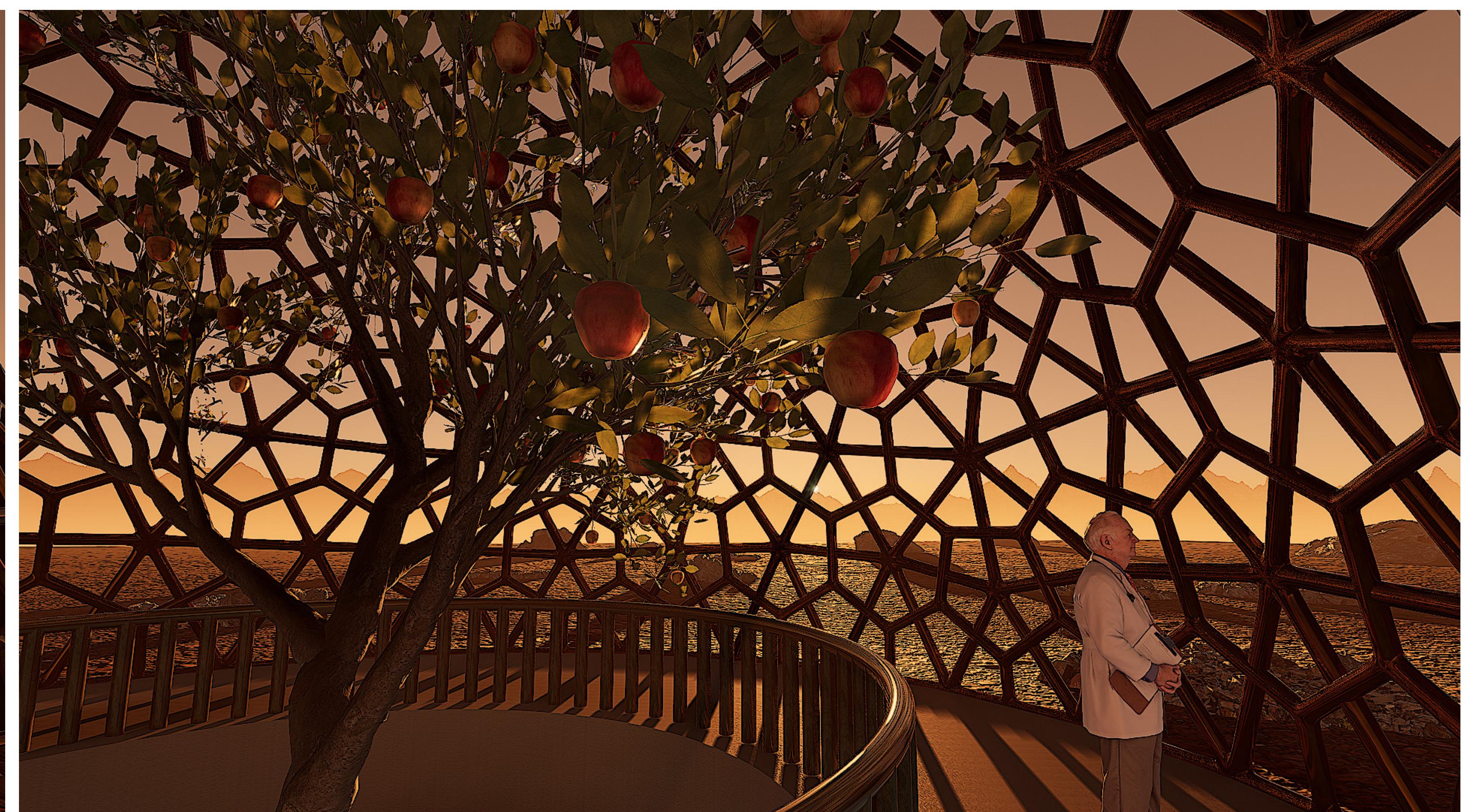
Second Iteration Sketch

- Parts (5) -
- 1) Geodesic dome
 - 2) Hallway Space
 - 3) living area
 - 4) Green House
 - 5) Connector Piece

Third Iteration Sketch



Exterior Rendering



Interior Rendering



Site Development

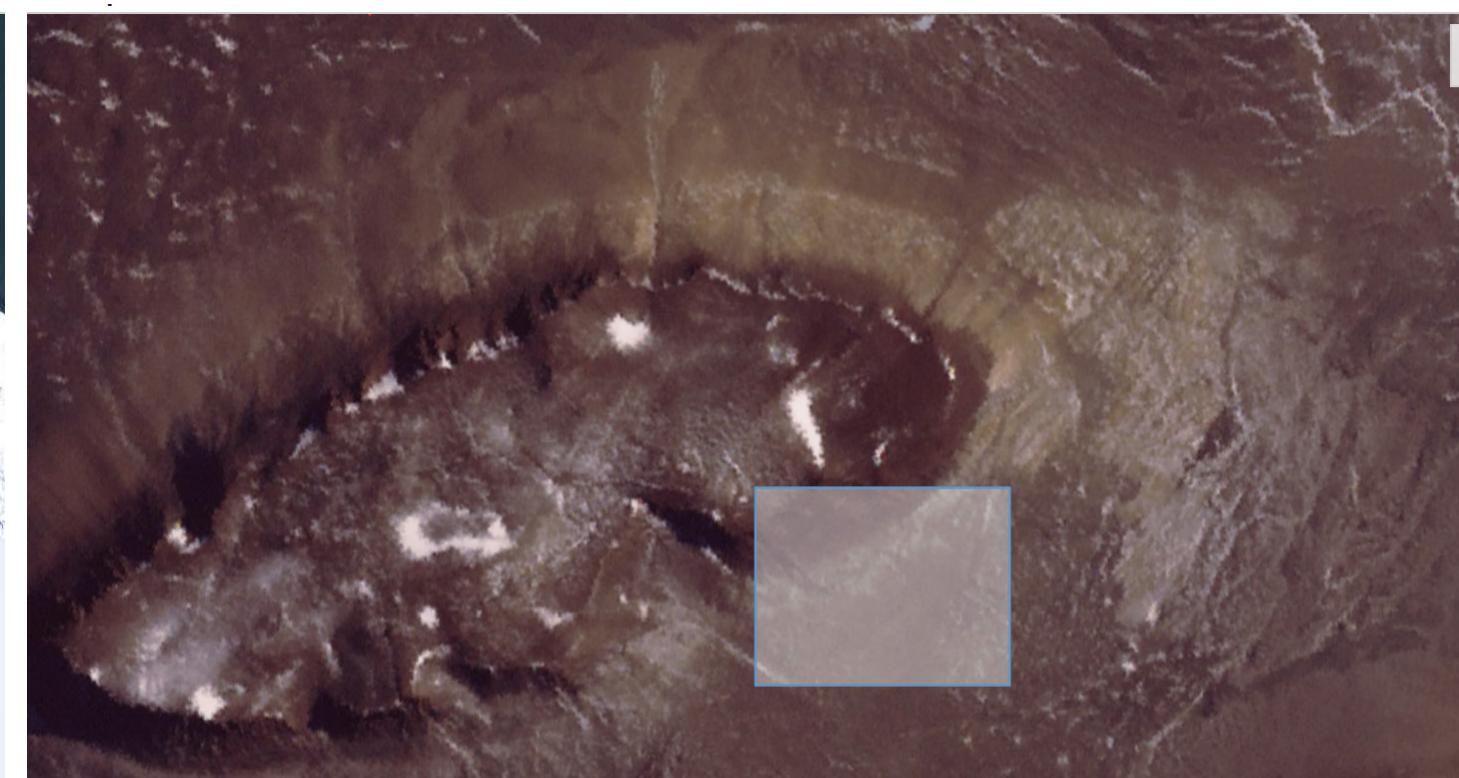
I knew from the beginning I wanted to create a design on Mars. The problem I quickly learned was that there is very limited information about Mars that is available to the general public. Despite this I knew there were several tools I wanted to learn that used locations on Earth to provide unique data. To work around this issue, I proposed that this would be an experimental design that would need to be tested on Earth. When I started learning about where space habitats where being tested, I discovered the McMurdo Dry Valley. They are a row of largely snow-free valleys in Antarctica, located within Victoria Land west of McMurdo Sound. The Dry Valleys experience extremely low humidity and surrounding mountains prevent the flow of ice from nearby glaciers. These features make the space similar to what might be expected in space.

