GEORGIA INSTITUTE OF TECHNOLOGY

PROJECT REPORT

GT Pioneer

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A report submitted in fulfillment of the requirements
for the team project of ME 1770

in the

Group X
George W Woodruff School of Mechanical Engineering

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Chapter 1

Project Ideation

1.1 Project Proposal

1.1.1 Description of Product / Structure: Describe the creative ideation and what is new?

Our product is a Mars capable ATV. We began with the idea of the standard ATV, coupled with the idea of a manned Mars rover. By combining these two concepts, we were able to create a more agile vehicle capable of handling Mars' low gravity and dusty environment. The combination of a pressurized capsule in an off-road vehicle can be challenging but the benefits would be immense in creating robust vehicles for a manned colony on Mars.

1.1.2 Description of subsystem

Subsystem	Description
Orbital Deployment	Circular parachute and coiled spring shocks.
Grabbers	Pivoting arm with ball socket and grabbing hands.
Suspension	Coil spring shocks, double A-frame suspension and tire rods.
Chassis	Triangular truss support frame.
Tires	Cylindrical tires with embossed treads.
Controls	Joystick,Displays, Plexiglas encased w/ rectangular control panel.
Cockpit	Oblong shaped cockpit
Powertrain	Circular Motor with chain drive to rear axle with rear diff.
Charging	Rectangular solar cells on roof.
Science/Storage	Large prismed storage area in back of ATV.
Communication System	Conic Satellite Dish.
Lighting	Semi-Paraboloid lights mounted on front of ATV.

1.1.3 Subassembly Functionality

Subsystem	Functionality
Orbital Deployment	Landing Gear when ATV is dropped from orbit.
Grabbers	Grabs materials for data inspection.
Suspension	Absorbs shocks from planetary terrain.
Chassis	Beefy frame for surviving rough conditions.
Tires	Extreme grip to handle unexpected terrain.
Controls	Steering, cockpit, seating, etc.
Cockpit	Location of Controls
Powertrain	Electric drivetrain, differential.
Charging	Solar cells from roof to charge batteries behind cockpit.
Science/Storage	Large storage area in back of ATV to collect data/samples.
Communication System	Antenna to communicate with base.
Lighting	To maintain visibility once night falls or in sandstorms.

1.1.4 Allocation for each member

Subsystem	Member	Complexity
Orbital Deployment	Vishakh Kumar	Medium
Grabbers	Justin Sackett	Hard
Suspension	Asimm Hirani	Medium
Chassis	Juan Rodriguez	Hard
Tires	Auston Ferrarer	Easy
Controls	Vishakh Kumar	Hard
Cockpit	Vishakh Kumar	Easy
Powertrain	Asimm Hirani	Hard
Charging	Vishakh Kumar	Easy
Science/Storage	Auston Ferrarer	Medium
Communication System	Juan Rodriguez	Medium
Lighting	Justin Sackett	Easy

1.1.5 Briefly explain what new functionalities (system and sub-system) you are planning to add. How your product is different from existing products:

This design differs from the traditional ATV because it has a improved suspension system for travel along Martian terrain. The ATV will be able to withstand orbital entry into the Martian landscape through its improved suspension and parachute for controlled descent. Additionally for increased driver visibility the pressurized cabin is built with GT-Superglass® which has the material strength of hardened steel and the weight of titanium. With this glass our vehicle will be able to withstand sandstorms containing heavy debris.

1.1.6 Picture of the Proposed System (or Similar System): (please include a reference if you are using pictures from internet). You can also include conceptual sketch.

FIGURE 1.1: Daybreak Games: Planetside 2 ANT Vehicle Concept

FIGURE 1.2: BAJA SAE India Team

1.2 Project Management

With a project as complex as ours, we needed to propose a schedule for each team member to turn their parts in, a system for sharing files and method of team communication.

- Timeline - Gantt Chart using Excel More about the Gantt Chart is explained in the section 1.2.2
- Data management - Google Drive and Github Although Github was more suited to collaborative work, we opted to use Google Drive in order to use a platform accessiblile to all team members. However, Google Drive proved to be a problem as it synced temporary files as well as permanent files, which caused issues with references inside an assembly. We would not reccommend using Google Drive in the future for said reason. At the end of the project, we used Github to sync Solidworks files together and to create our report. We have two repositories for the project and the report.
  - ME1770 files - https://github.com/vishakhkumar/ME1770
  - ME1770 report - https://github.com/vishakhkumar/ME1770Report

1.2.1 Part Distribution

Allocating subsystems among team members

An important element of team success lies in allocating tasks to team members equitably. We kept in mind two factors while allocating tasks:

- The set of tasks that has to be completed (which may be one task or it may be several.)
- The set of individuals (the team members) able to complete them.

Given each team member's skill level and complexity of the part, we assigned tasks as shown in the table 1.1.4

Further notes: Since the cockpit and the controls were interrelated task, it was decided to allocate both tasks to the same person.

1.2.2 Timeline

Planning our project was simple using Gantt chart created in an Excel sheet. We opted to finish our tasks earlier than suggested by the Gantt chart provided to us by our instructor due to our experience with Solidworks and inreased workload at the end of the semester from other subjects. We've included an image of our Gantt chart in the figure 1.3 on page 5.
A detailed view of our timeline can be found at https://github.com/vishakhkumar/ME1770

