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

December 6, 2016

Chapter 1

Project Ideation

Insert spiel about 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.

(Daybreak Games: Planetside 2 ANT Vehicle Concept)

(https://grabcad.com/library/baja-atv-1 - BAJA SAE India Team)

1.2 Project Management

Insert spiel about ProjectManagement.

1.2.1 PartDistribution

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 Project Proposal (I forgot the table number).

Further description

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

This probably should be filled out more.

1.2.2 Planning

Insert spiel about planning.

1.2.3 Timeline

Insert spiel about Timeline.

Chapter 2

Preliminary Design

Insert spiel about PreliminaryDesign.

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.

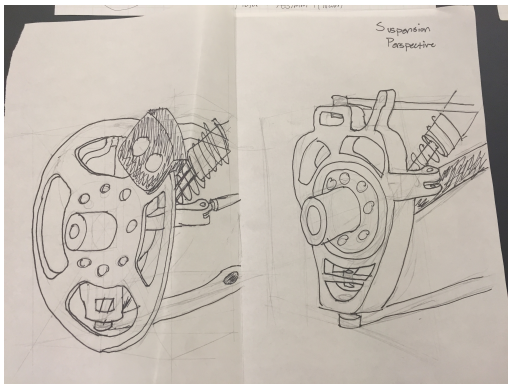


FIGURE 2.1: Hirani, Asimm: Suspension

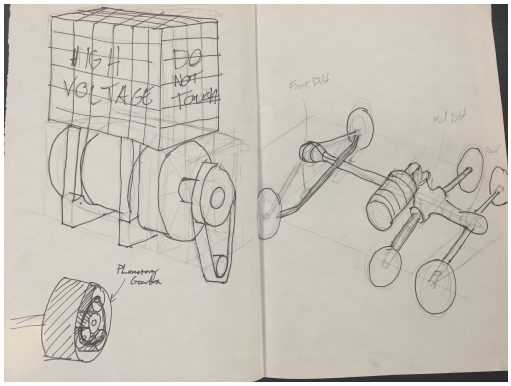


FIGURE 2.2: Hirani, Asimm: Powertrain

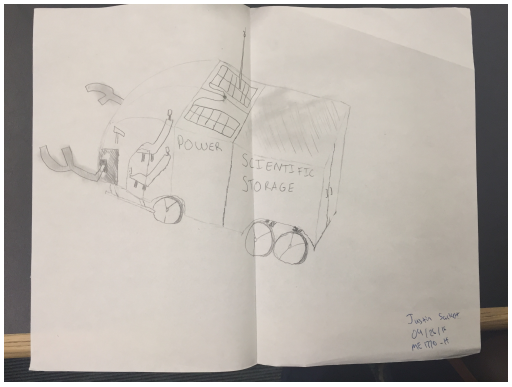


FIGURE 2.3: Hirani, Asimm: Scientiic Storage

FIGURE 2.4: Ferrarer, Auston:

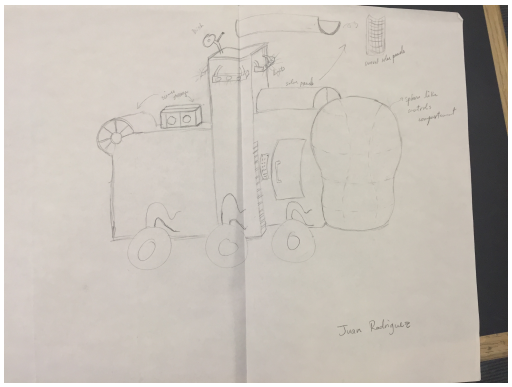


FIGURE 2.5: Rodriguez, Juan: Overview

FIGURE 2.6: Sackett, Justin:

FIGURE 2.7: Kumar, Vishakh:

2.2 Isometric 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.

2.2.1 Asimm

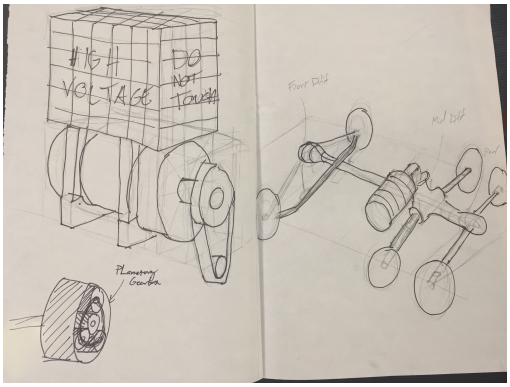


FIGURE 2.8: Hirani, Asimm: Suspension

2.2.2 Auston

FIGURE 2.9: Ferrarer, Auston:

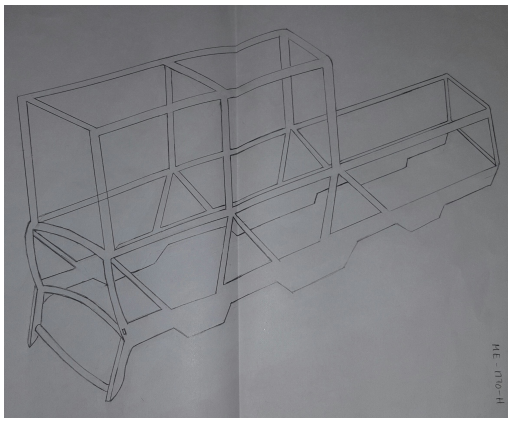


FIGURE 2.10: Rodriguez, Juan:

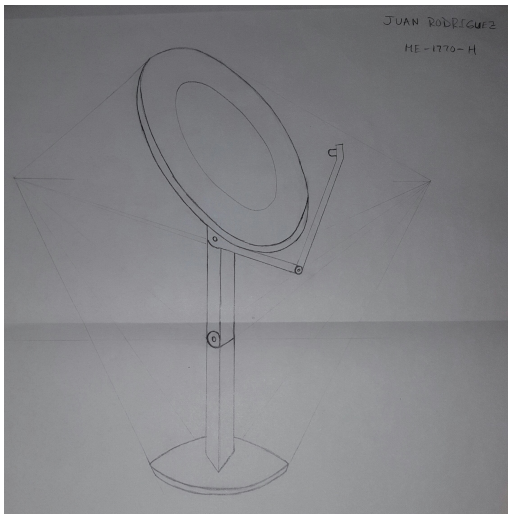


FIGURE 2.11: Rodriguez, Juan:

FIGURE 2.12: Sackett, Justin:

FIGURE 2.13: Kumar, Vishakh:

2.2.3 Juan

2.2.4 Justin

2.2.5 Vishakh

2.3 Multiview Sketches

2.3.1 Multiview Drawings

Vishakh Kumar

Justin Sackett

Asimm Hirani

Juan Rodriguez

Auston Ferrarer

Chapter 3

Detail Design

Insert spiel about Detail Design.

3.1 Antenna

3.2 Cockpit

3.3 Joystick

3.4 MechanicalDisplay

3.5 Suspension

Chapter 4

ManufacturingWorkingDrawing

Insert spiel about ManufacturingWorkingDrawing.

4.1 WorkingDrawing

Insert spiel about DetailDesign.

4.1.1 Antenna

4.2 AssemblyInstructionManual

Insert spiel about AssemblyInstructionManual.