When it came to making a contour map of the area I ran into several issues. To start with, I struggled to understand the exact scale of the area I was referencing. Once I was able to analyze the pointcloud to create a LiDAR map I realized it was hundreds of miles wide. The second attempt, I made sure to pay attention to the scale and size.

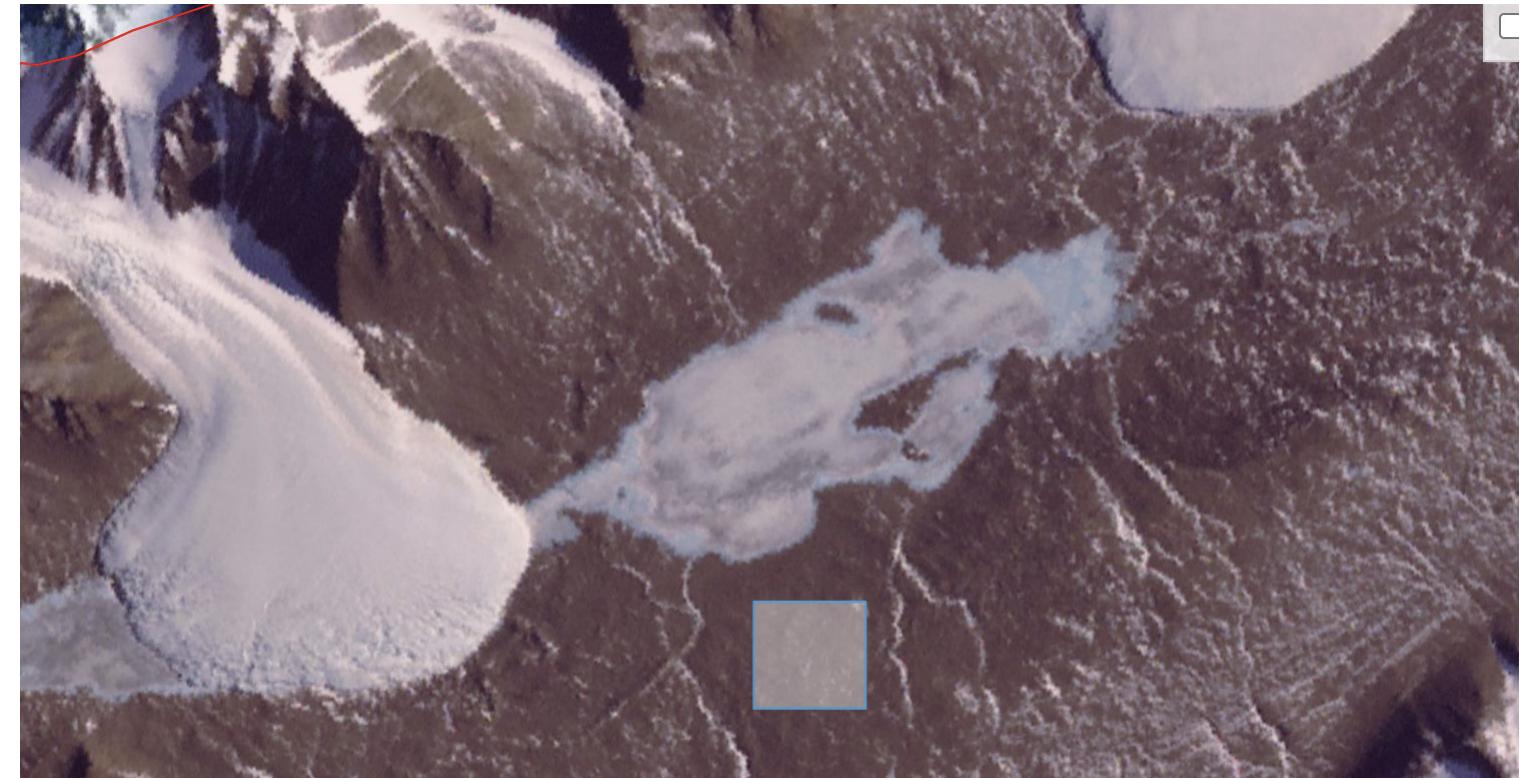
Once I had the area picked out I next wanted to learn how to get weather data. The easiest way to do this was to utilize Ladybug plugin with Grasshopper. I tried to find data directly from mars but the mars to day ratio created a lot of confusion.



