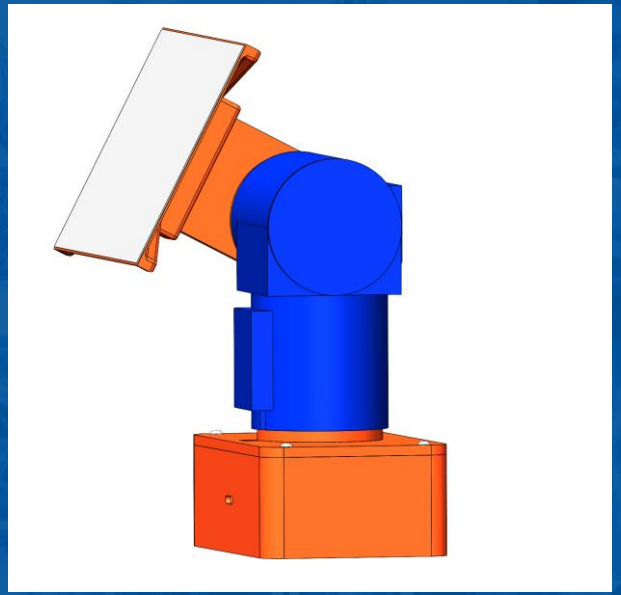
Herbert Wertheim College of Engineering
UNIVERSITY of FLORIDA

S.T.A.R.

Sun Tracking Accurate Reflector



Section 20720, Group 261F

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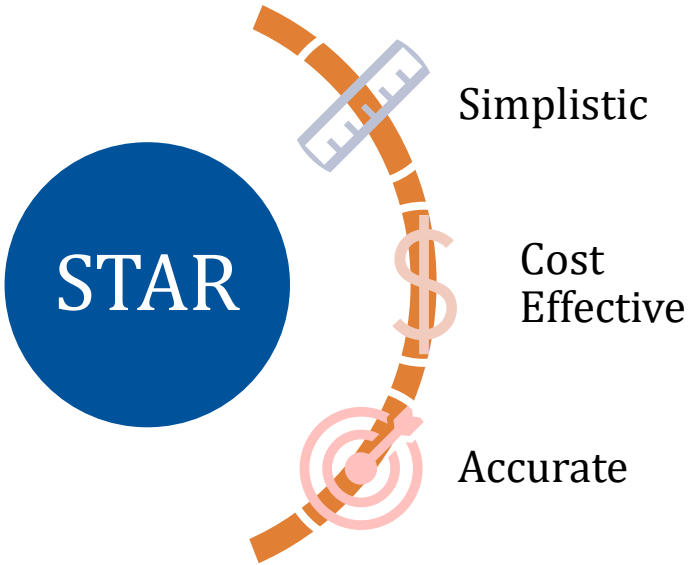
Dante Marra, Connor Murray, Sierra Vidales

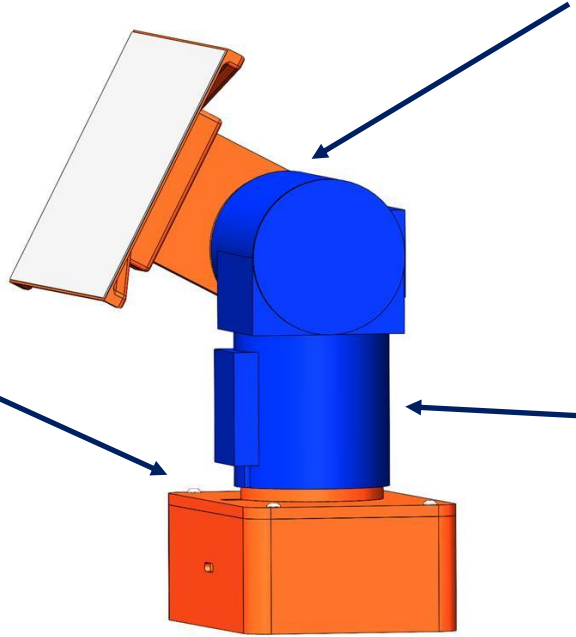
Team Motivation (Hedgehog Concept)



Design Highlights

Accurate Tracking

- MA = 5
- 1600 steps/rotation
- Internal limit switches



Durable Design

- All enclosed electronics
- Integrated internal gears
- Low profile tracking assembly