4.2.1 Antenna

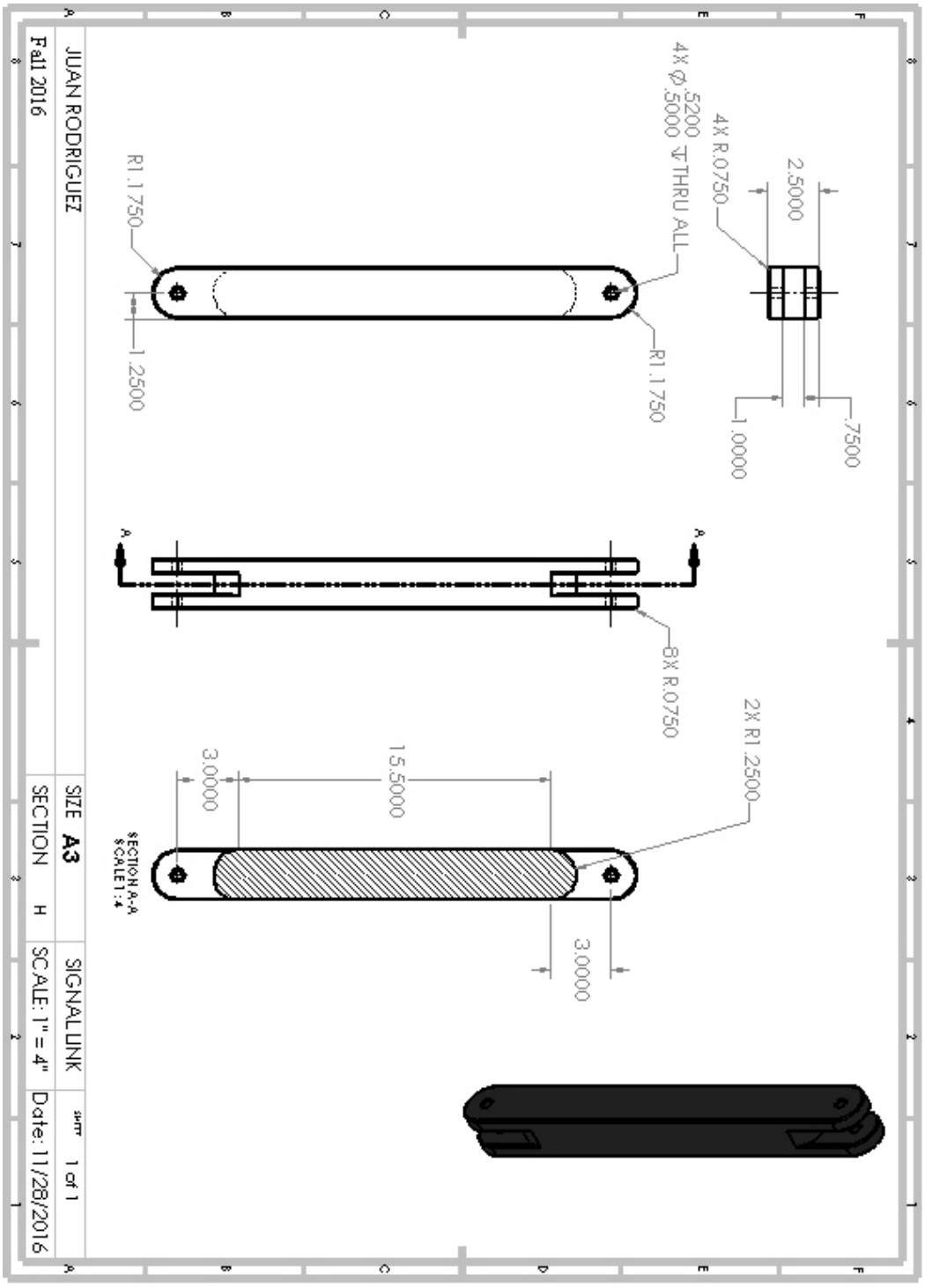


FIGURE 4.1: Rodriguez, Juan: Signal Bar

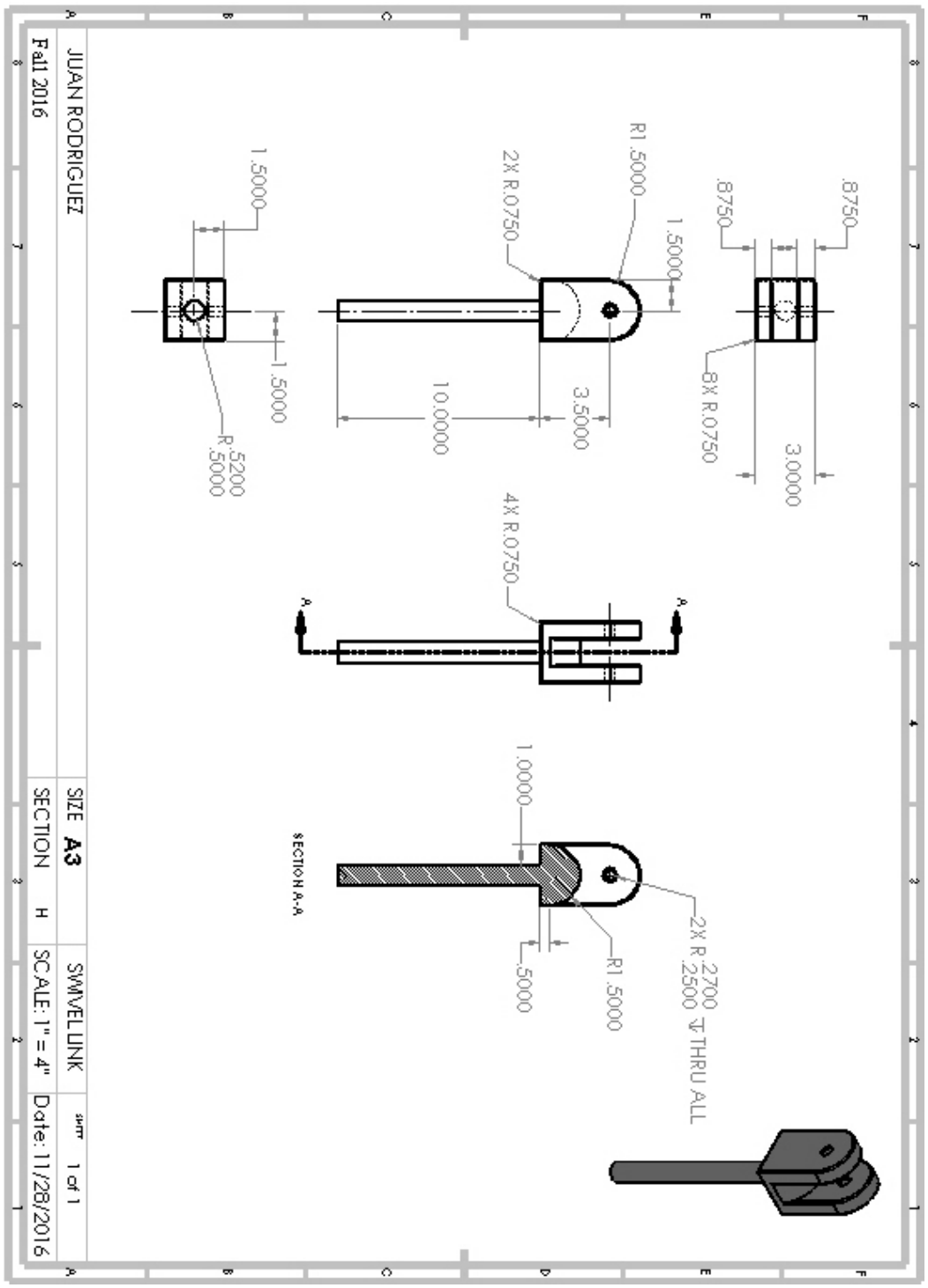


FIGURE 4.2: Rodriguez, Juan: Swivel link