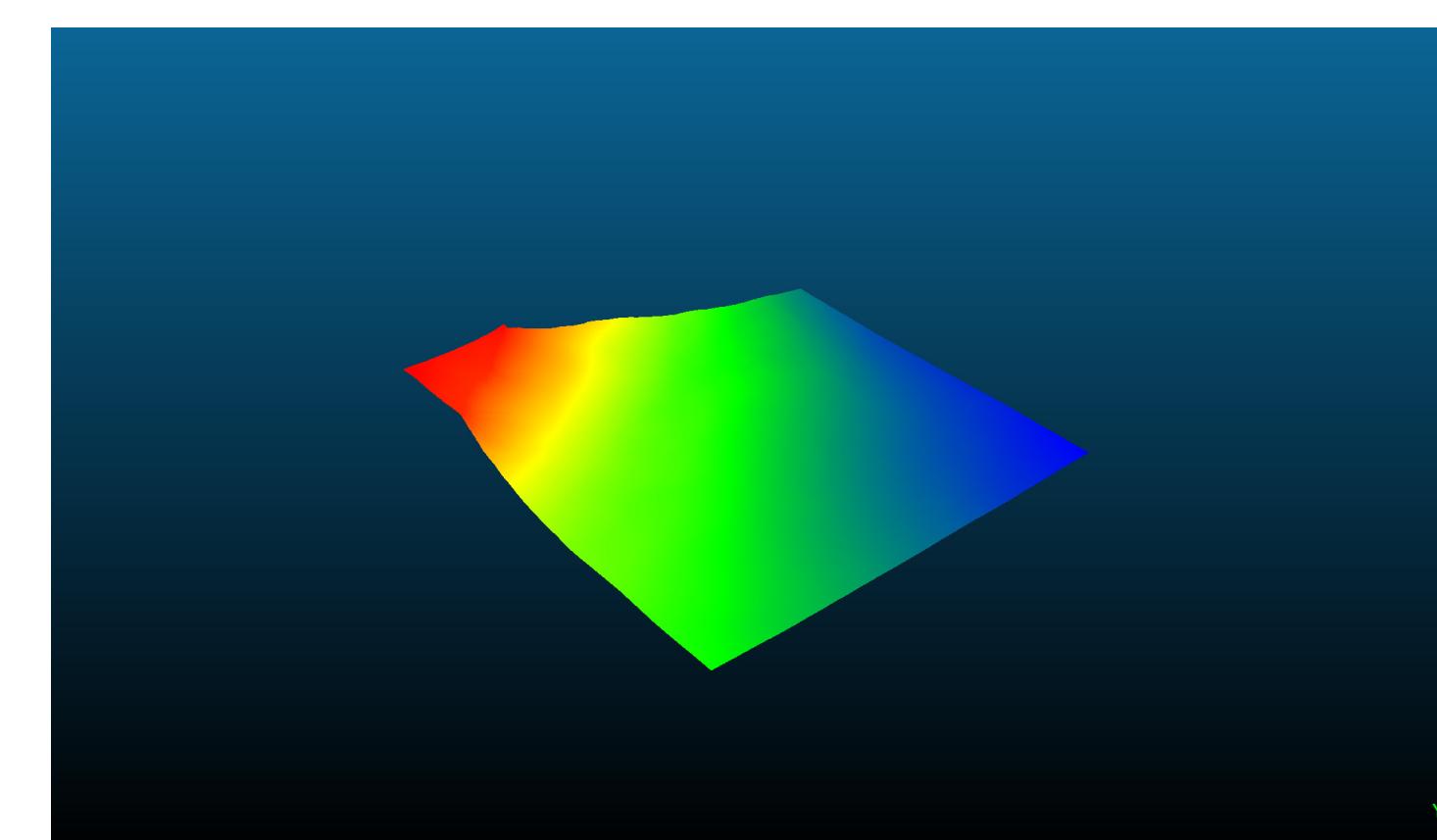
The McMurdo Dry Valleys



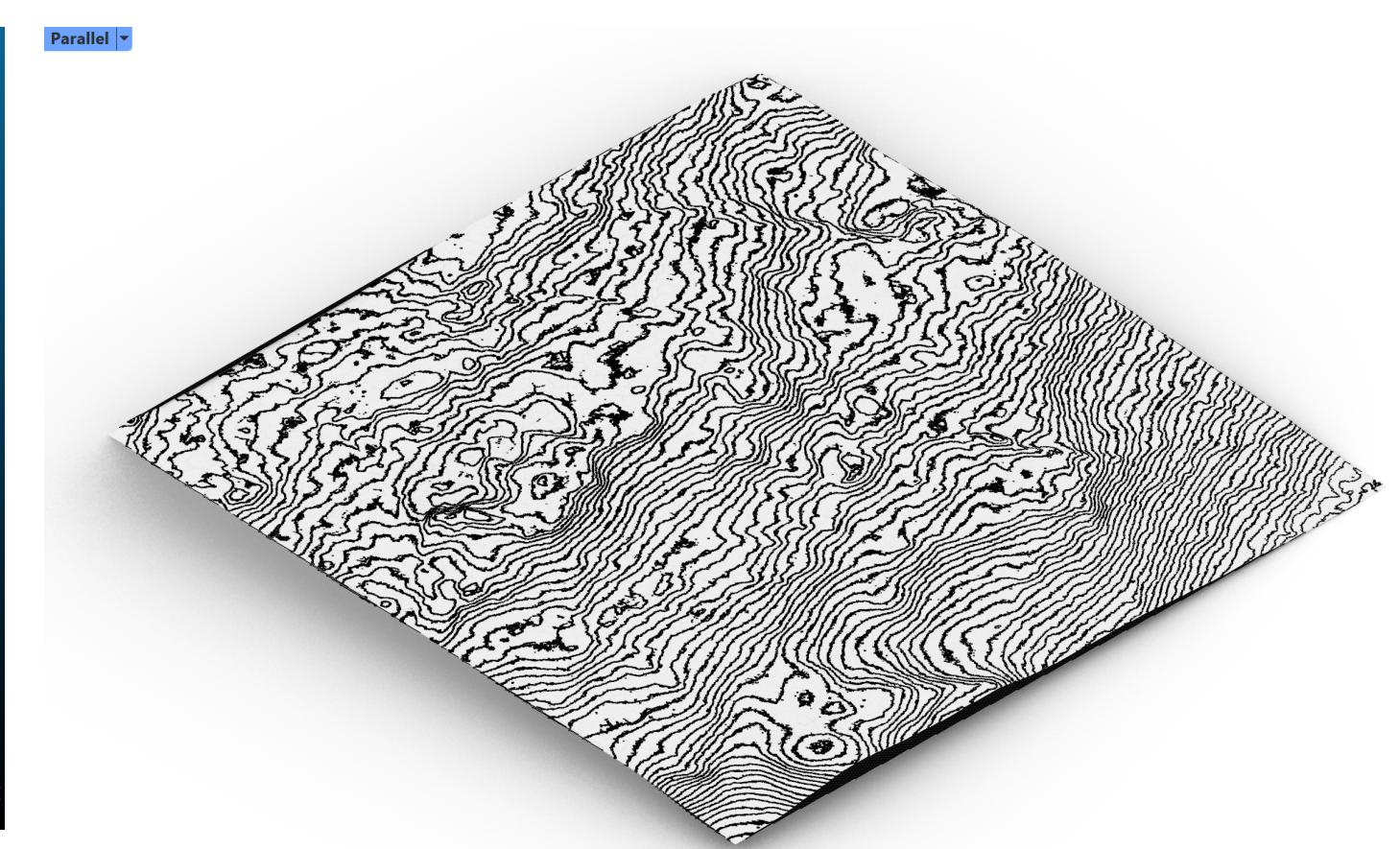
Initial Site Selection



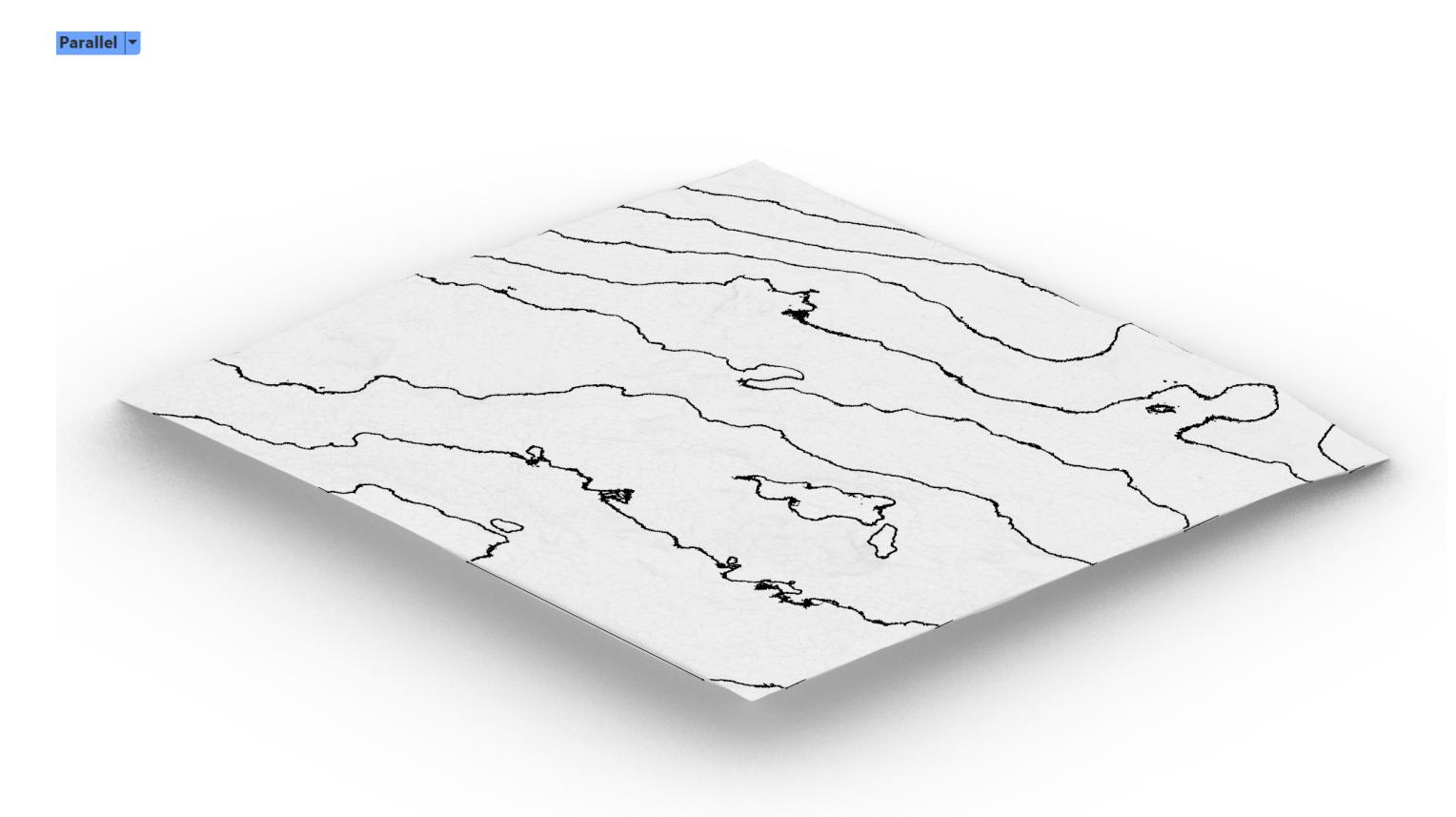
Final Sight Selection



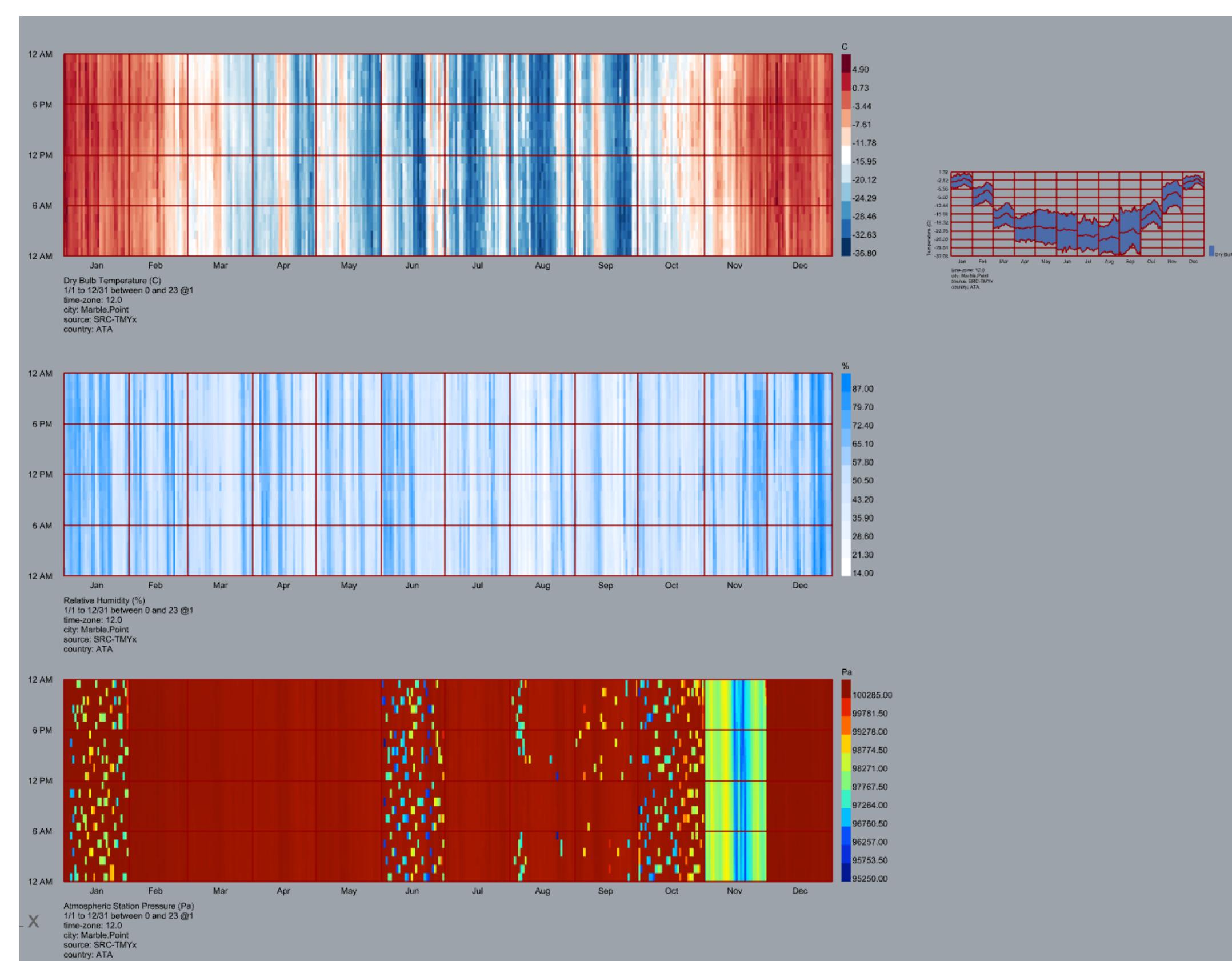
Initial Site Relief Shading



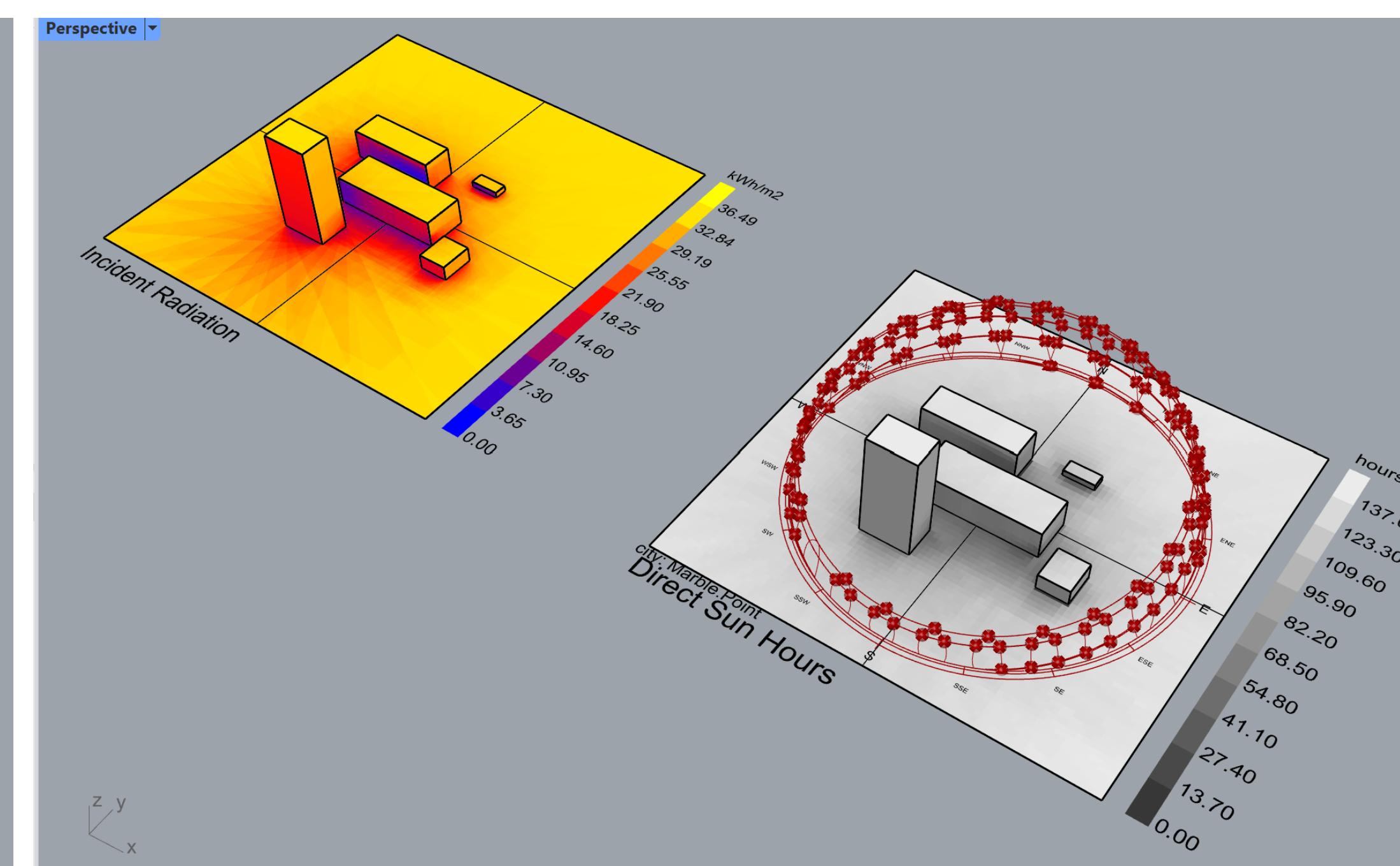
Final Site Selection 1ft Contours