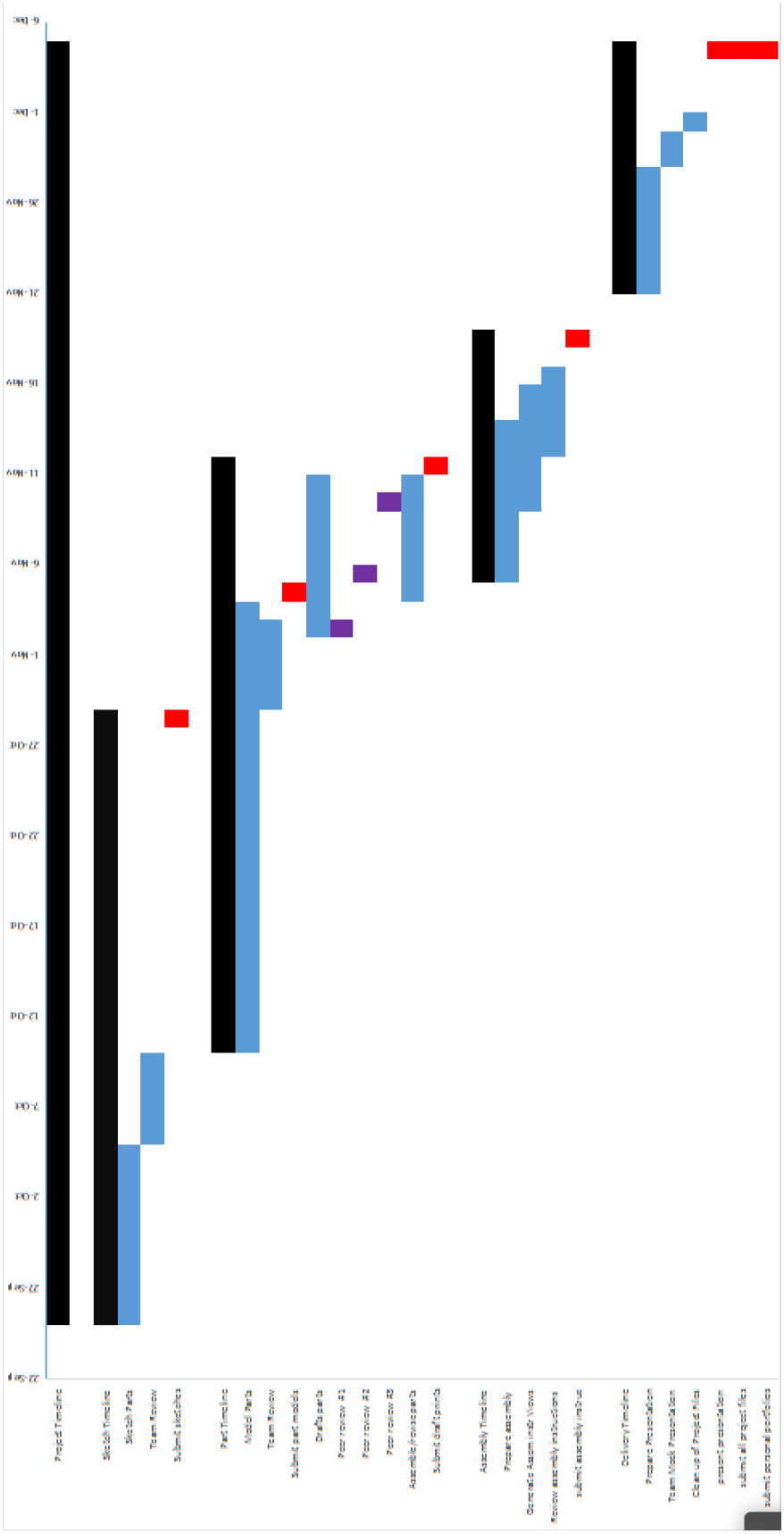

FIGURE 1.3: Gantt Chart

Chapter 2

Preliminary Design

Like any group of engineers,we used our intuition and napkin drawings to visualize our product before we proceded to attempt to build a Mars rover. Preliminary designs also helped us build a context for our group to work on.

2.1 Conceptual Sketches

Our project was fairly ambitious in that we combined two very different worlds - the rough and tumble world of off-road vehicles and the pressurized environments of space vehicles. Conceptual drawings were invaluable in sketching out a basic idea of what this vehicle would look like.