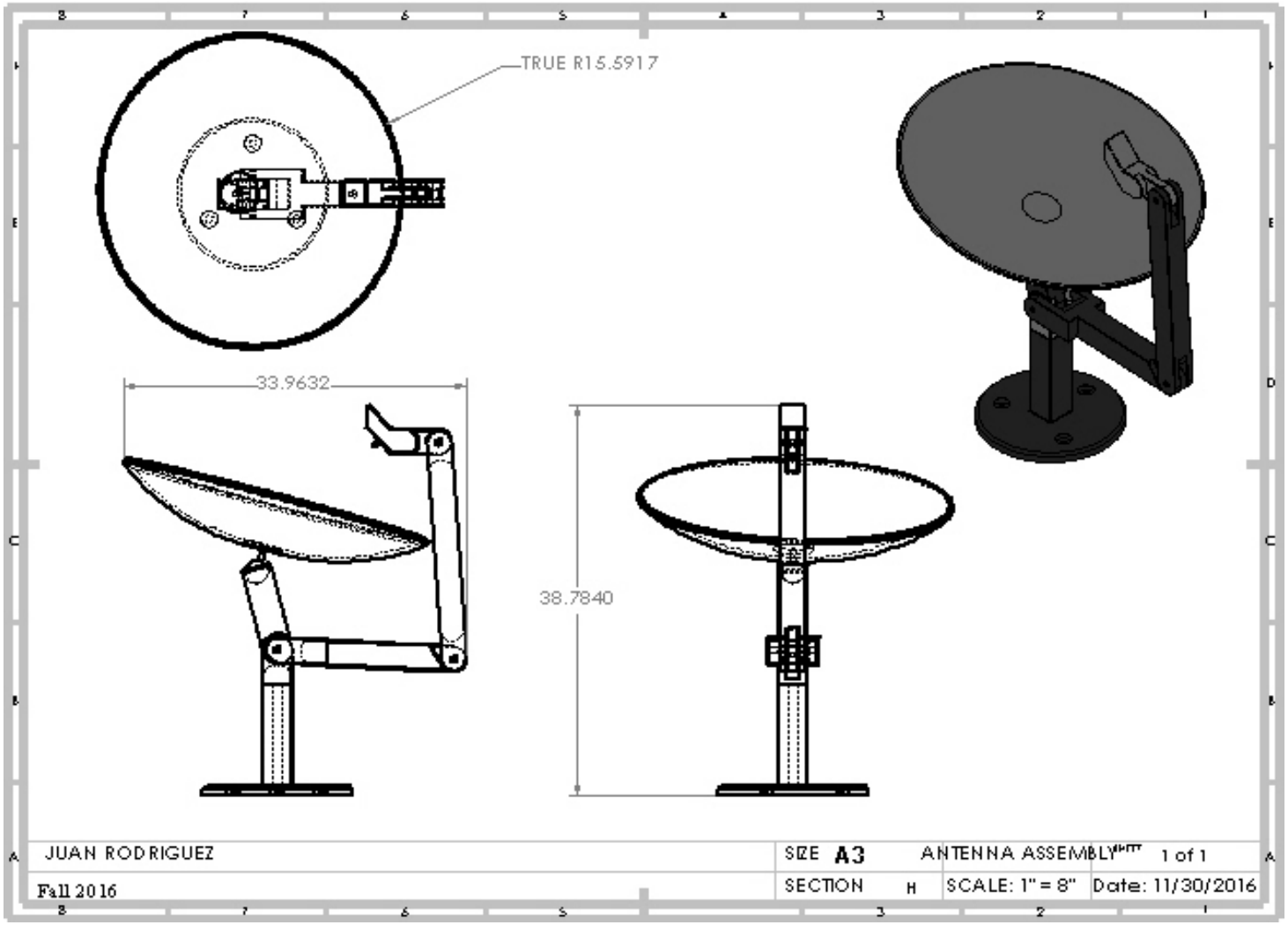


FIGURE 4.3: Rodriguez, Juan: Antenna Assembly

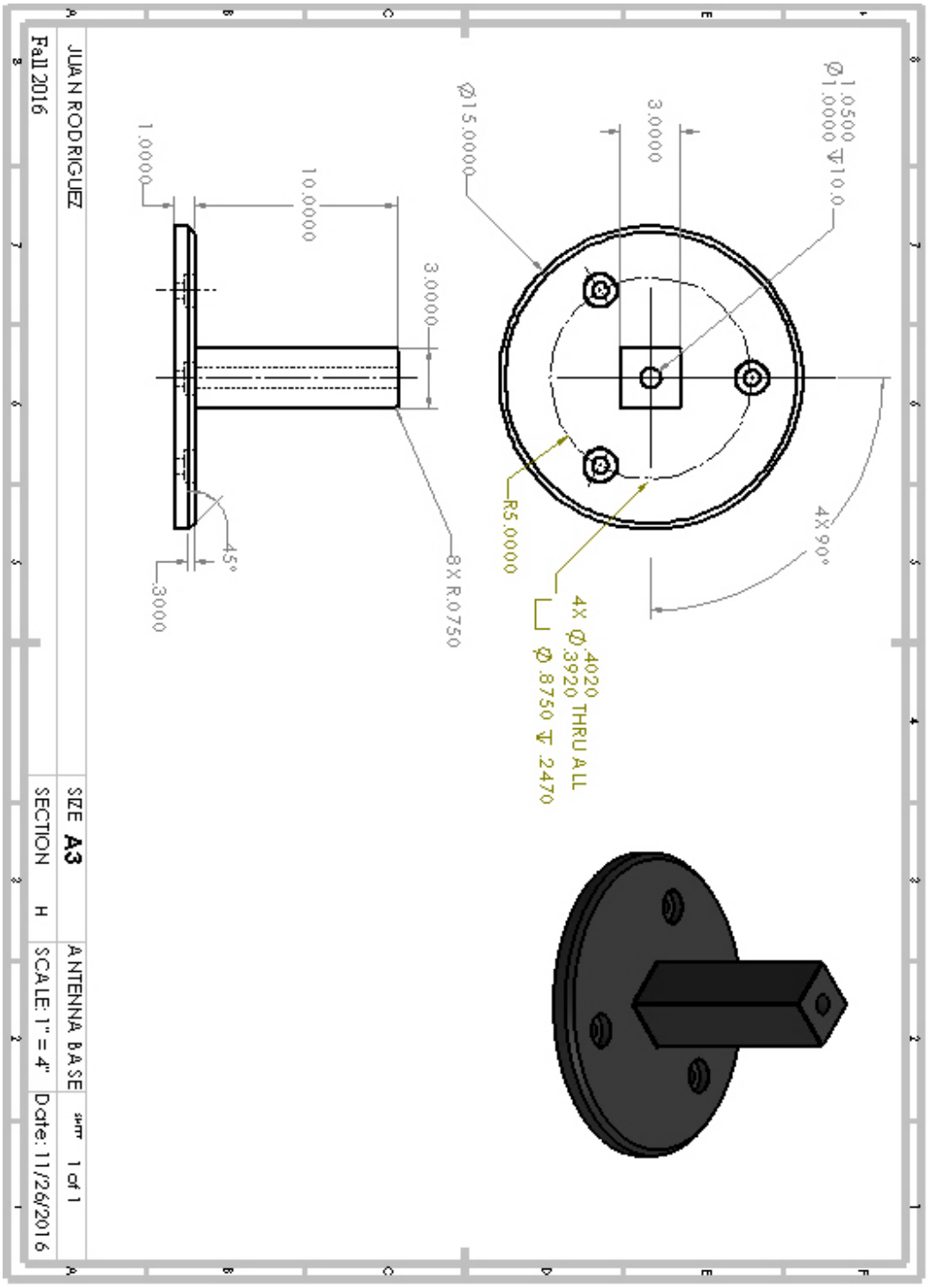


FIGURE 4.4: Rodriguez, Juan: Antenna Base