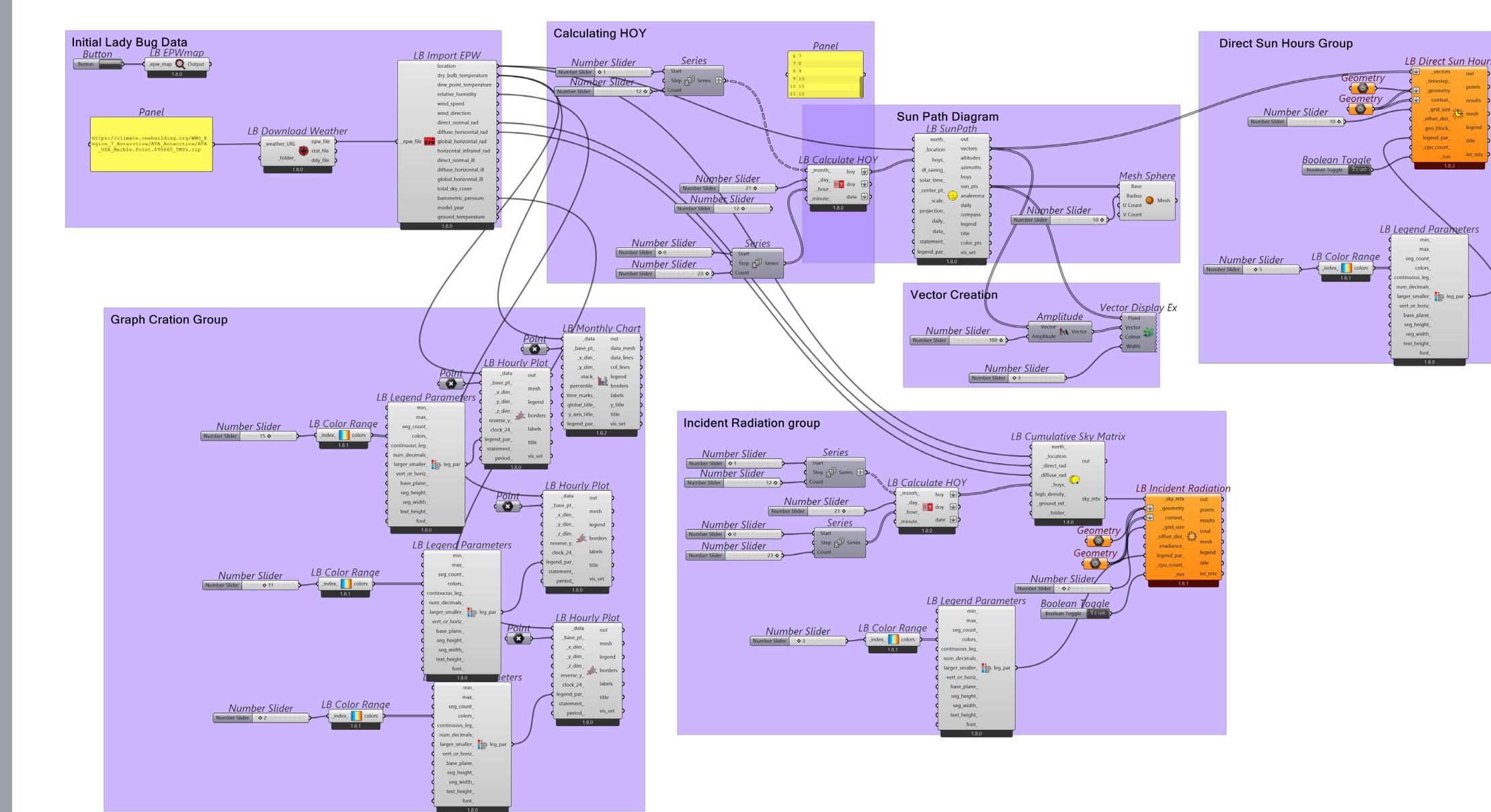
Final Site Selection 10ft Contours



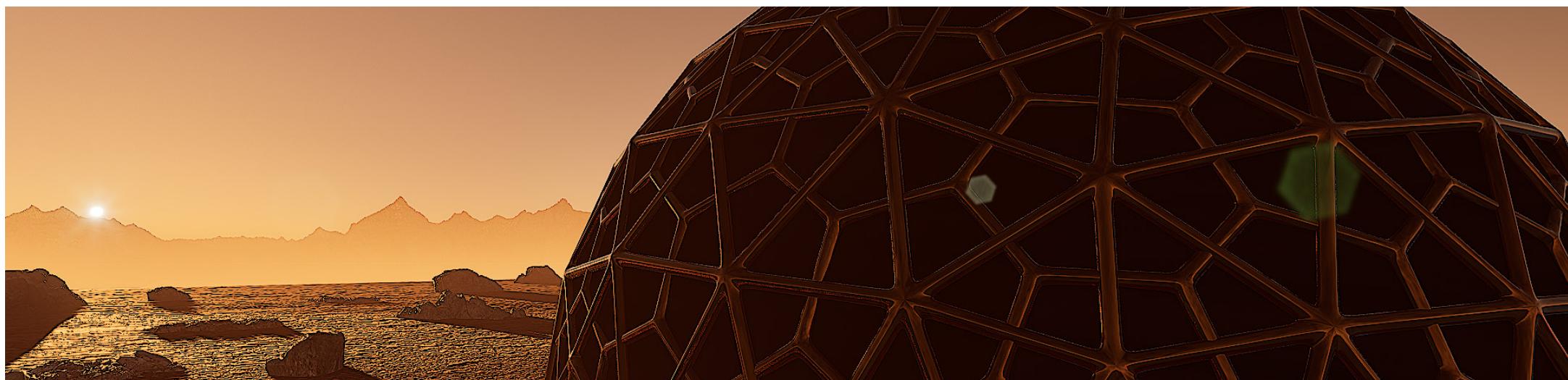
The McMurdo Dry Valleys Temp. Charts



The McMurdo Dry Valleys Sun Studies



Grasshopper Script that Produced Weather Data



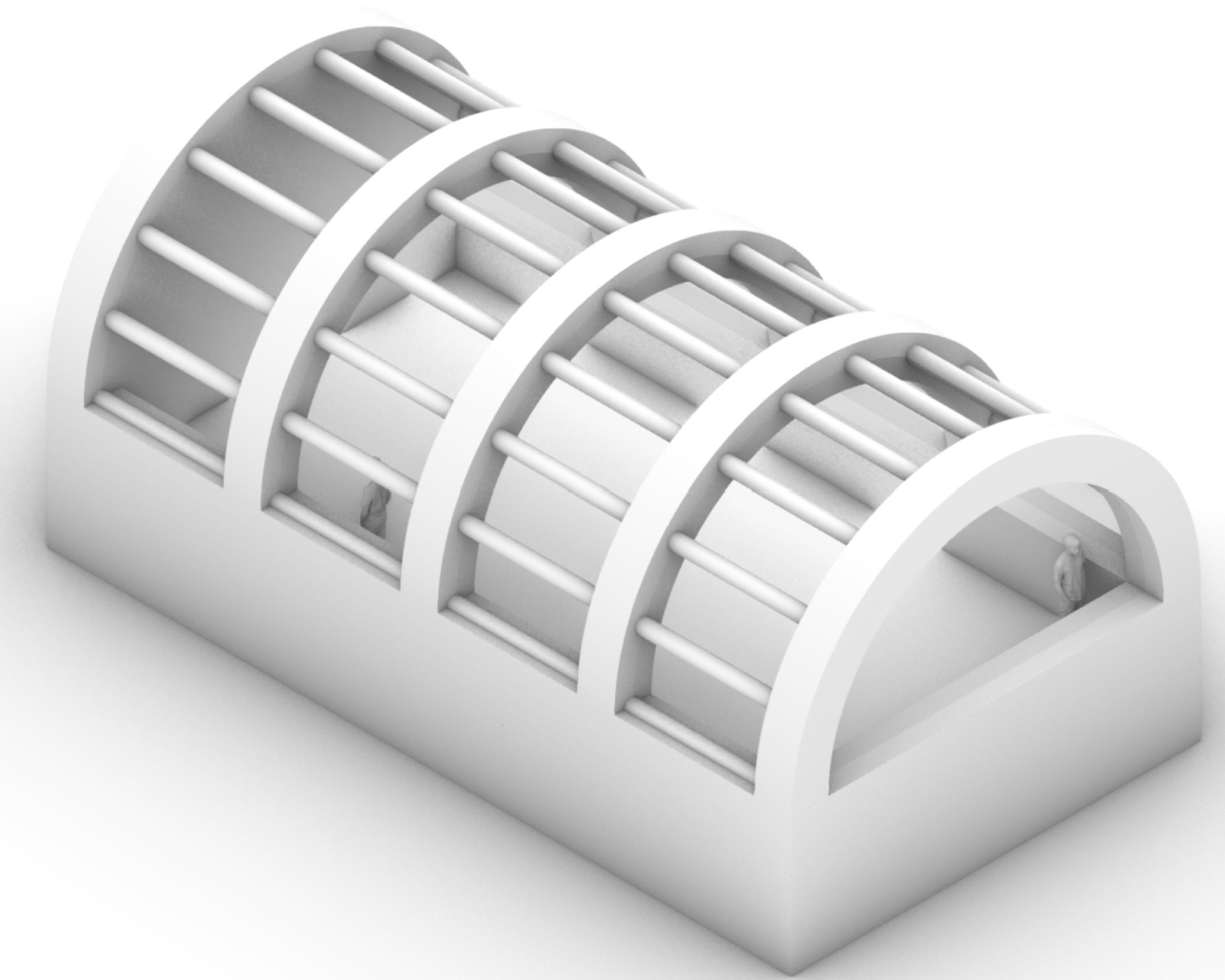
Design Details

Through sketching and drawing out the variety of ideas I had in regards to this