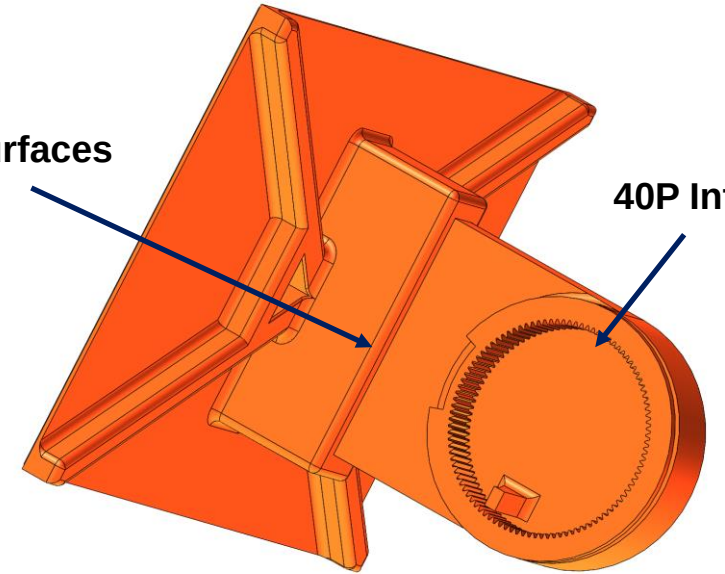
Simplistic

- 9 Structure parts
- 13 Fasteners
- Minimal OTS parts
- Easily serviceable

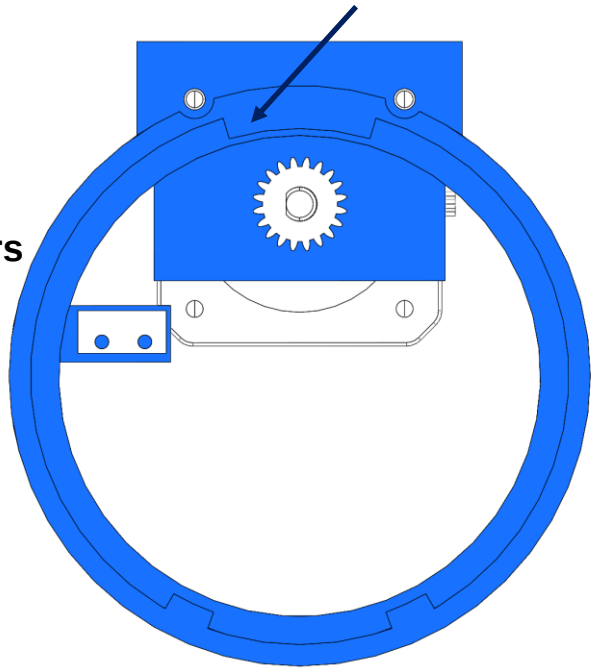
Unique Design Features

Glued surfaces

40P Internal Gears



Slide Lock



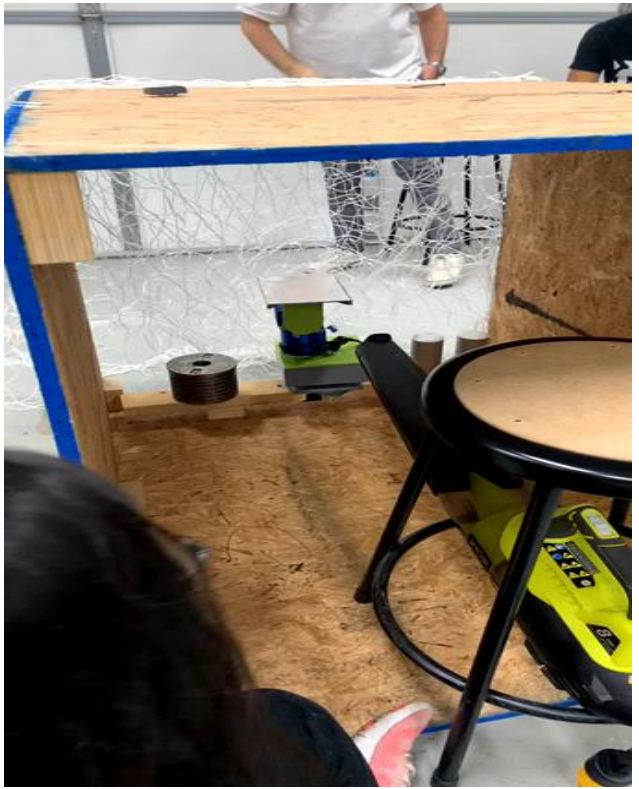
Successful completion of tests

Wind Test

- ☑ Withstand 4.1 m/s and 5.3 m/s air velocity during normal heliostat operation
- ☑ Withstand 60 m/s air velocity during safety mode heliostat operation