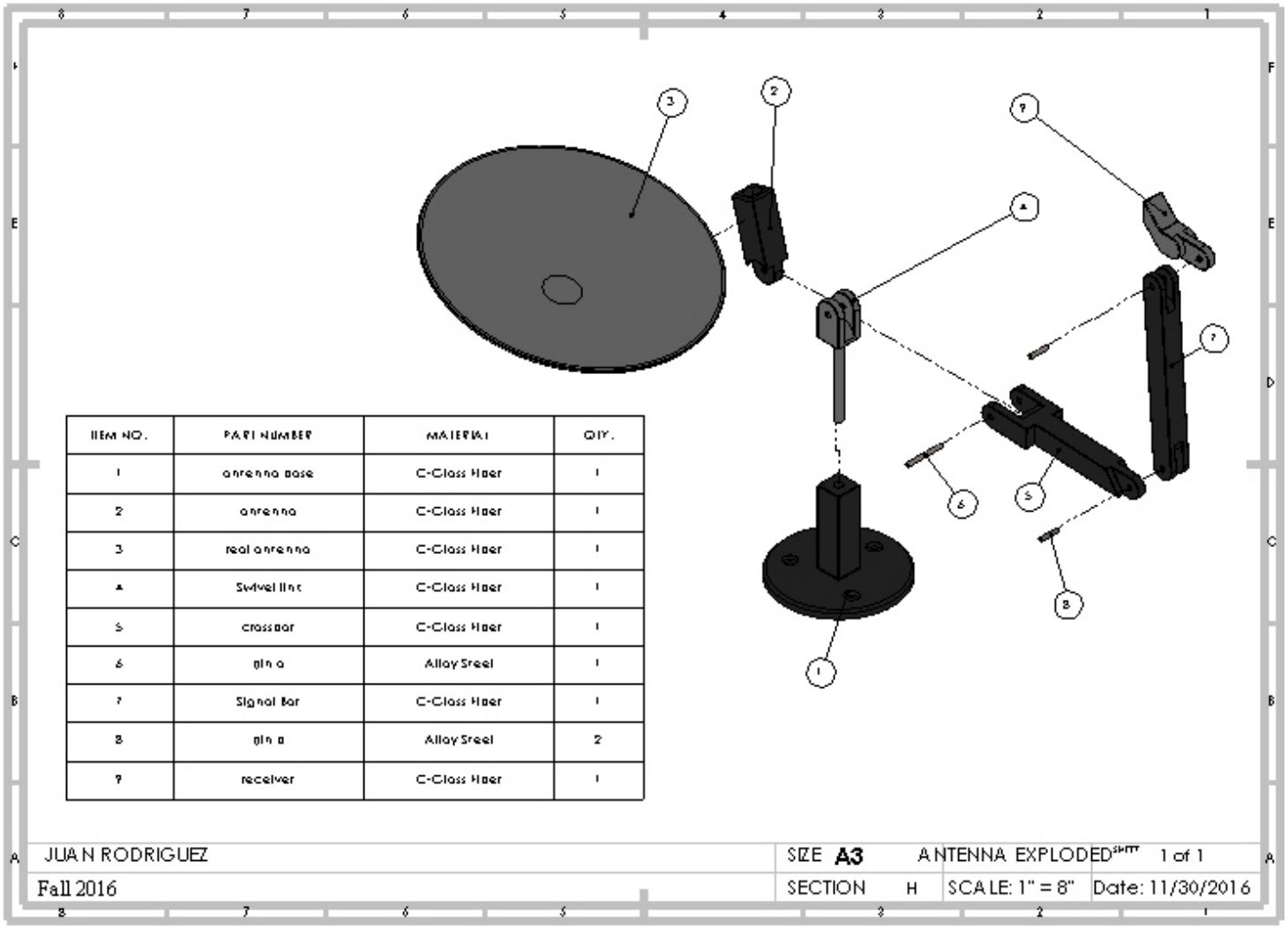


FIGURE 4.5: Rodriguez, Juan: Antenna Exploded

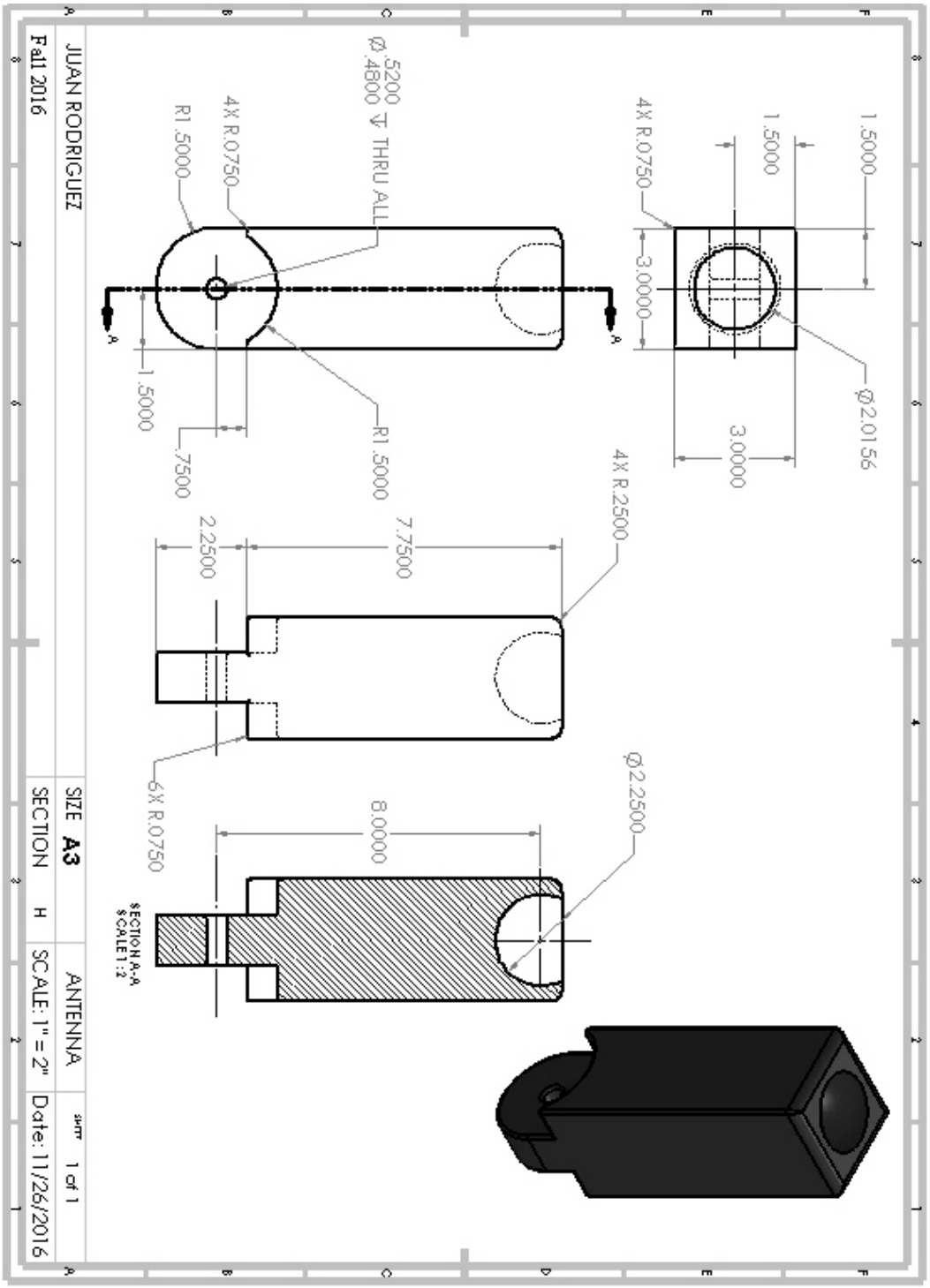


FIGURE 4.6: Rodriguez, Juan: Antenna Support

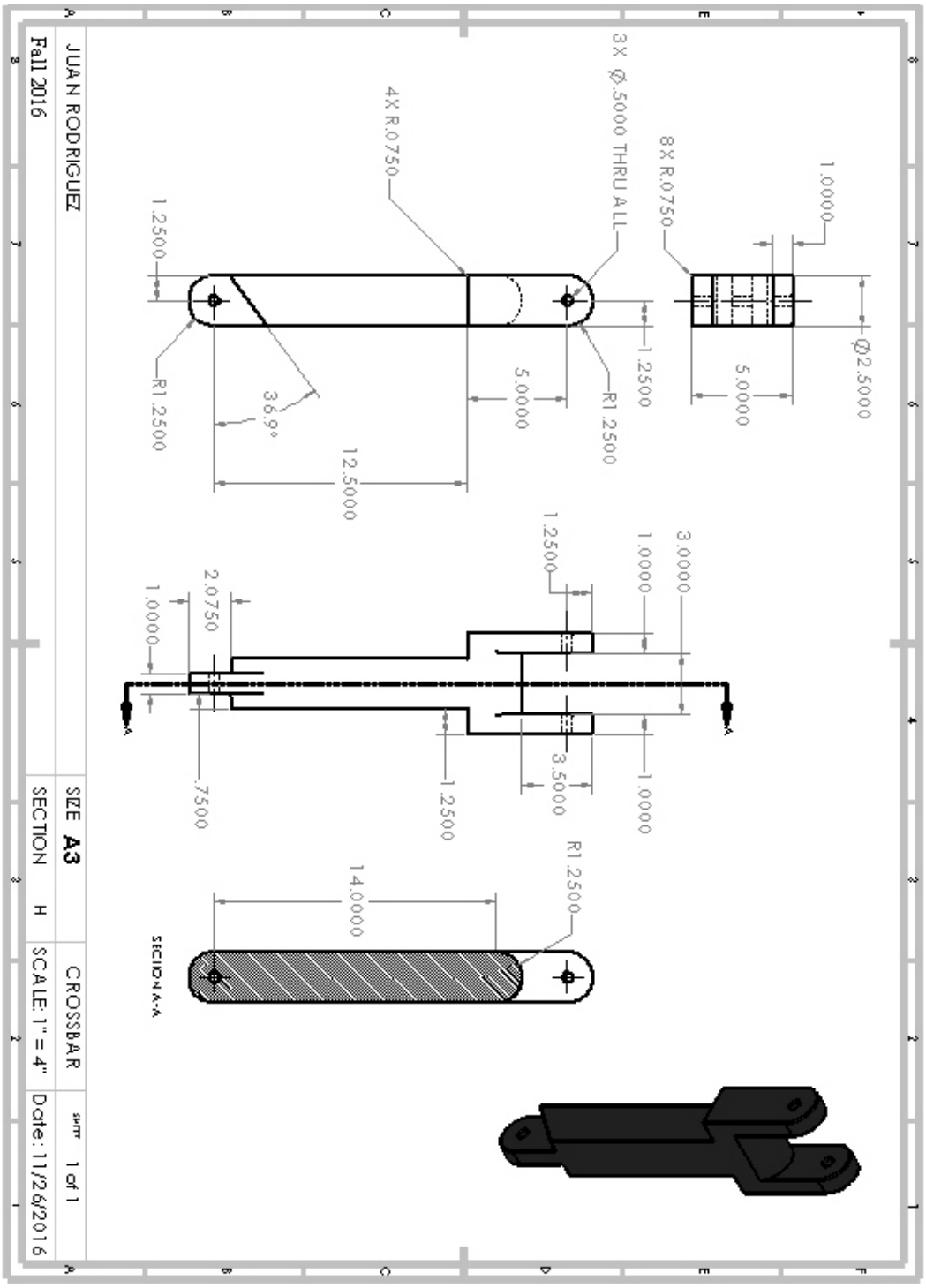