project, I ended up creating two different designs. While both designs feel very simple, I challenged myself to create everything through Grasshopper. This ended up complicating things more than I expected. Despite these complications, I ended up learning far more about Grasshopper. Another program I ended up having a lot of problems with was the RhinolInside plugin for Revit. Despite trying several fixes and changes, I was never able to get the application to work.

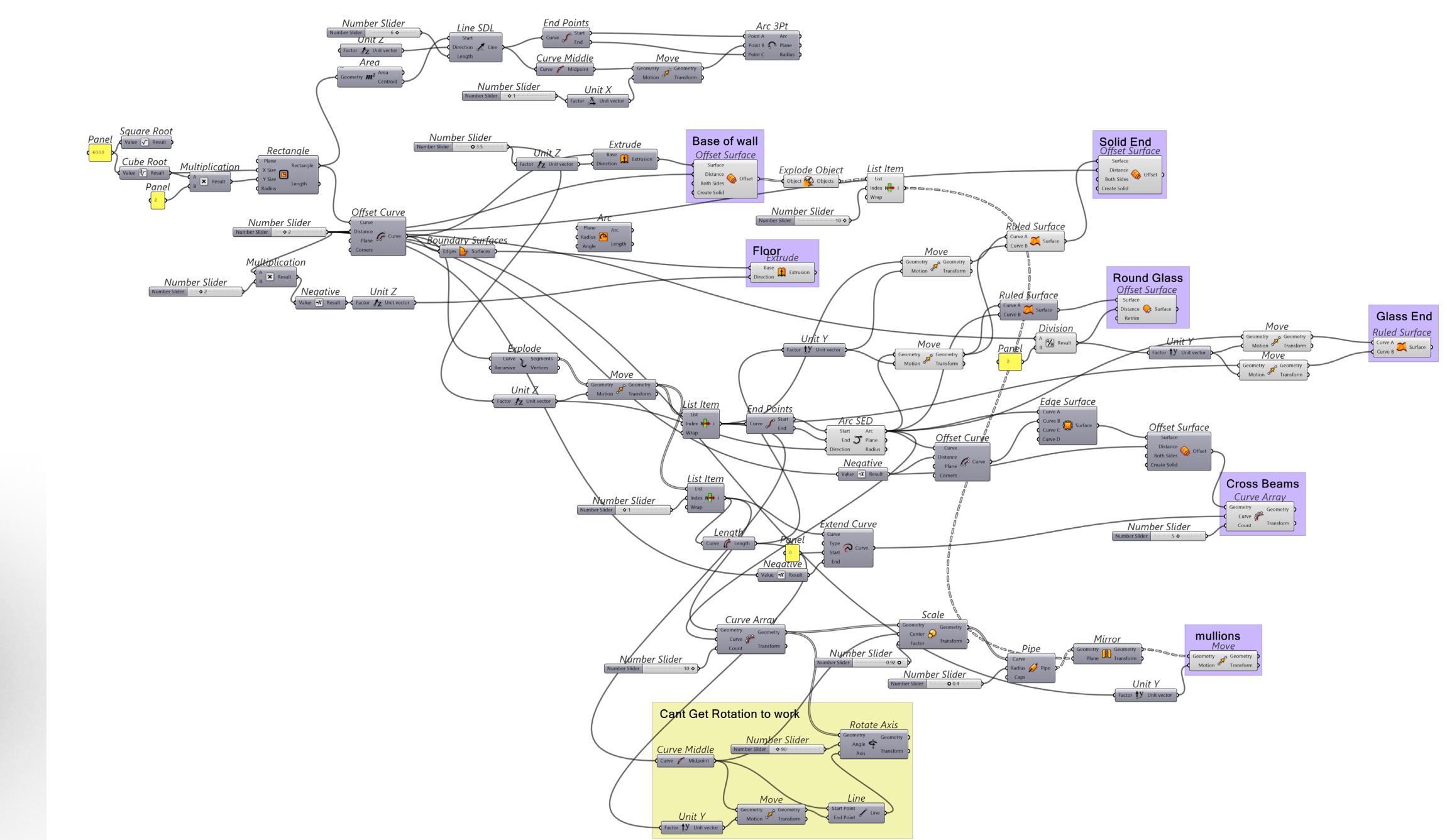
The first design I created was the Greenhouse. When I originally proposed this design I was hoping I could create some sort of shading device. The idea was to utilize the Ladybug plugin to read data and change the shading based on the conditions. This condition ended up falling to the side as I encounter issues getting data from Mars.

The next design I created was the Dome. I have always wanted to create round architecture and this was a fun attempt at it. The unique patterning on the dome originally started as a miss click in Grasshopper but I quickly grew to really enjoy it.