Motor Test

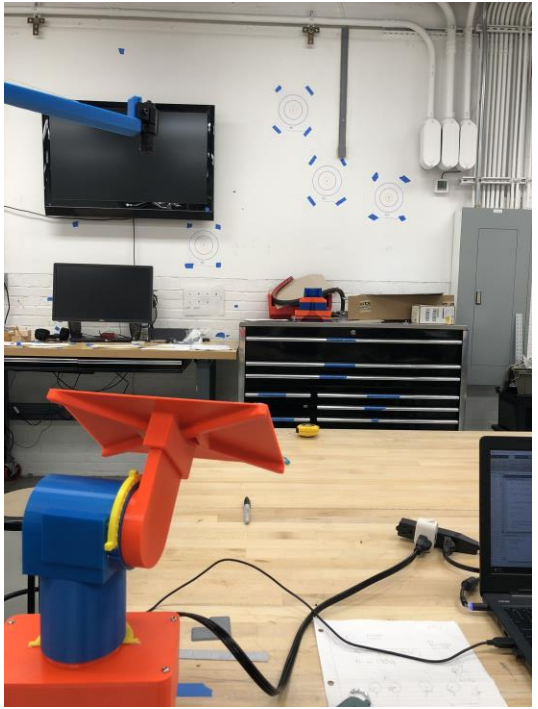
- ☑ Initialize to a specified home position
- ☑ Movement of both azimuth and elevation axis



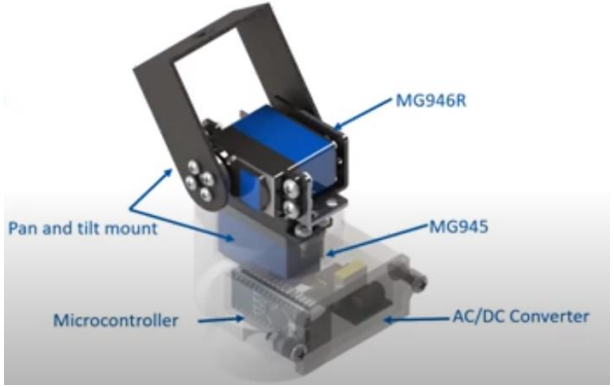
Successful completion of tests (pt 2)

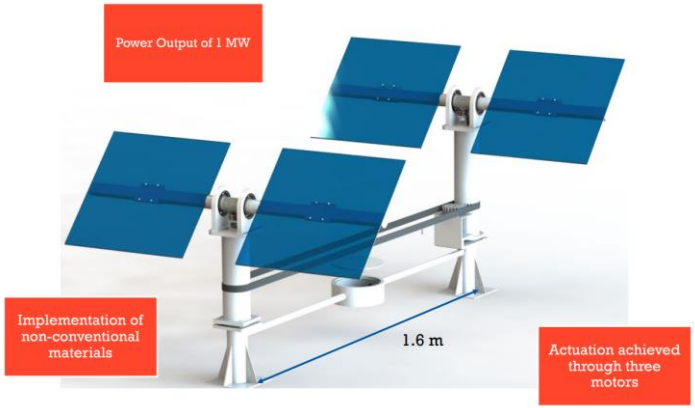
Laser Targeting Test

- ☑ Closed Loop Target Location
- ☑ Closed Loop Target Coordinates
- ☑ Open Loop Known Target Location
- ☑ Open loop Targeting of Unkown Target Location
- ☑ Open Loop Ceiling Target Location



Evolution of Design





Evolution of Design

- From the start of the spring our design has undergone many major and minor design changes.
- The initial design was created to be simple, yet easy to assemble and take apart in the field. Over the past four months our design has undergone many alterations all with those two goals in mind.
- All electronic components were initially to be housed in a large control box, yet over the semester the volume of the box has been cut in half to save space and money. The large box had an initial volume of 59.88 in^3, whereas the new box has a much smaller volume at 41.18 in^3.
- Attached to the top of this control box are the azimuth and elevation casings, and these components have not changed too much at all over the semester. Small dimensional tolerances were added, and the addition of a limit switch was made on each of the two casing walls.
- The elevation arm and mirror bracket have remained relatively constant throughout the semester, with the only major change being a length reduction to the elevation arm from 4.5 inches to 3.75 inches.