FIGURE 4.7: Rodriguez, Juan: Crossbar

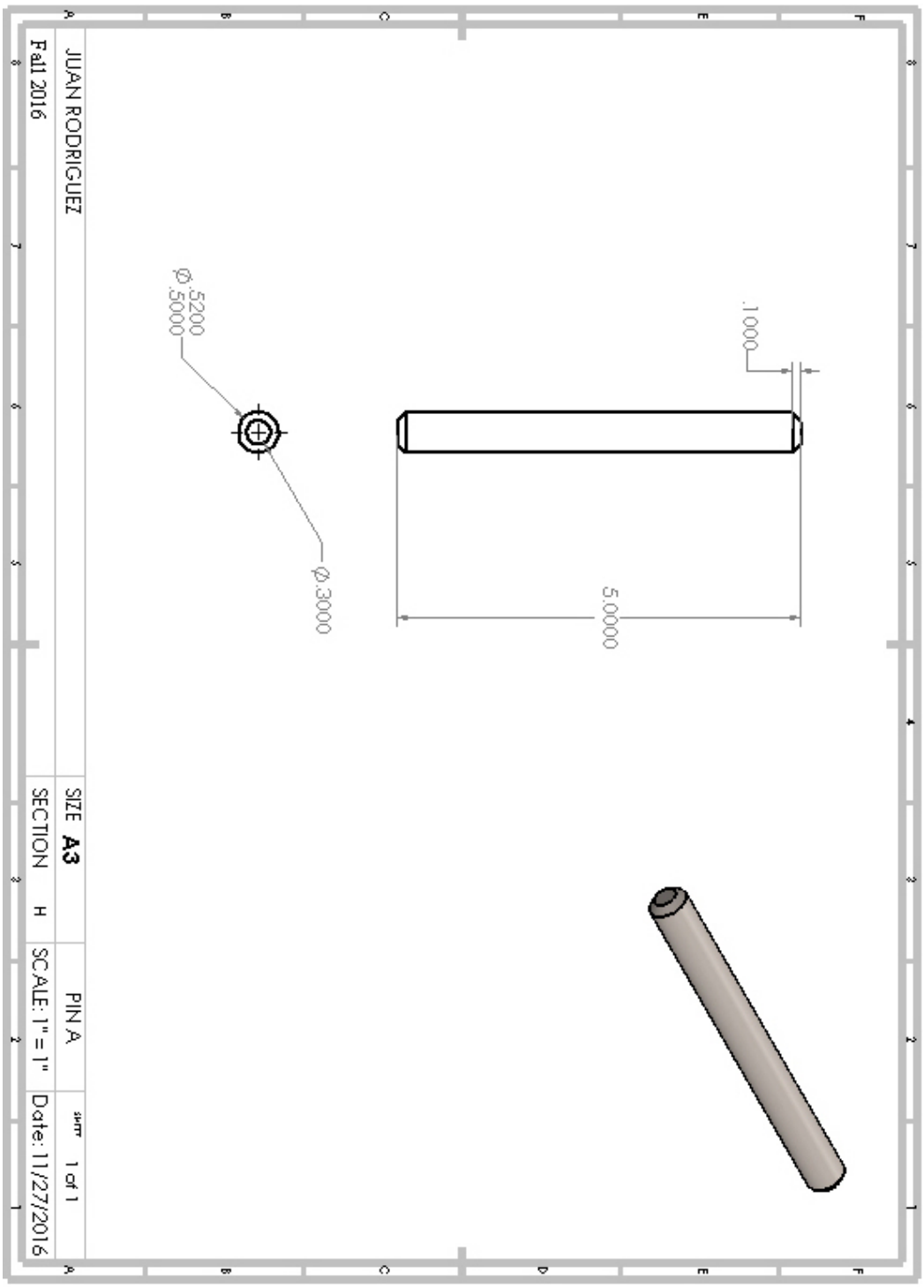


FIGURE 4.8: Rodriguez, Juan: Pin A

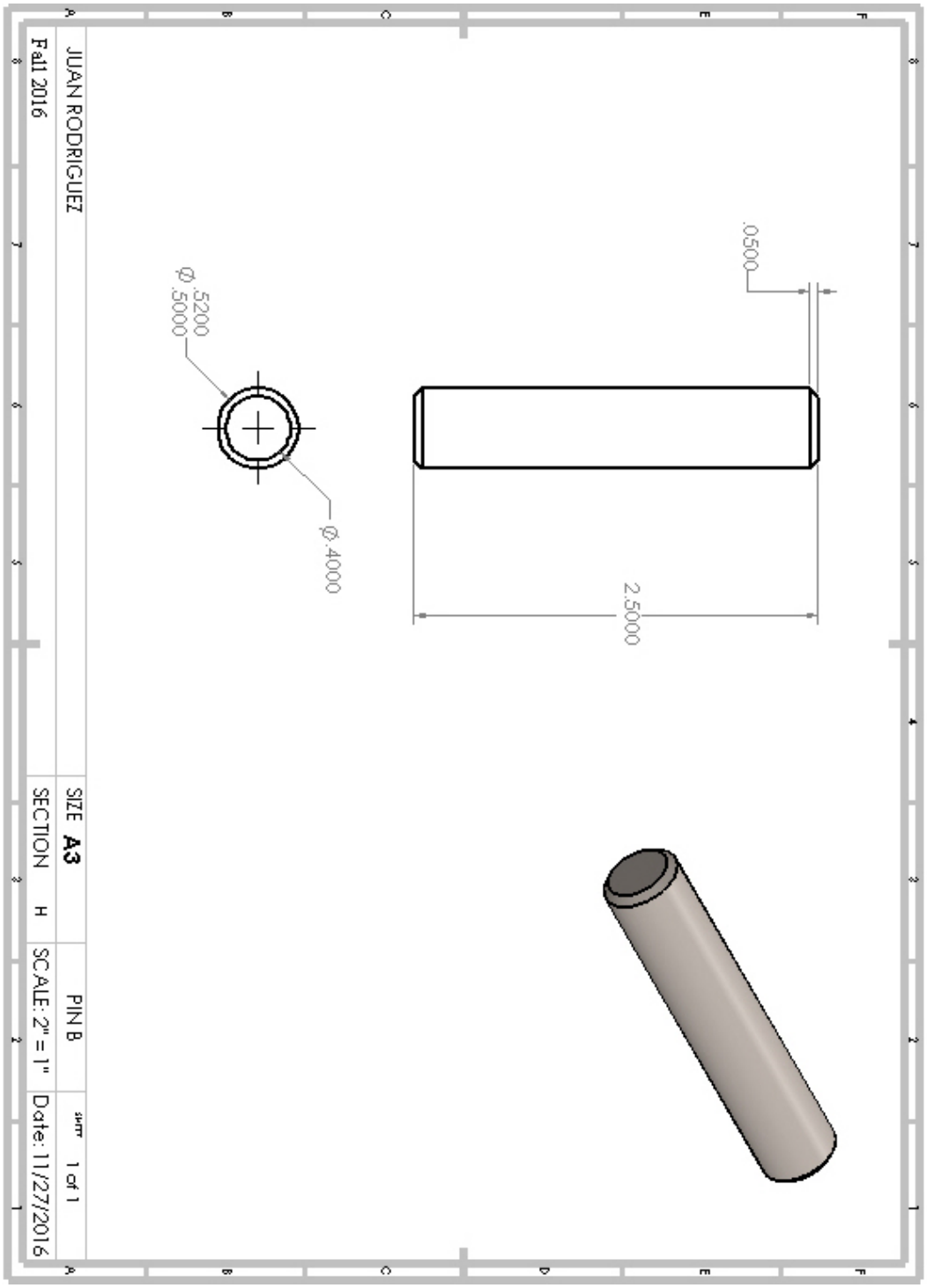