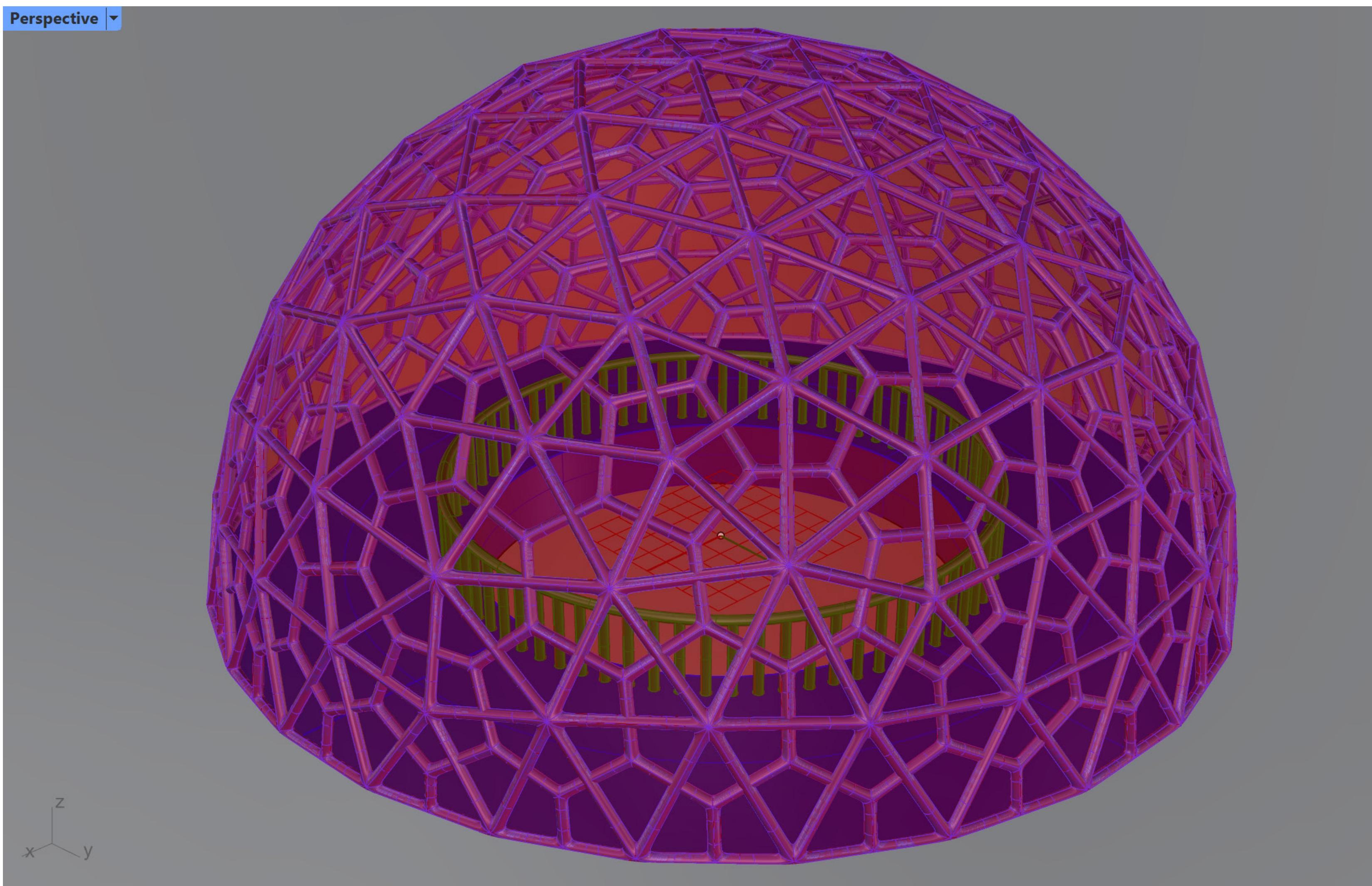
I plant to continue working to connect these two components.



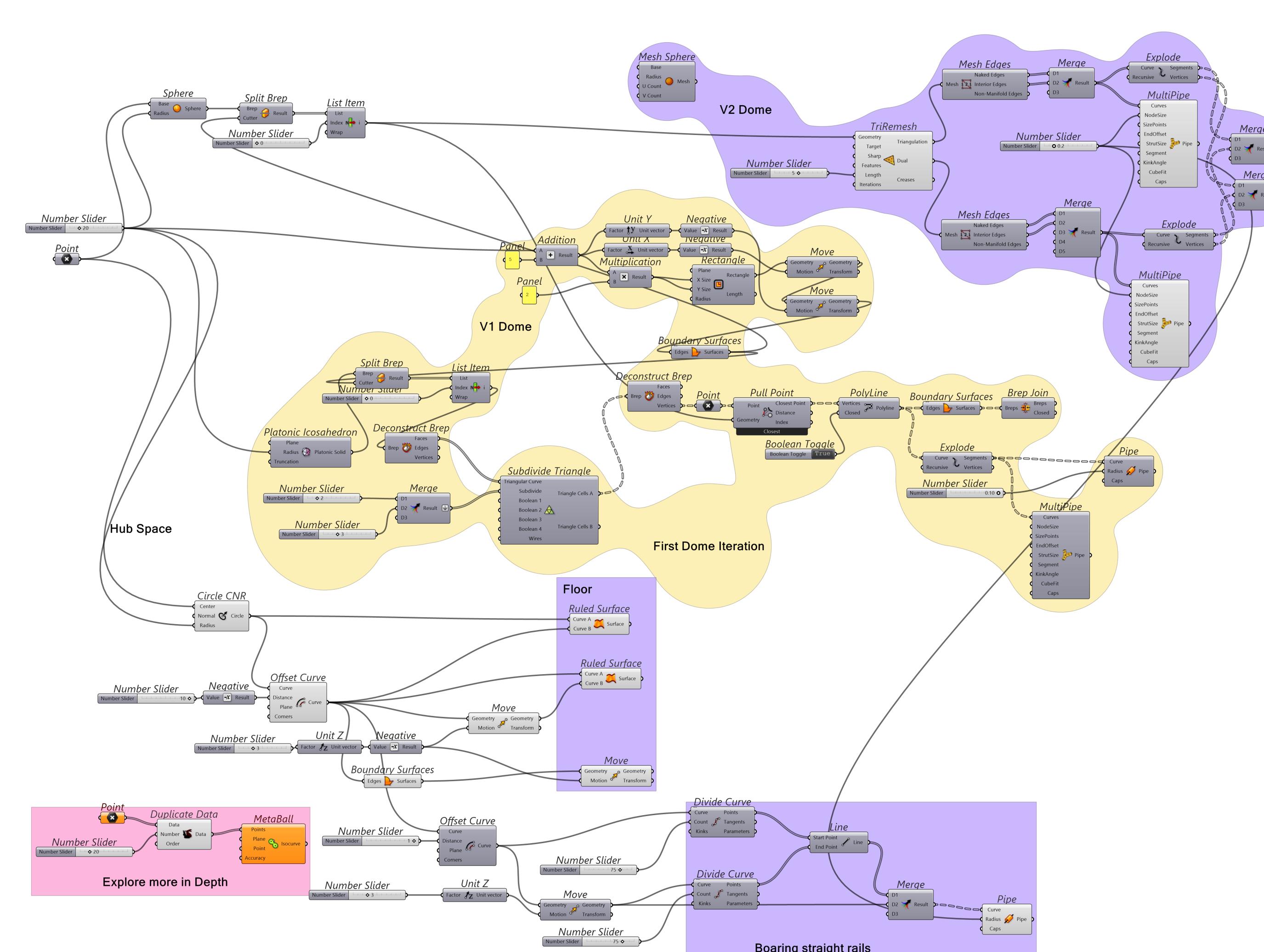
Greenhouse Design



Greenhouse Design Grasshopper Script



Communal Dome Design



Communal Dome Design Grasshopper Script