Evolution of Design

By reducing the elevation arm's length from 4.5 inches to 3.75 inches the moment acting on the system is reduced, while remaining clear of any interference.

The mirror bracket weighs 0.1181 kg and paired with gravity it gives a downward force of 1.158 N.

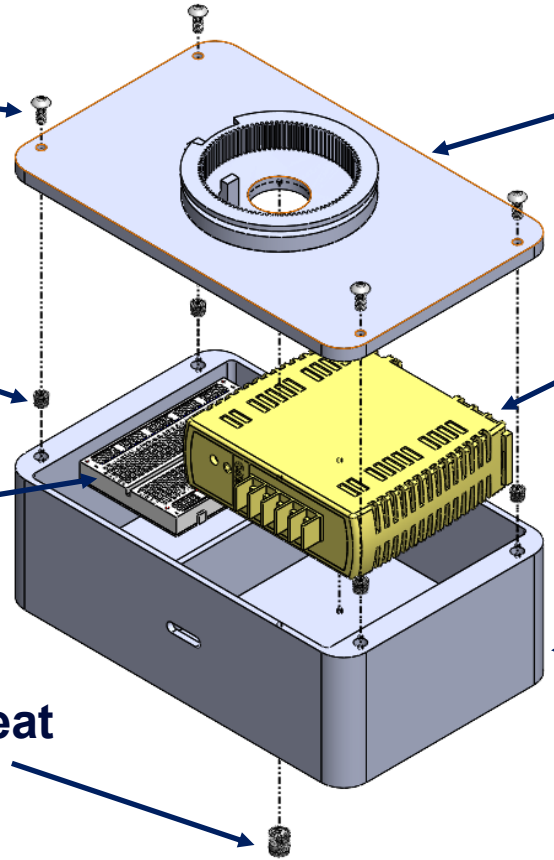
To find both moments, the two respective elevation arm lengths are then multiplied by this force calculated above.

$$M_1 = (4.5\ in)(1.158\ N)$$

$$M_2 = (3.75\ in)(1.158\ N)$$

From these two calculations it was found that the moment acting on the system with a 4.5-inch arm was 5.21 J and the moment using a 3.75-inch arm was 4.34 J.