2.1.1 Asimm

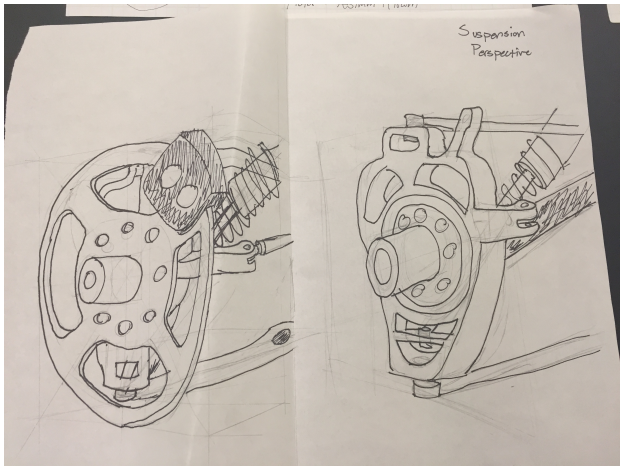

FIGURE 2.1: Hirani, Asimm: Suspension

2.1.2 Auston

2.1.3 Juan

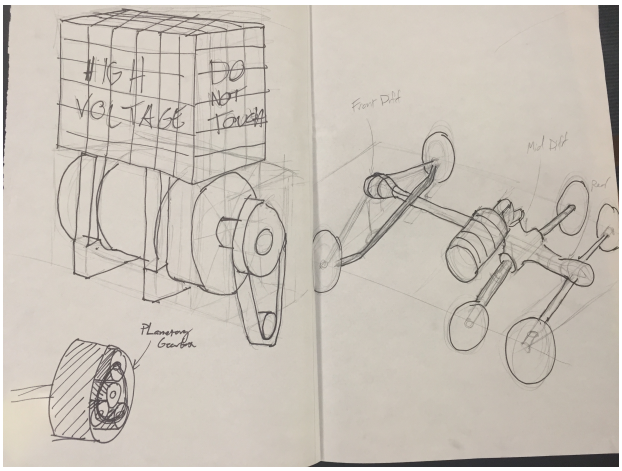

FIGURE 2.2: Hirani, Asimm: Powertrain

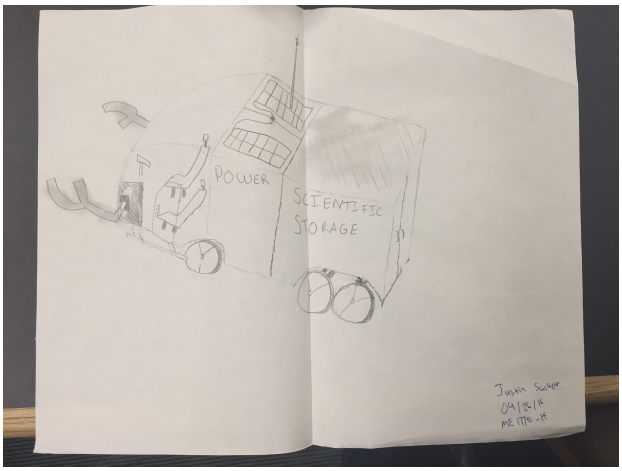

FIGURE 2.3: Hirani, Asimm: Scientiic Storage

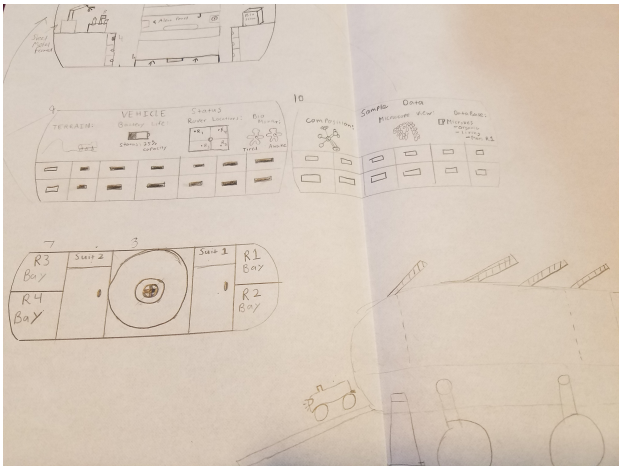

FIGURE 2.4: Kumar, Vishakh: Exterior

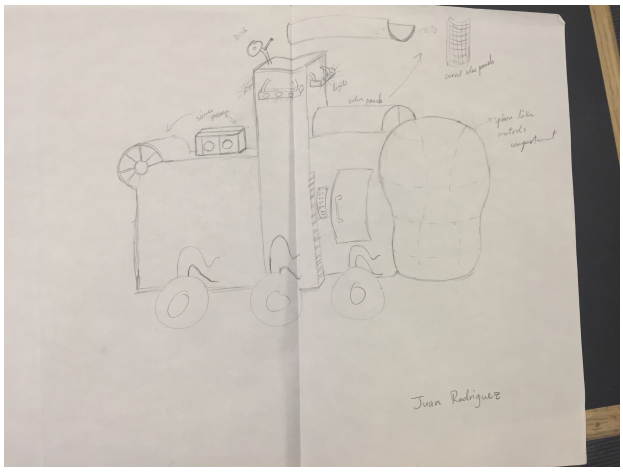

FIGURE 2.5: Rodriguez, Juan: Overview

2.2 Perspective Sketches

After sketching out our conceptual drawings and allocating tasks between team members, we then proceded to create isometric drawings of each assembly and the top level subassemblies. This helped us refine our ideas about what our parts would look like and how we could improve them. As our product was fairly complicated, we also had the benefit of improving our drawing skills - more than a few parts had interesting features that were a challenge to draw.

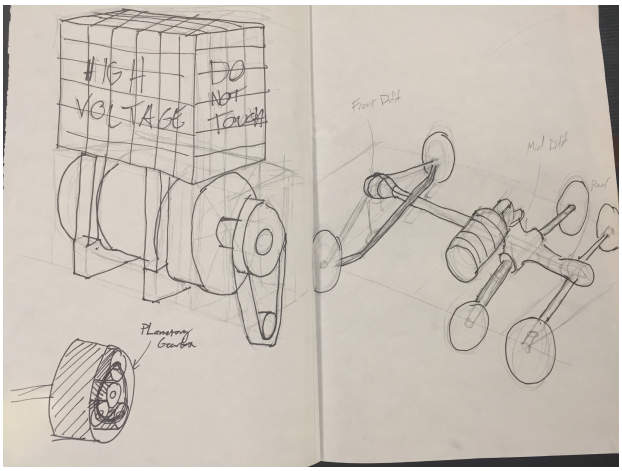

FIGURE 2.6: Hirani, Asimm: Suspension

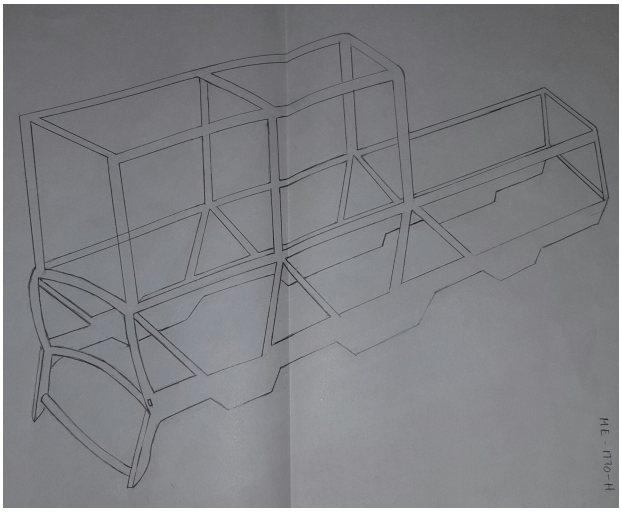

FIGURE 2.7: Rodriguez, Juan:

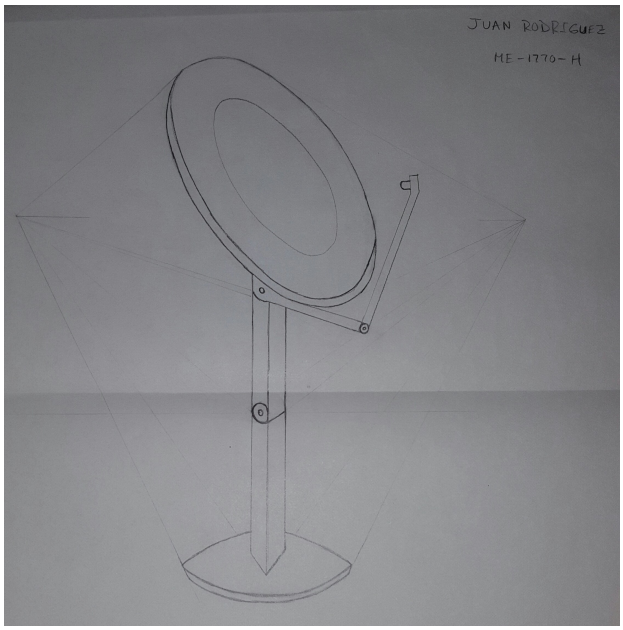

FIGURE 2.8: Rodriguez, Juan:

2.3 Multiview Sketches

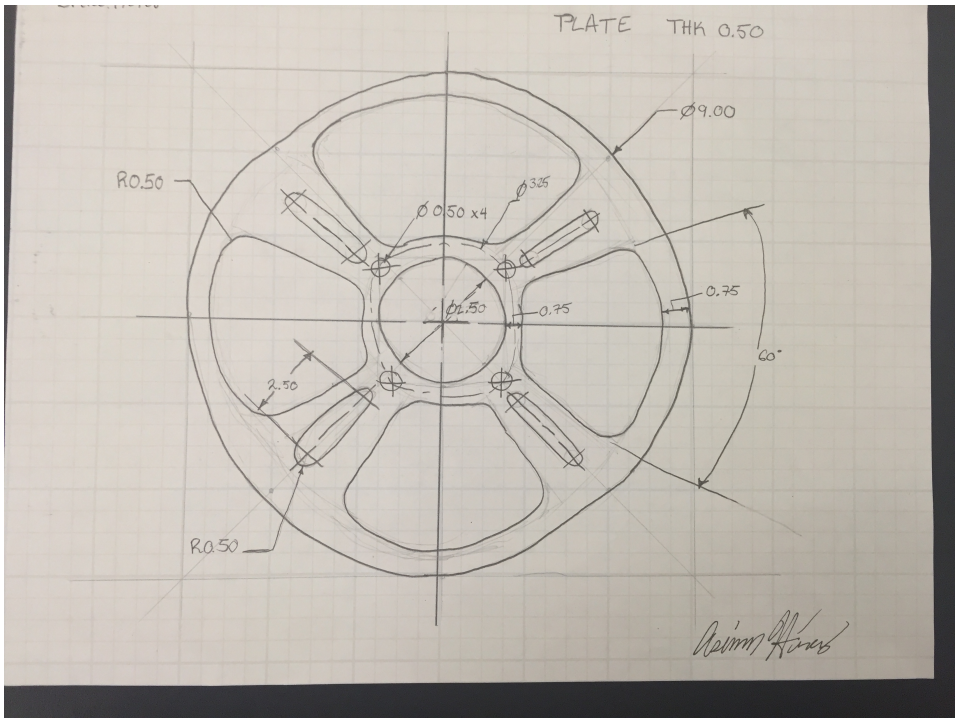

FIGURE 2.9: Hirani, Asimm: Gear One

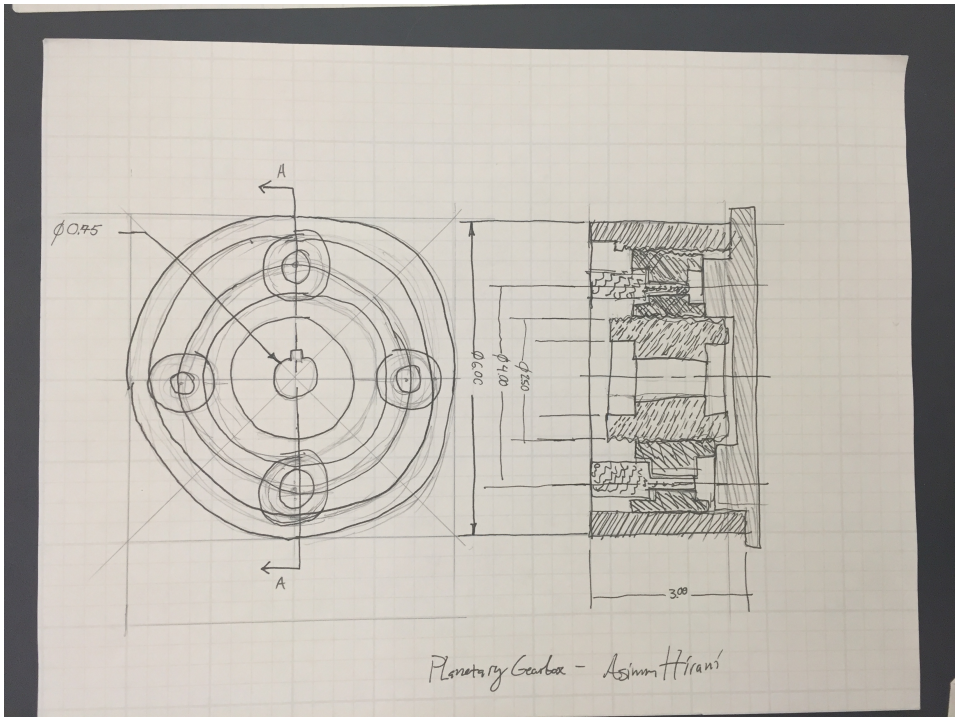

FIGURE 2.10: Hirani, Asimm: Disc BRake

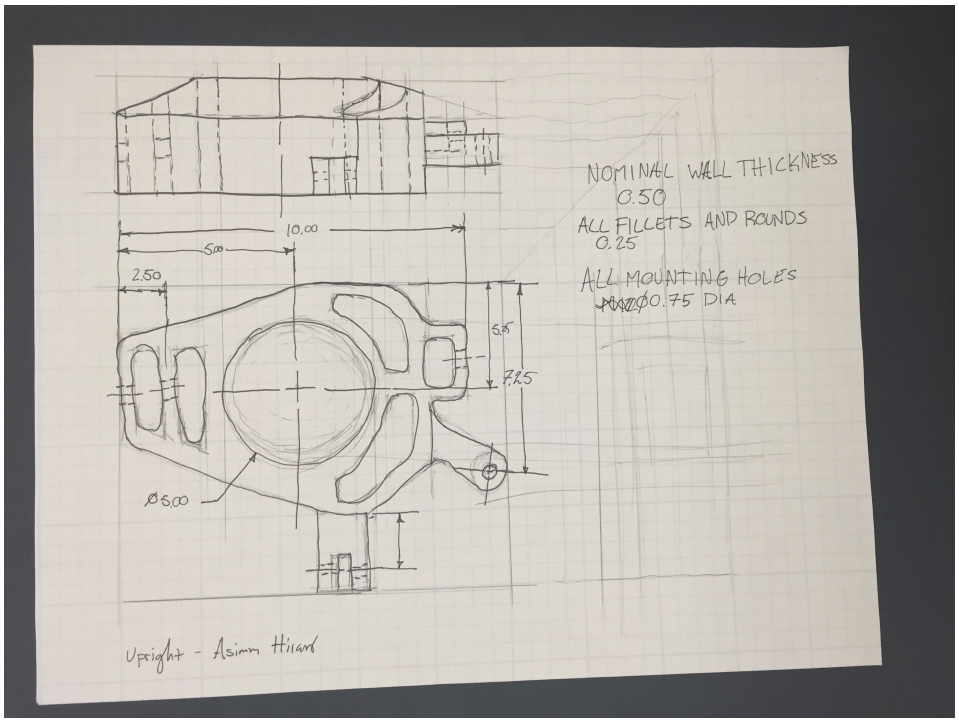

FIGURE 2.11: Hirani, Asimm: Upright