FIGURE 4.9: Rodriguez, Juan: Pin B

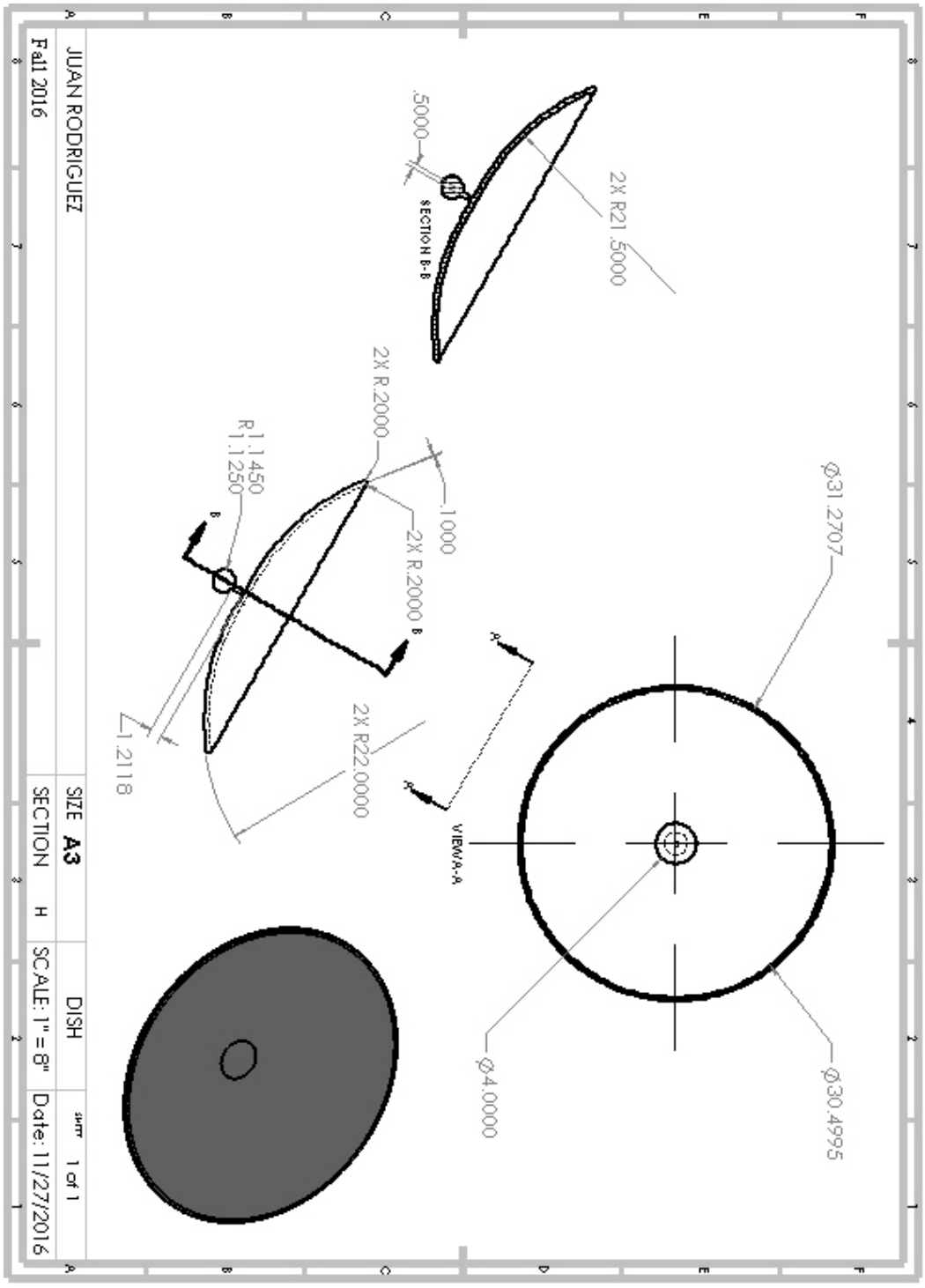


FIGURE 4.10: Rodriguez, Juan: Real antenna

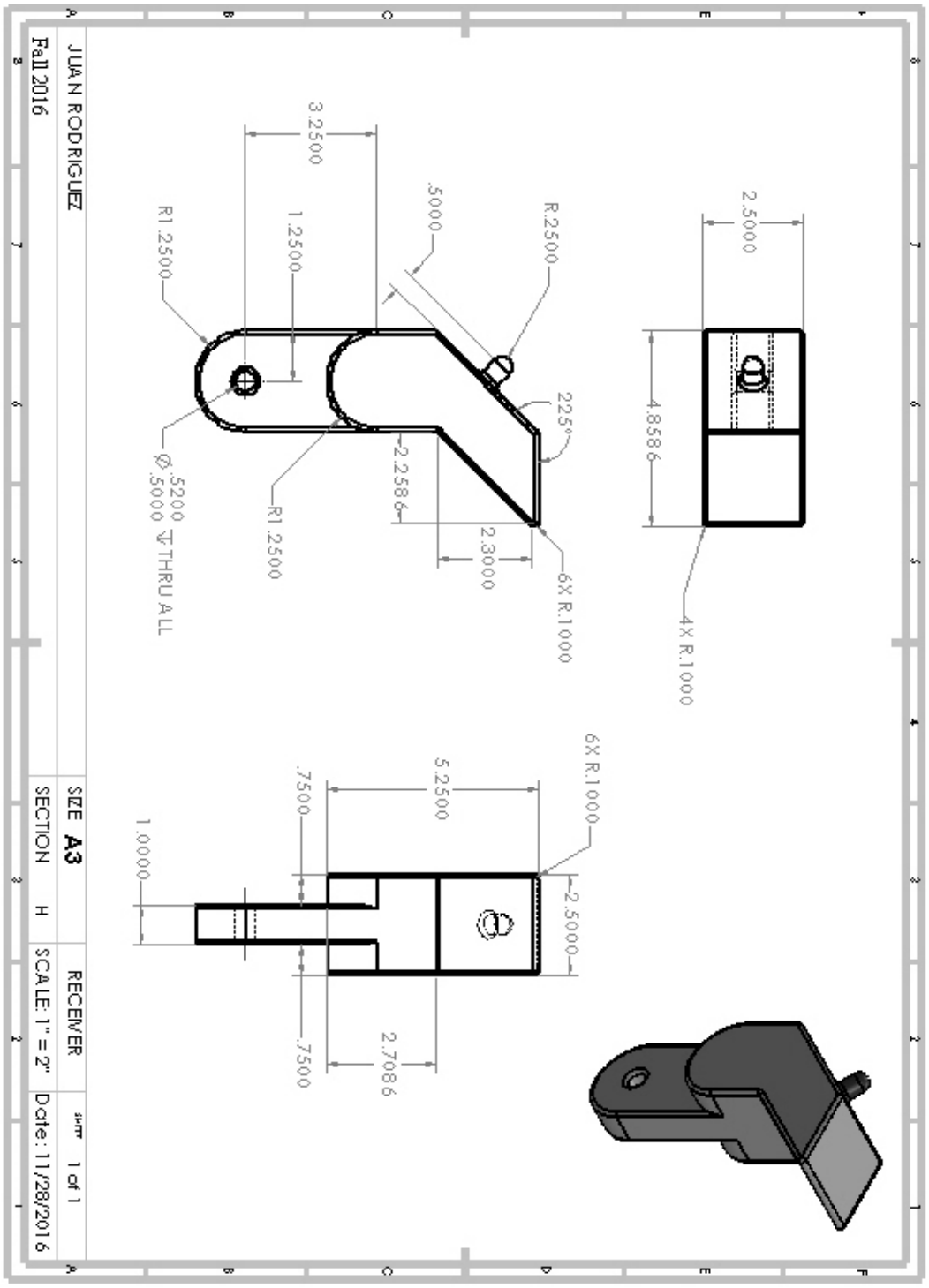
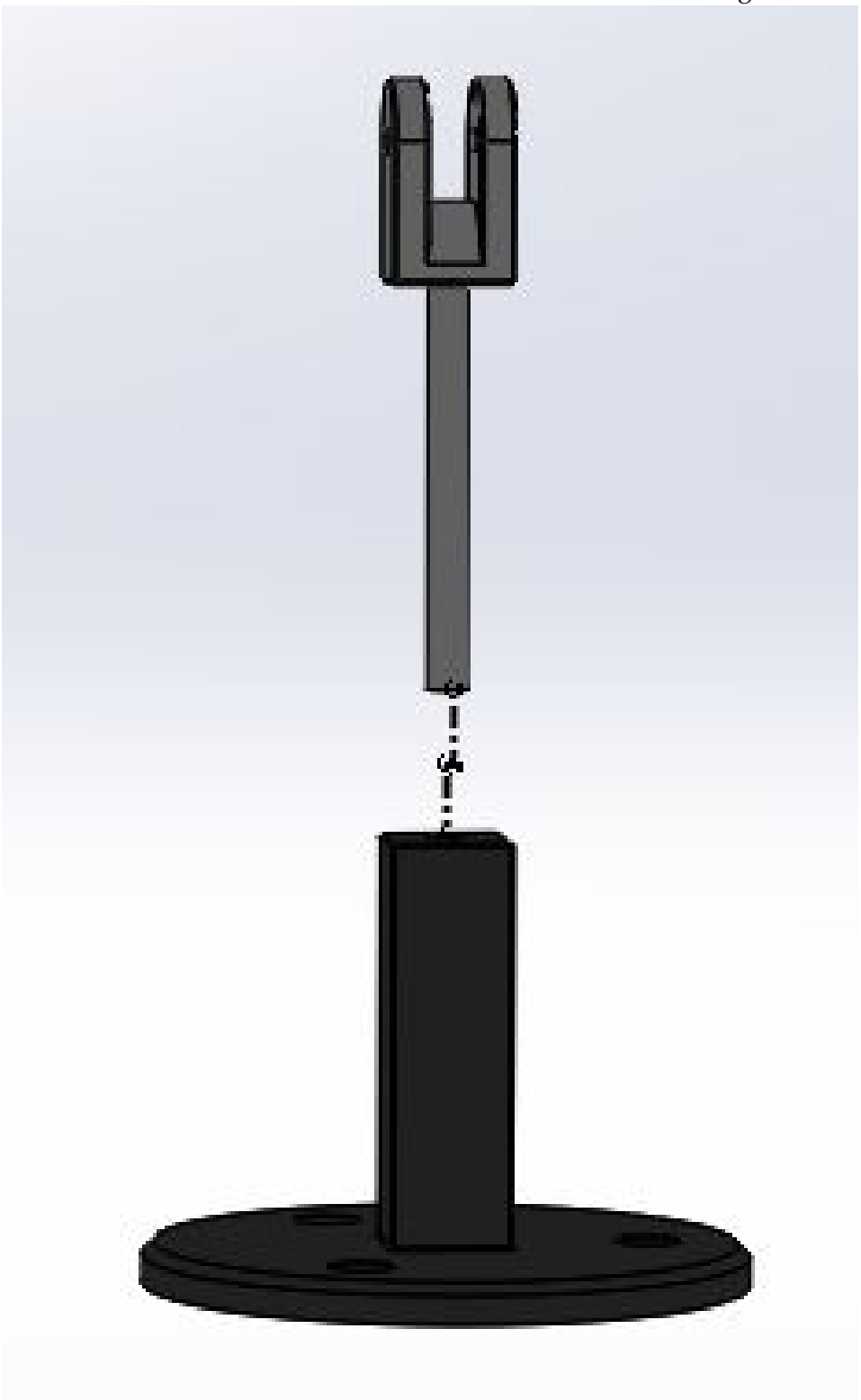