Exploded Base Assembly CAD View



18-8 Stainless Steel Button Hex Screw

Bottom Lid

8-32 Thread Heat Inserts

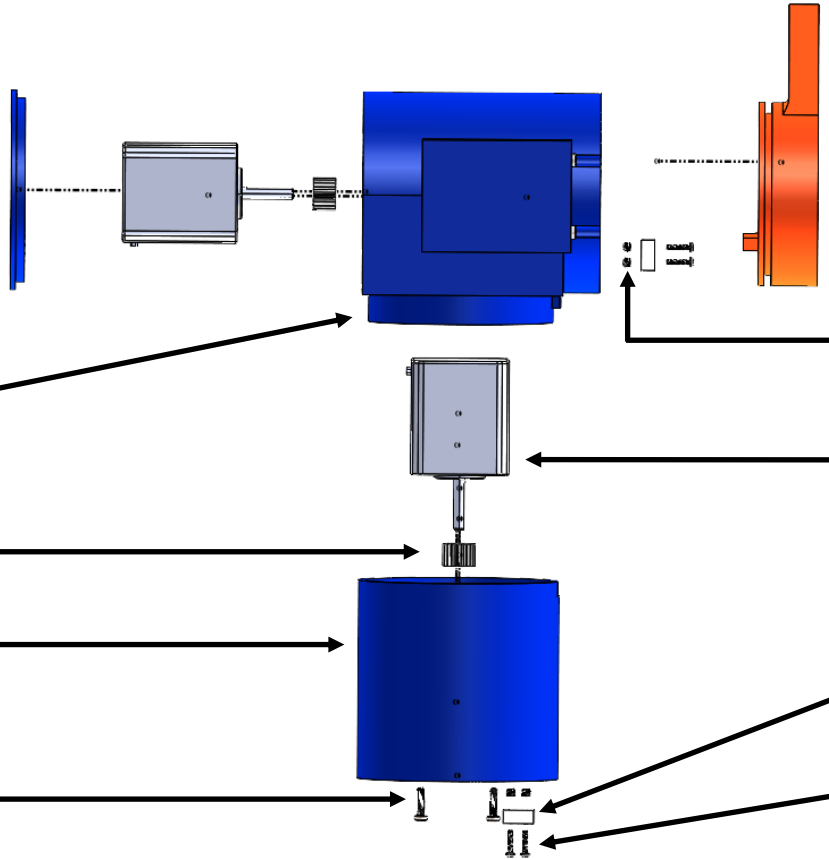
Power Supply

Breadboard

Bottom Case

¼” Thread Heat Insert

Tracking Assembly Exploded CAD Views



Cost for 1/1

Parts	Cost
8/32 0.185 Heat Sets (base cap) (4)	$ 0.78
1/4-20 3/8 Heat Set (tripod mount)	$ 0.43
8-32 3/8 Screws (Base) (4)	$ 0.30
PLA/PETG Filament	$ 43.33
M2x4x3.5mm (limit switch heat sets) (4)	$ 0.56
M2x0.4x10mm (limit switch screws) (4)	$ 0.54
M3x0.5x12mm (motor screws) (4)	$ 0.41
Limit Switch	$ 0.38
Total	**$ 46.72**

FILAMENT COST CALULATION

Material	Part	Mass (kg)	Price
PETG	Base	0.39076	$ 11.72
PETG	Base cap	0.10002	$ 3.00
PLA	Lower (Vertical) Case	0.08899	$ 2.67
PLA	Top (Horizontal) Case	0.14139	$ 4.24
PLA	End Cap	0.01662	$ 0.50
PETG	Lever Arm	0.07078	$ 2.12
PETG	Mirror Bracket	0.1181	$ 3.54
PLA	Motor shaft gear (1/2)	0.00109	$ 0.03
PLA	Motor shaft gear (2/2)	0.00109	$ 0.03
	TOTAL	**0.92884**	**$ 27.86**

Material	Mass (kg)
PLA	0.24918
PETG	0.67966
TOTAL	**0.92884**

Cost for 1/3000

Parts	Cost
8/32 0.185 Heat Sets (base cap) (4)	$ 1,871.04
1/4-20 3/8 Heat Set (tripod mount)	$ 1,023.36
8-32 3/8 Screws (Base) (4)	$ 727.68
PLA Pellets	$ 4,560.00
PETG Pellets	$ 12,312.00
M2x4x3.5mm (limit switch heat sets) (4)	$ 600.00
M2x0.4x10mm (limit switch screws) (4)	$ 1,200.00
M3x0.5x12mm (motor screws) (4)	$ 360.00
Limit Switch	$ 911.04
Total for 3000	**$ 23,565.12**
Total for 1	**$ 7.86**

Summary of Design

Manufacturability

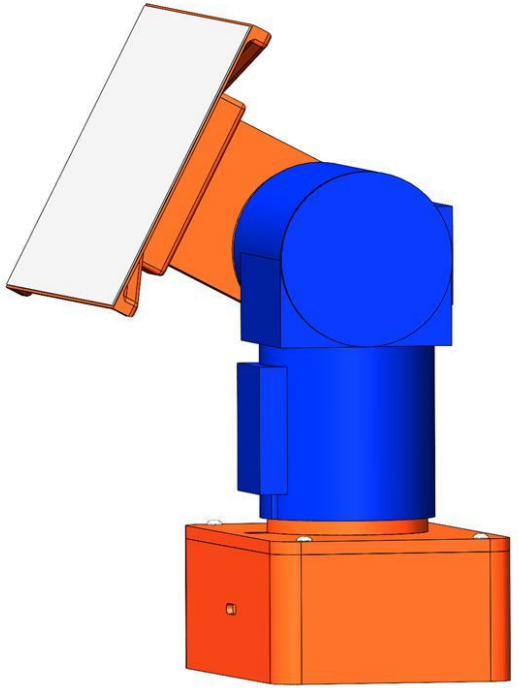
- Modular Design
- Minimized Number of Parts
- Integrated Internal Gears

Maintenance

- Accessible Electronics System
- Tool-less Locking Mechanism
- Easily Serviceable

Accuracy

- Use of Limit Switches
- Homing Process



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Questions?

POWERING THE NEW ENGINEER TO TRANSFORM THE FUTURE