TEXAS STATE UNIVERSITY

*The rising* STAR *of Texas*

# M5 – HE Solar

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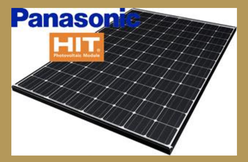
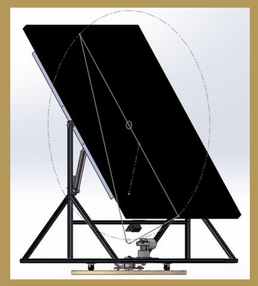
Mark Summers

HEsolar

## About Us

- With a desired need for sustainable energy, solar panels have become one of the most efficient and environmentally friendly energy sources on the planet.
- Our technical mentor and lead sponsor, Mark Summers, created the foundation of this project by making a dual axis tracking system that will utilize a Panasonic solar panel that was donated by our co-sponsor, HE Solar.



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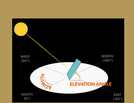
## Problem Definition

### Current State of The Solar Panel


- The overall goal of this project is to get the solar panel to orient itself to face the sun with the use of a GPS tracking system.
- With that major goal in mind, our customer has presented our team with two problems that focus on the mobility of the solar panel.

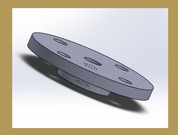




- First to stabilize the Elevation of the Solar Panel.
- Then Improve Azimuth Mobility

## Proposed Solutions - Synthesis

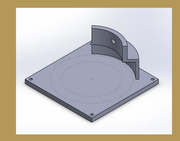
### Azimuth Designs

#### Insert Design



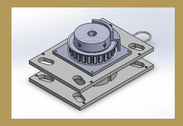
#### Stabilizing Frame Design

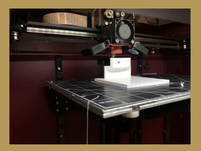
- These two designs are made to constrain the pully connector to the top plate of the turn table



### Concept Selection Matrix

| Cameron, Steven | | Insert | Stabilizing Frame |
|---|---|---|---|
| Azimuth Design | Cost | 4 | 1 |
| Design Desirability at 1-5 Rating | Ease of Maintenance | 2 | 4 |
| 1 = Low; 5 = High | Machinability | 3 | 1 |
| | Customer Preference | 2 | 4 |
| | Ability To Function | 1 | 5 |
| | | | |
| | | | |
| | Total | 12 | 15 |

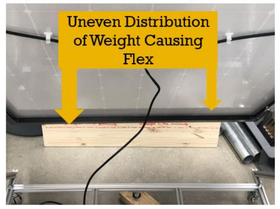




### Design Ideas: Stabilizing the Elevation of the Solar Panel

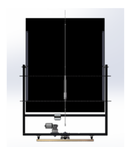

The proposed idea was to find a way to distribute the weight of the solar panel evenly.

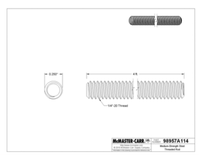
- Centering the actuator in the middle of the structure.
- Adding another actuator on the opposite side from the current actuator.

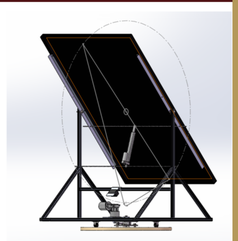



### Centering Actuator

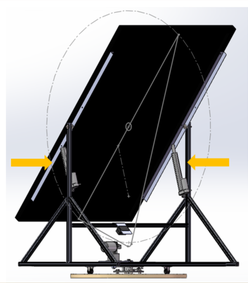
- We would need to purchase 2 [ ¼" – 48"] Steel Threaded Rods.
- The length from the farthest ends of the solar panel structure is at 45.6in ≈ 4ft





### Adding a Second Actuator on the Opposite Side



- This design idea would stabilize the solar panel, by giving support on both sides.
- If we synchronize the two actuators, it will require major precision, and that precision could cause damage to the overall structure. Our customer was not in favor of taking this risk.
- Not ideally necessary, given each actuator can supply a load capacity of 750 N or 169 lbs. when the solar panel itself is only 40 lbs.

### Concept Selection Matrix

| Shelby | | Adding a Second Acuator | Centering the Acuator |
|---|---|---|---|
| Elevation Design | Cost | 2 | 5 |
| Design Desirability at 1-5 Rating | Stability | 4 | 4 |
| 1 = Low; 5 = High | Ease of Operation | 2 | 3 |
| | Customer Preference | 2 | 4 |
| | | | |
| | Total | 10 | 16 |

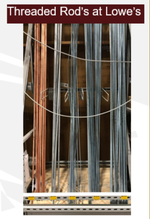
The cost of 2 steel rods = $8 while the cost of an actuator ranges = $75-$125.

There would be an improved amount of stability in both designs.

The ease of operation will be difficult when synchronizing the 2nd actuator. While the operation of centering the actuator in the center will be more simplistic.

Our customer has let us know that he would prefer not to synchronize the two actuators.

Threaded Rod's at Lowe's

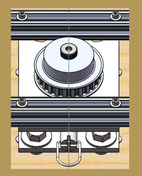


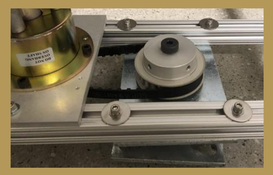
## Conceptualization

### Current State of Lockable Turntable (Azimuth Designs)

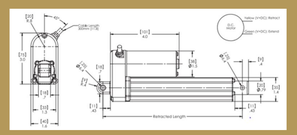
**Lockable Turn Table Findings**

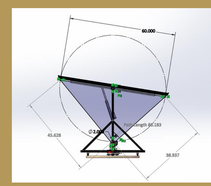
- Bottom plate is fixed, and shoulder screw is screwed into bottom plate
- Caused the pulley to unscrew itself from the turntable






### Elevation Conceptualization/Stabilizing Tilt






| Model | LT150* |
|---|---|
| Load Capacity (Push/Pull) | 750N (169 lbs.) |
| 12 VDC | |
| Speed at No Load | 10mm/sec (.4in/sec) |
| Speed at Rated Load | 8mm/sec (.3in/sec) |
| Current at Rated Load (Amps) | 3.5 |

**Solar Panel Need To Know:**

Solar Panel Weight = 40.81 lbs.

The Max Wind Load of the Solar Panel = 130mph

It has a Maximum Rotation ≈ 90 Degrees

Length of Solar Panel = 41.5"

Actuator Need to Know:

Load Capacity of Actuator = 169 lbs.

Load Rate = 3.5 Amps Max at 12VDC

Diameter of Hole = ¼"

Extension Length = 8.1"