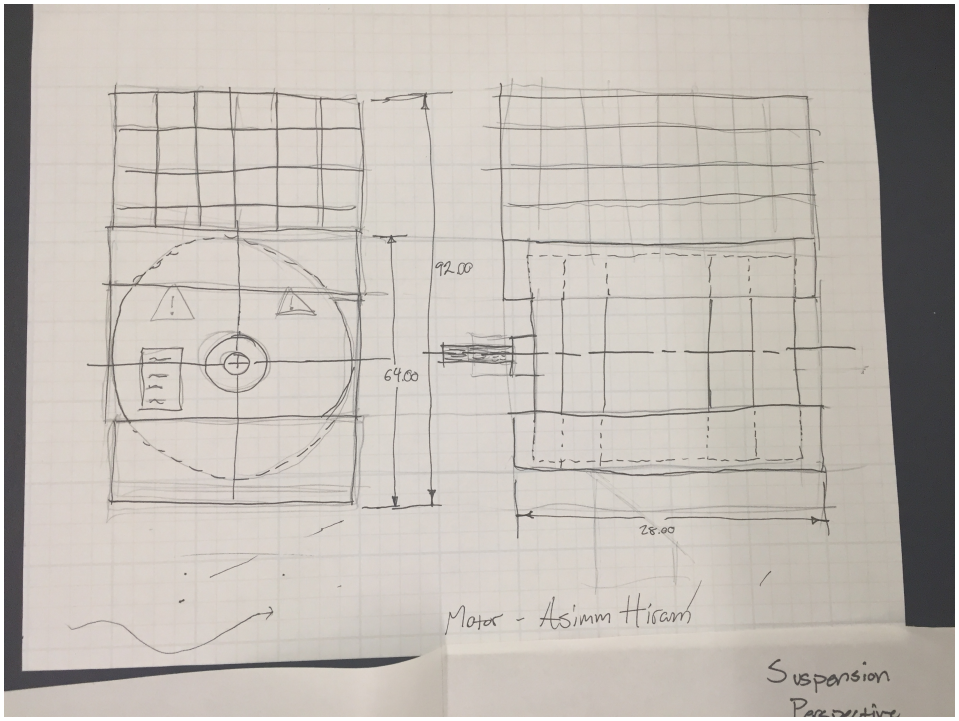

FIGURE 2.12: Hirani, Asimm: Motor

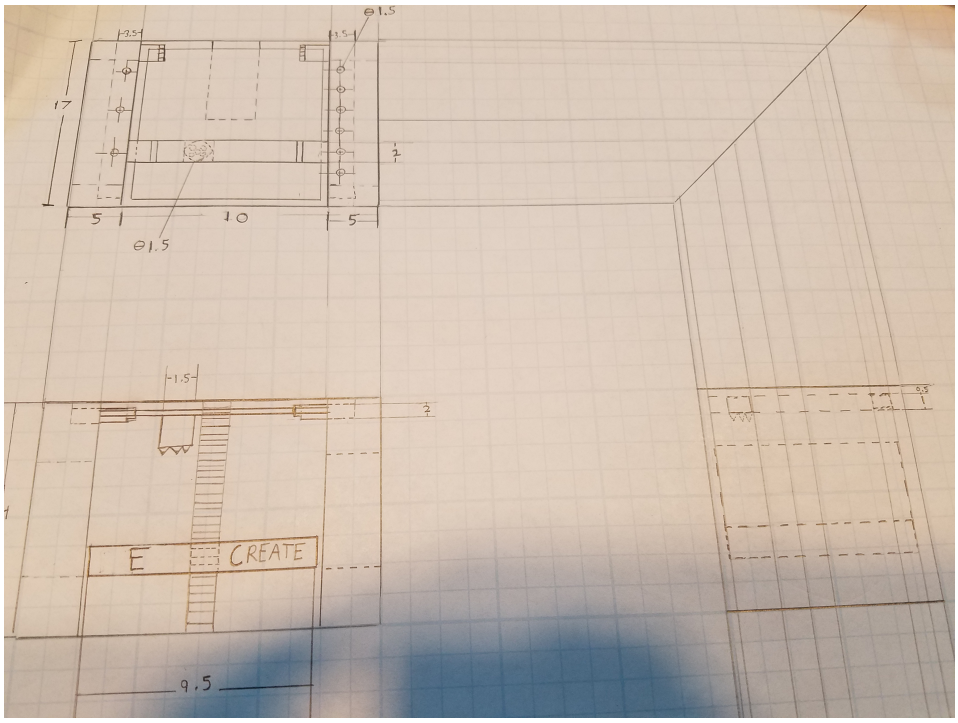

FIGURE 2.13: Ferrarer, Auston: 3D Printer

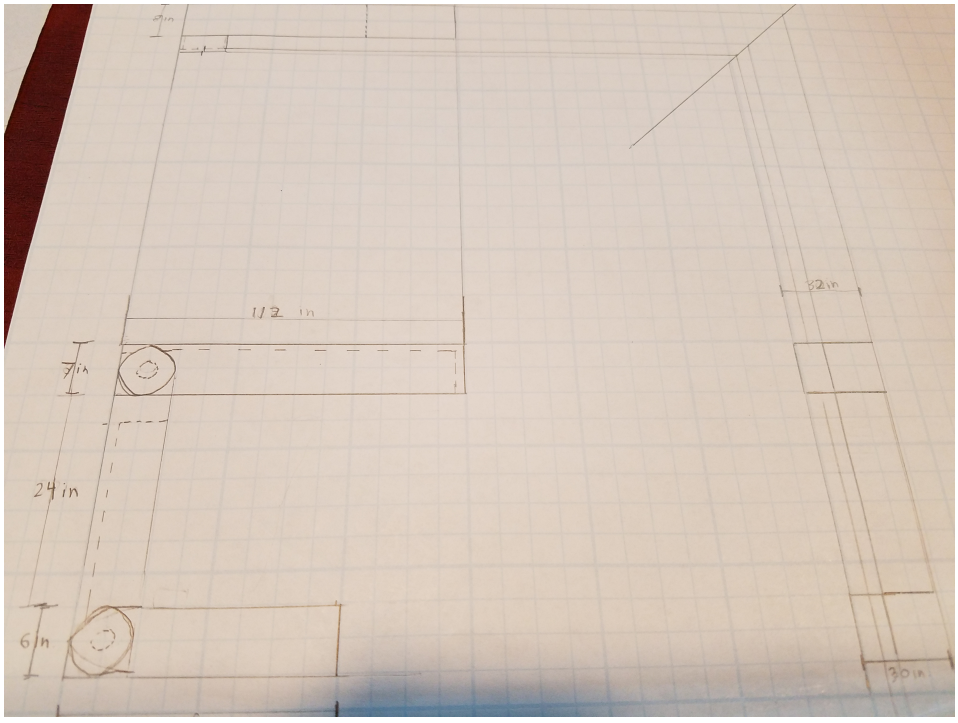

FIGURE 2.14: Ferrarer, Auston: Bed