FIGURE 4.11: Rodriguez, Juan: Receiver

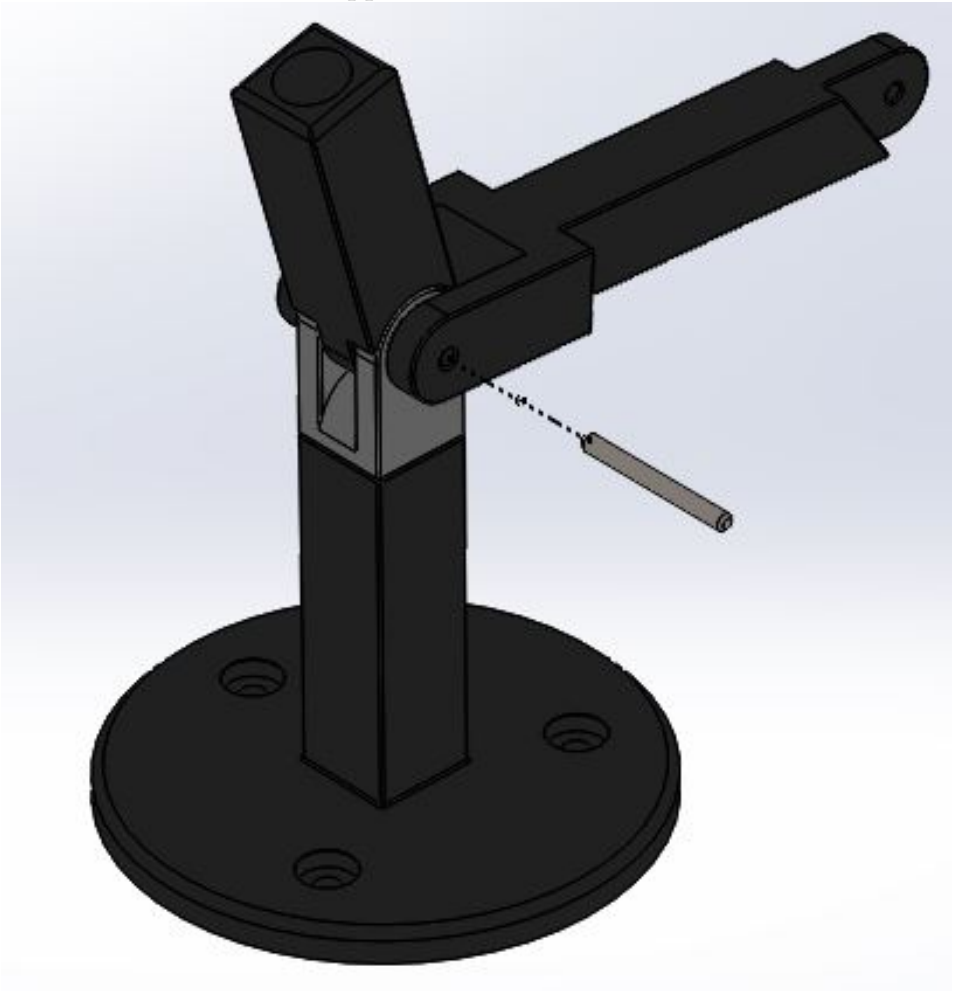
STEP 1

Insert the Swivel Link into the antenna base and check for tight fit.



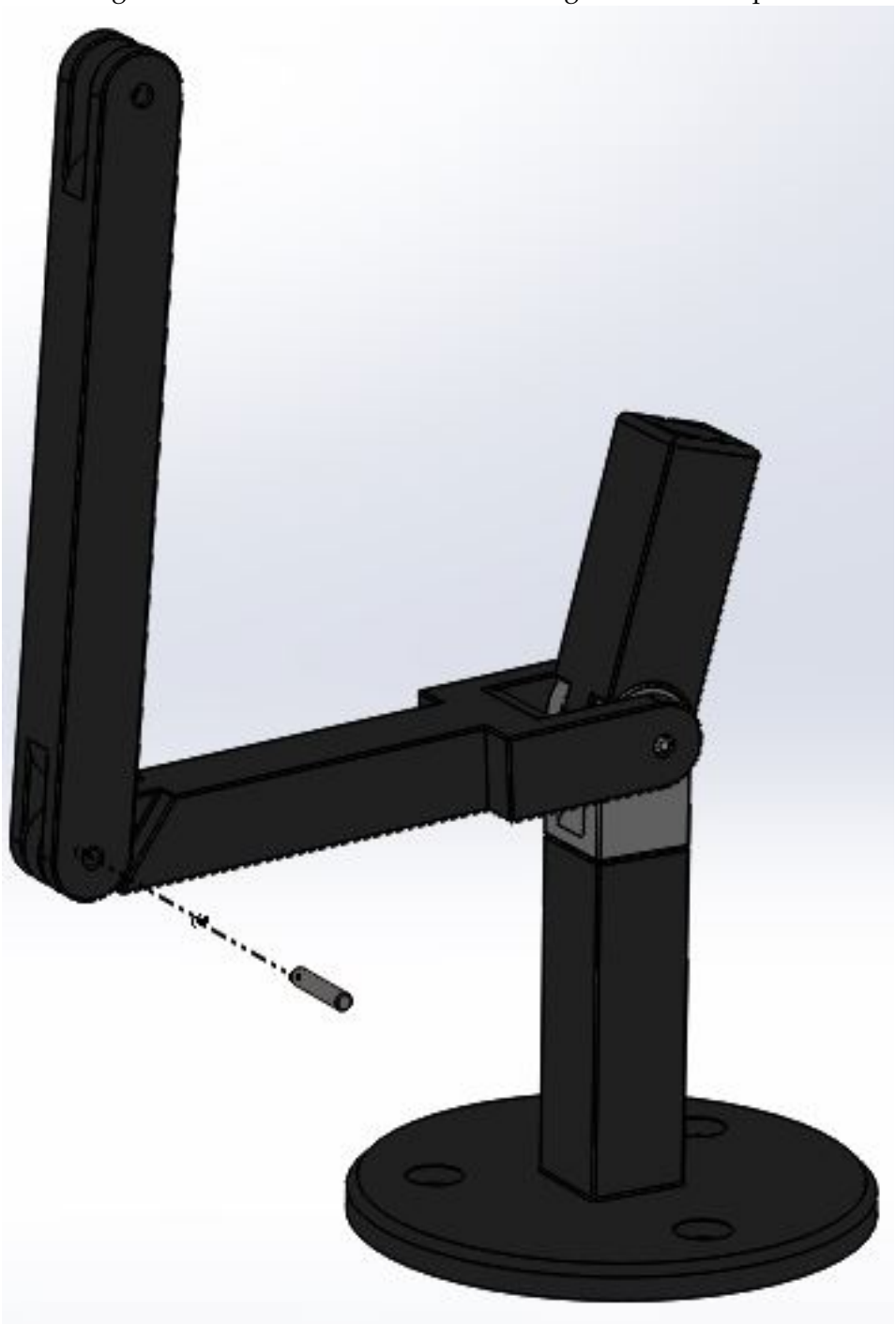
STEP 2

Align the holes of the antenna support, the crossbar and then swivel link. Insert pin a.



STEP 3

Align the holes of the crossbar and the signal bar. Insert pin b.

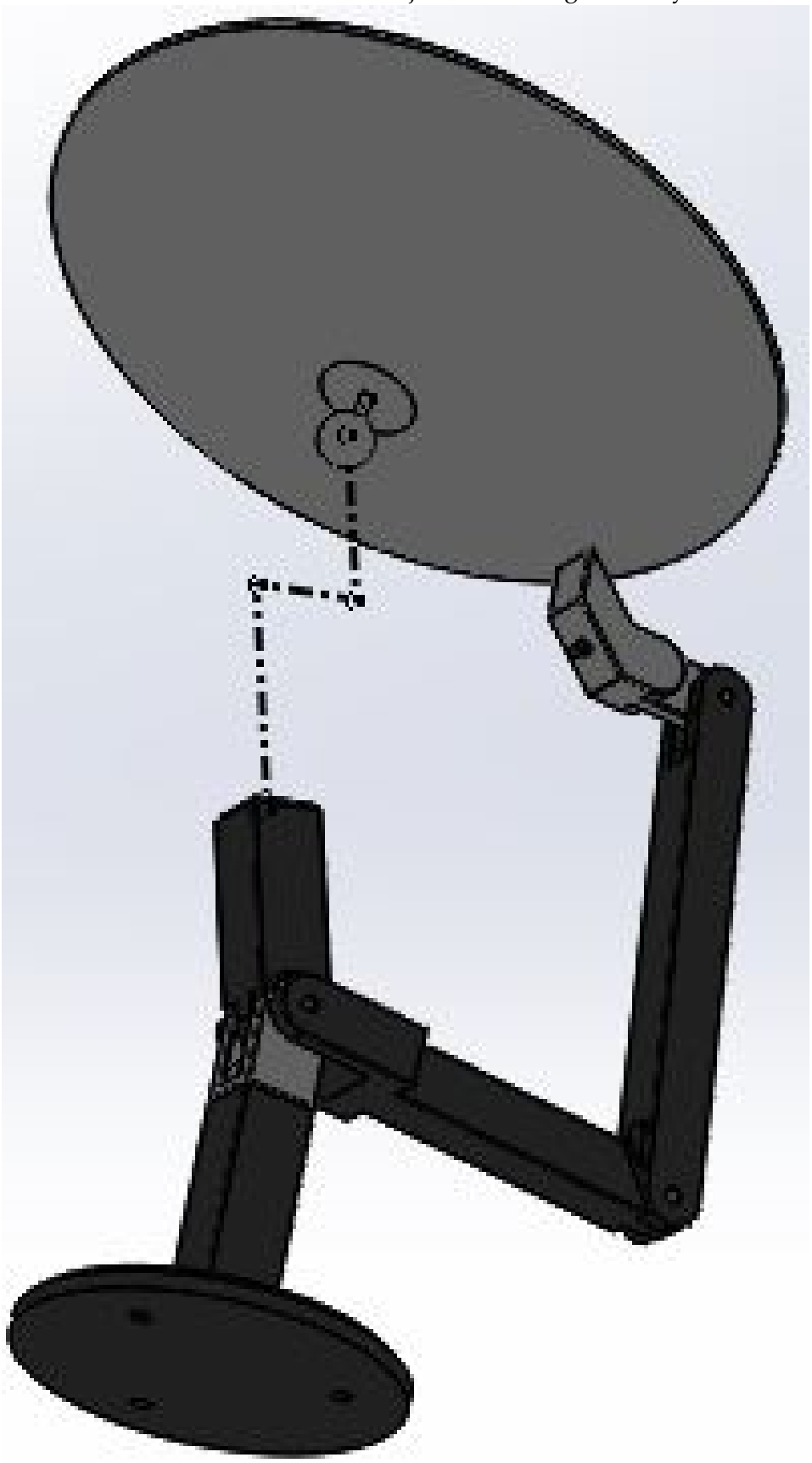


STEP 4

Align the holes of the signal bar and the retriever. Insert the second pin b.

STEP 5

Attach the ball and socket joint to existing assembly.



4.3 ExplodedView

Insert spiel about ExplodedView.

4.3.1 Antenna

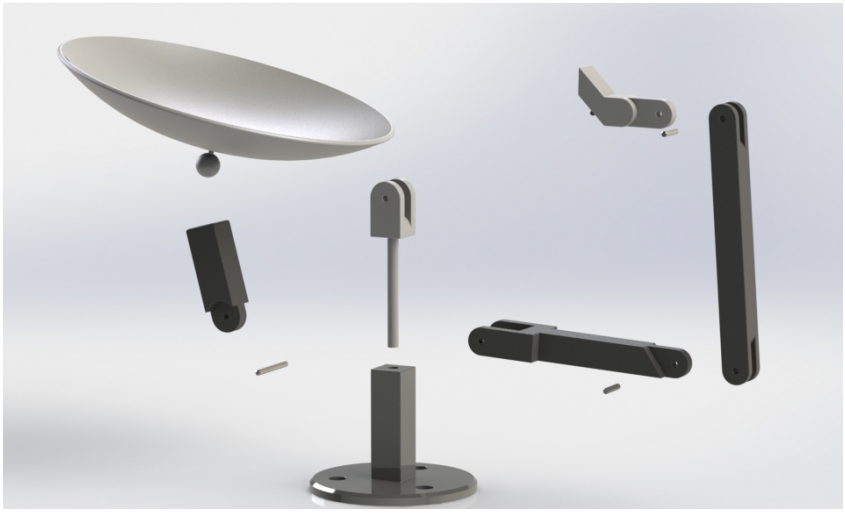


FIGURE 4.12: Exploded View of Antenna Assembly

4.3.2 Lights

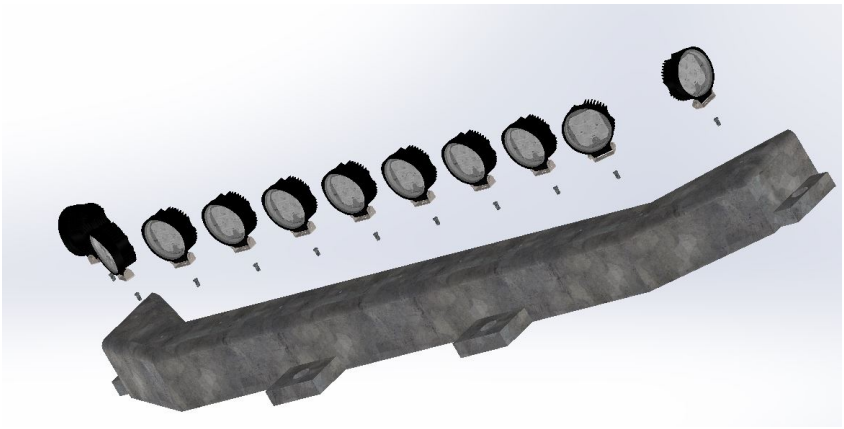


FIGURE 4.13: Exploded View of Light Assembly

4.4 PartsList

Insert spiel about PartsList.

4.4.1 Antenna

Chapter 5

CheckForFunctionality

Insert spiel about CheckForFunctionality.

5.1 SwivelLight

Chapter 6

Summary And Concluding Remarks

Insert spiel about SummaryAndConcludingRemarks.

6.1 Met Objective And Goal

The objective of our project was to create a functional high quality mars rover. However, we desired to create a rover much different than the current rovers. To do this we created a rover that was larger and had a higher impact strength. Additionally, our rover has better vision than previous rovers used by NASA. To accomplish this we designed a new and innovative cocpkpit that uses high performance glass which can survive in typical mars conditions. Additionally, we used grabbers on the front for mooving debris out of the way and pick up large objects as necessary. There is a comprehensive joystick in the cockpit that controls the grabbers and the vehicle for a full 3D range of motion. Additionally, the science compartment is retrofitted with its own 3D printer for impromptu part creation as needed while on Mars. Our antenna is used for long distance communication backk to earth. All in all, we feel that we achieved out goals of a realistic rover that is a viable option to create.

6.2 Course Comment

Throughout this project we faced many challenges in the SolidWORKS program. Each challenge needed a unique solution and helped us all to learn about many different features of SolidWORKS that we did not know prior to the project. For example, we gained experience and figured out how to work with subassemblies within a larger assembly. The probem we faced with this aspect was the fact that when subassemblies are placed into a final assembly they are unable to move within the subassembly unless they are made to be flexible. We went through a complext process to figure out how to make a subassembly flexible and also be able to be animated. During Visakh's creation of the cockpit, he learned a great deal on surface modeling techniques and how to best implemnt the different tools that surface modeling has to offer. Justin learned a great deal on how to create a functioning ball join in SolidWORKS by using a axis to axis advanced angle mate. Juan learned everything there is to know about 3d sketches with weldments. Assim figured oout the intricate workings of suspensions. Also, Auston figured out how to use surface modeling as wel which was taught to him by Visakh.

6.3 Team Experience

We developed as a team as the proect progressed. When we began the project we did not have any team meeting outside of class and did not have the communication network that we needed to complete the project proficiently. However, through team communication and organized team meeting we were able to get everyone on the same page and organized. This organizational structure of the group chat and team meeting are what made this project a great team experience. We were all passionate about our individual subassemblies, and strived to create the best project possible.

6.4 Course Suggestions

Appendix A

CheckForFunctionality

Insert spiel about CheckForFunctionality.

A.1 Week 1