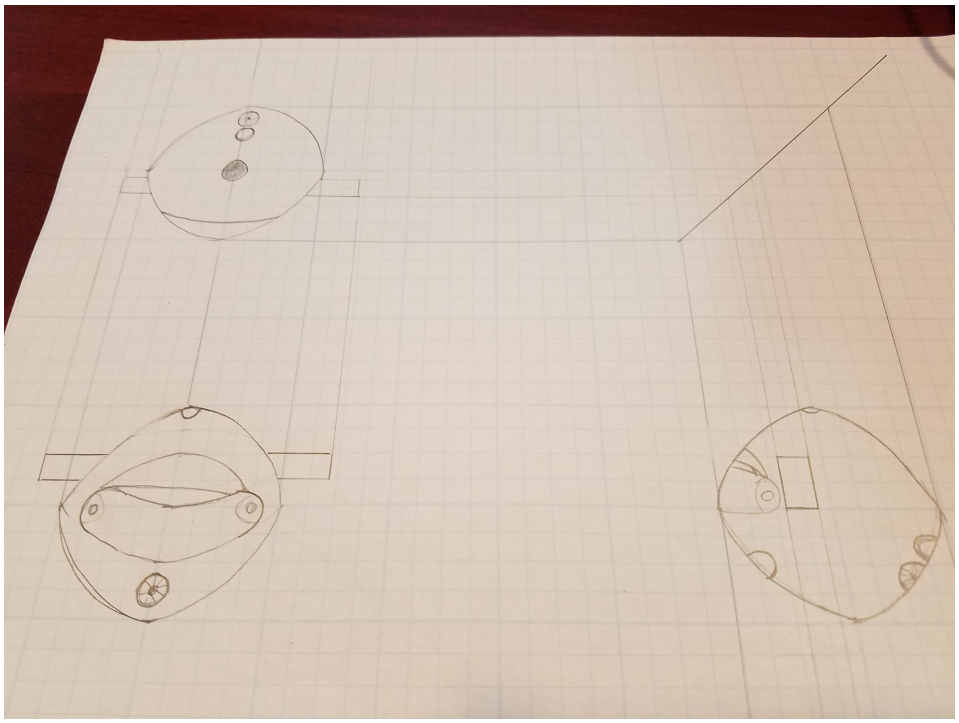

FIGURE 2.15: Ferrarer, Auston: Helmet

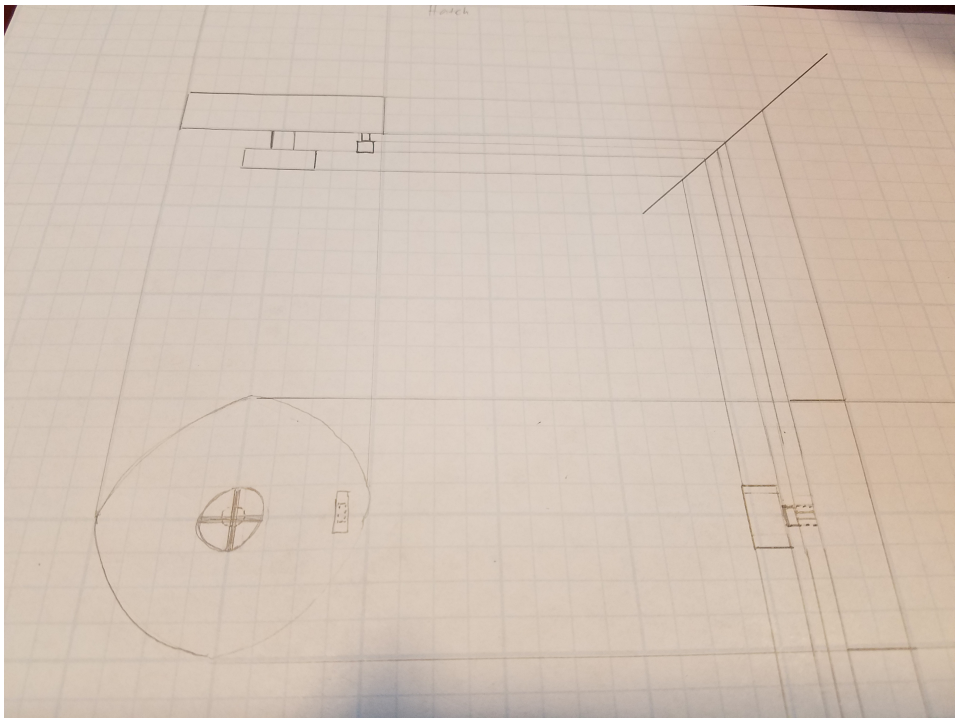

FIGURE 2.16: Ferrarer, Auston: Rear Hatch

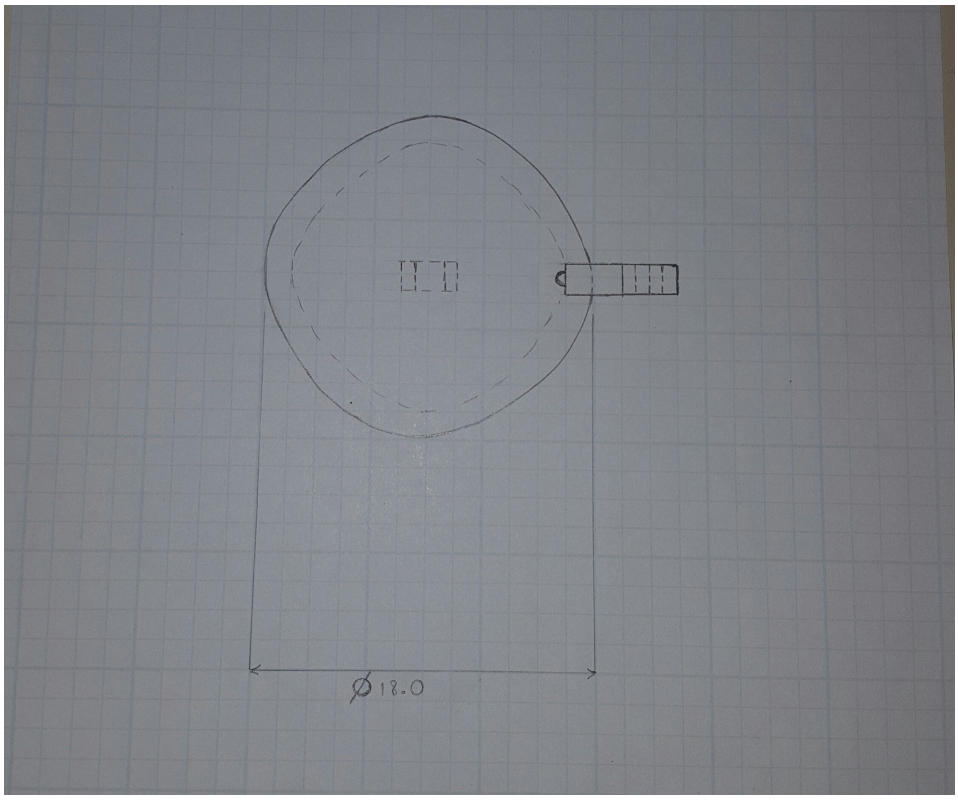

FIGURE 2.17: Rodriguez, Juan:

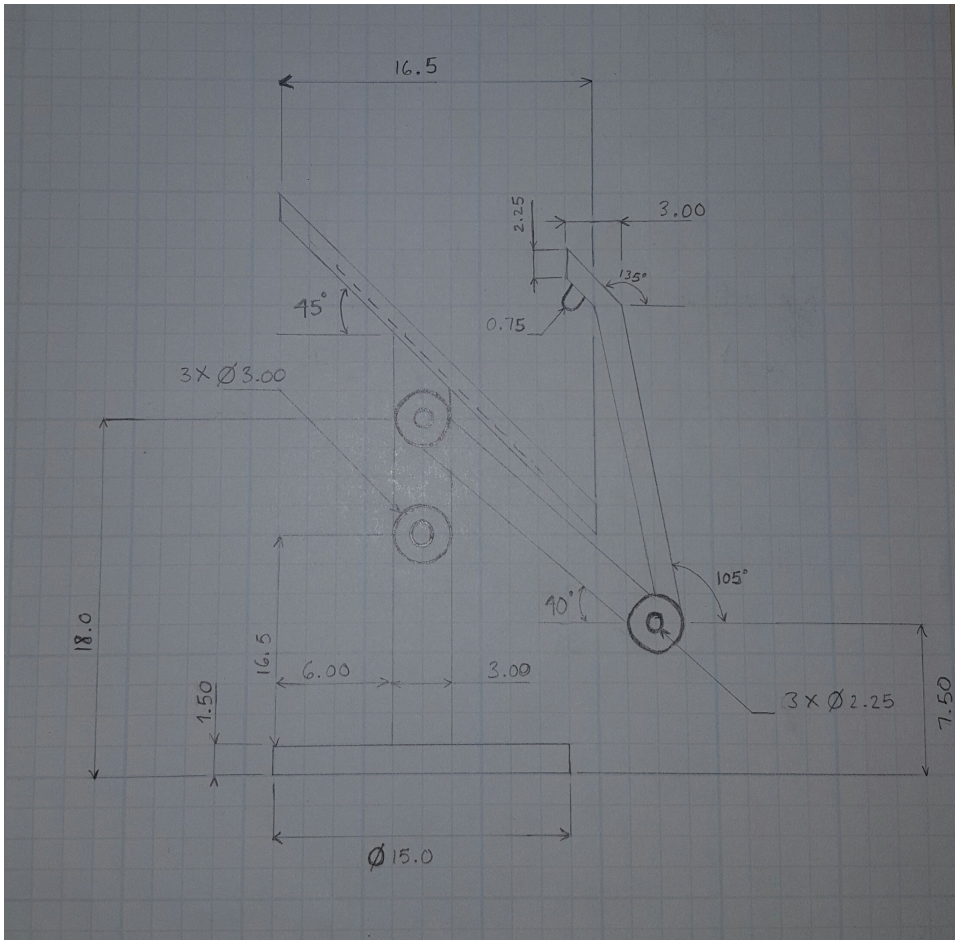

FIGURE 2.18: Rodriguez, Juan:

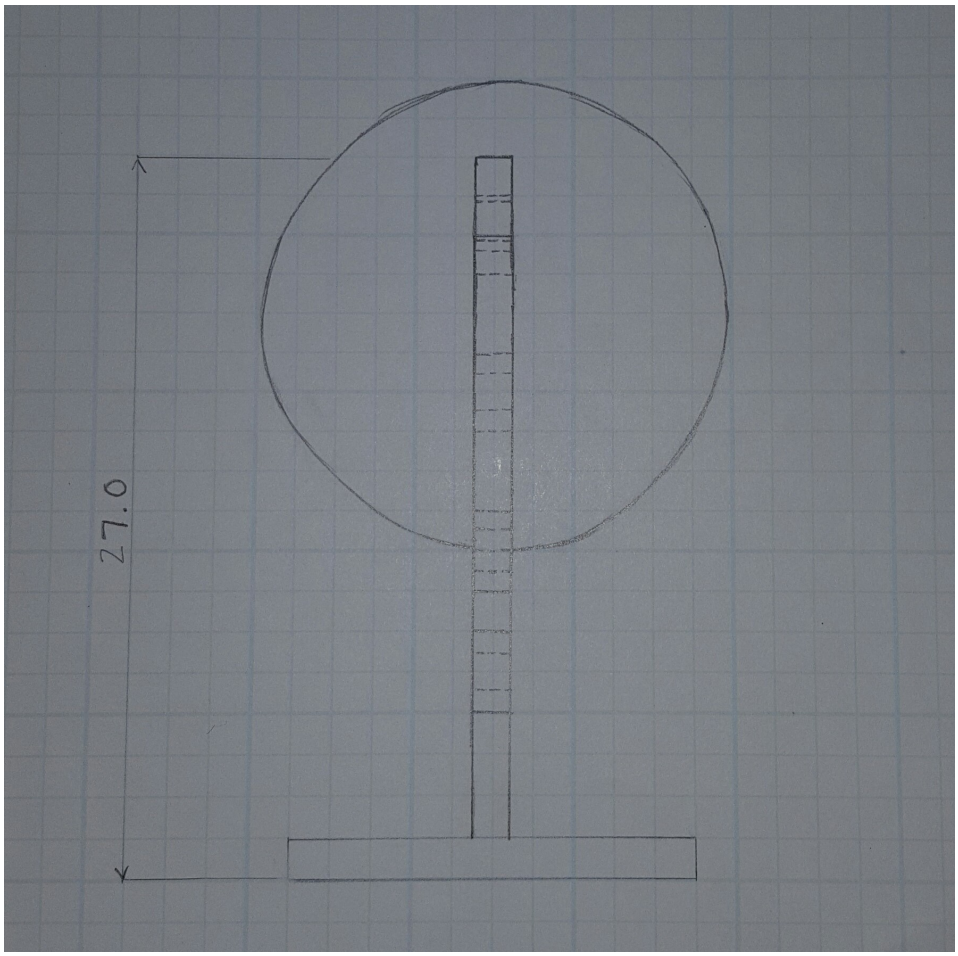

FIGURE 2.19: Rodriguez, Juan:

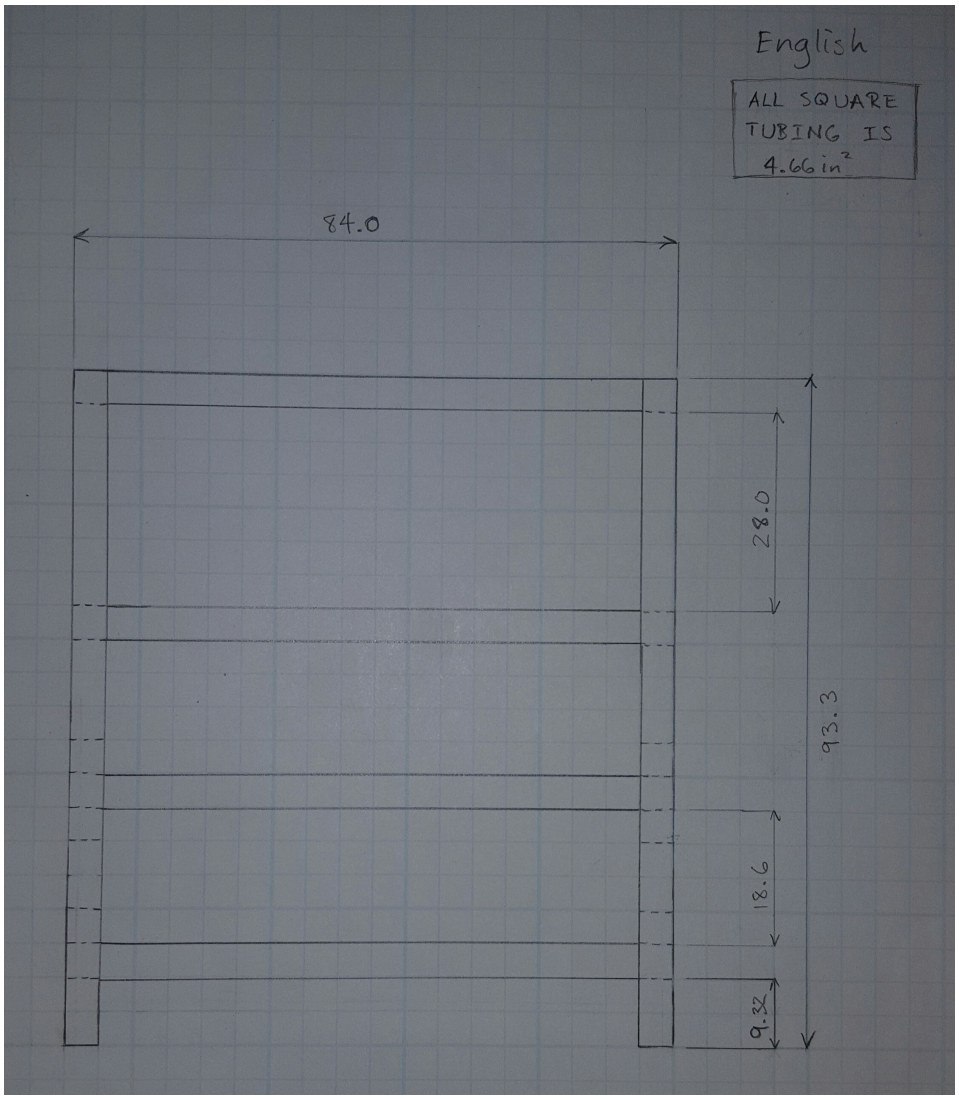

FIGURE 2.20: Rodriguez, Juan:

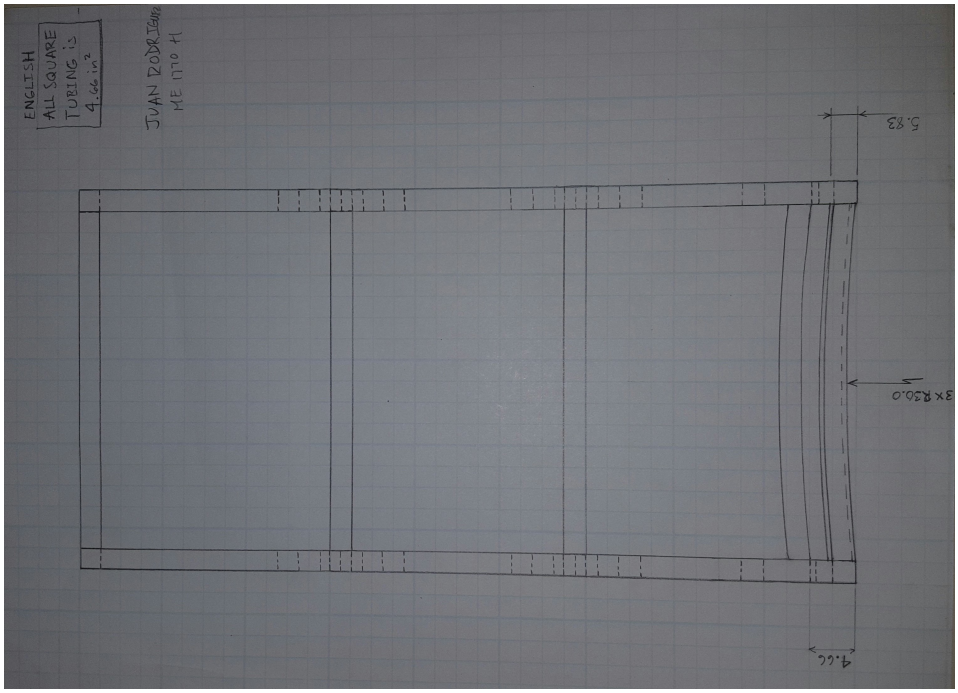

FIGURE 2.21: Rodriguez, Juan:

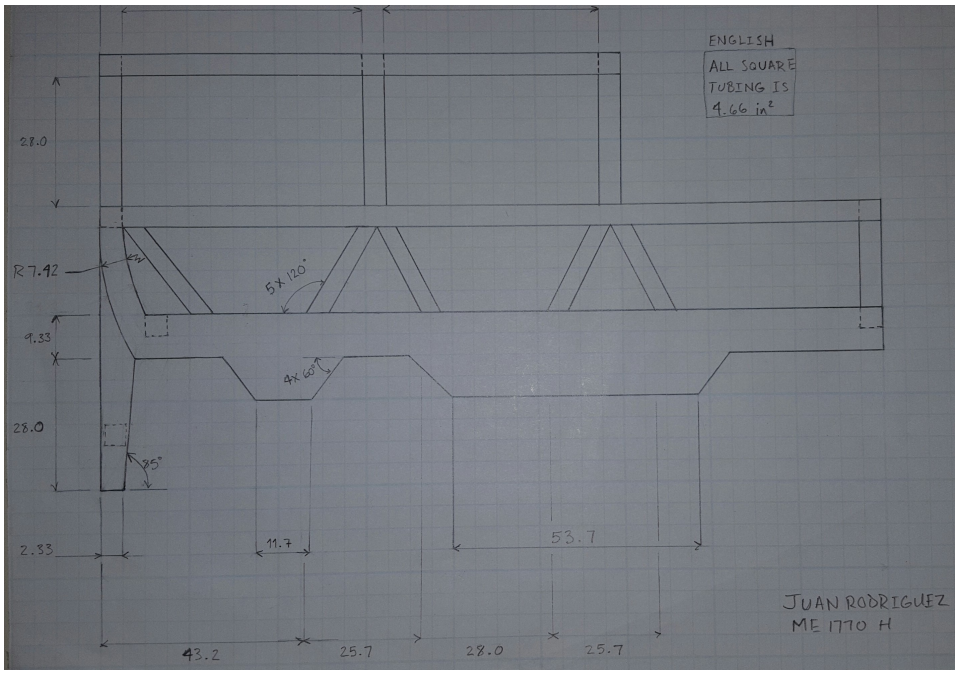

FIGURE 2.22: Rodriguez, Juan: