

## Modular Heliostats

### Abstract

The GatorRays Heliostat introduces novel ideas enabled by utilizing a smaller heliostat design. The GatorRays heliostat is modular and light, utilizing 3D printing technologies to not only mitigate weight of the design, but to also lower prices for custom pieces. UV resistant coatings are applied in order to protect vulnerable parts from the harsh desert climate. This design differs from others in that the GatorRays heliostat is future proof; the simple base structure design enables accessible alterations along its support structure, alternate shaft lengths could be fit to the mirror panels to allow for more mirrors to be connected, and the use of Wi-Fi enabled microcontrollers allows for wireless updates to all heliostats in the field. The system consists of four mirrors actuated using five motors, one to enable entire platform rotation and four enabling the mirrors to operate independently on at least one axis. The reflective surface and controls system is mounted onto two square steel rods set in concrete. The ESP-32 microcontroller takes in signals from the central tower and sends messages to the motors, enabling the system to accurately track the sun. The design is to be the most easily manufacturable design to lower the solar field cost while still providing the power of 7,360 suns onto the solar tower.

### Total Costs

Subsystem	Cost
OTS Parts	\$79.41
Modified OTS	\$6.82
Raw Materials	\$6.44
Assembly Labor	\$5.51
Manufacturing Labor	\$9.07
Energy Consumption	\$0.32
<b>TOTAL</b>	<b>\$107.57</b>

### Final Design CAD Model

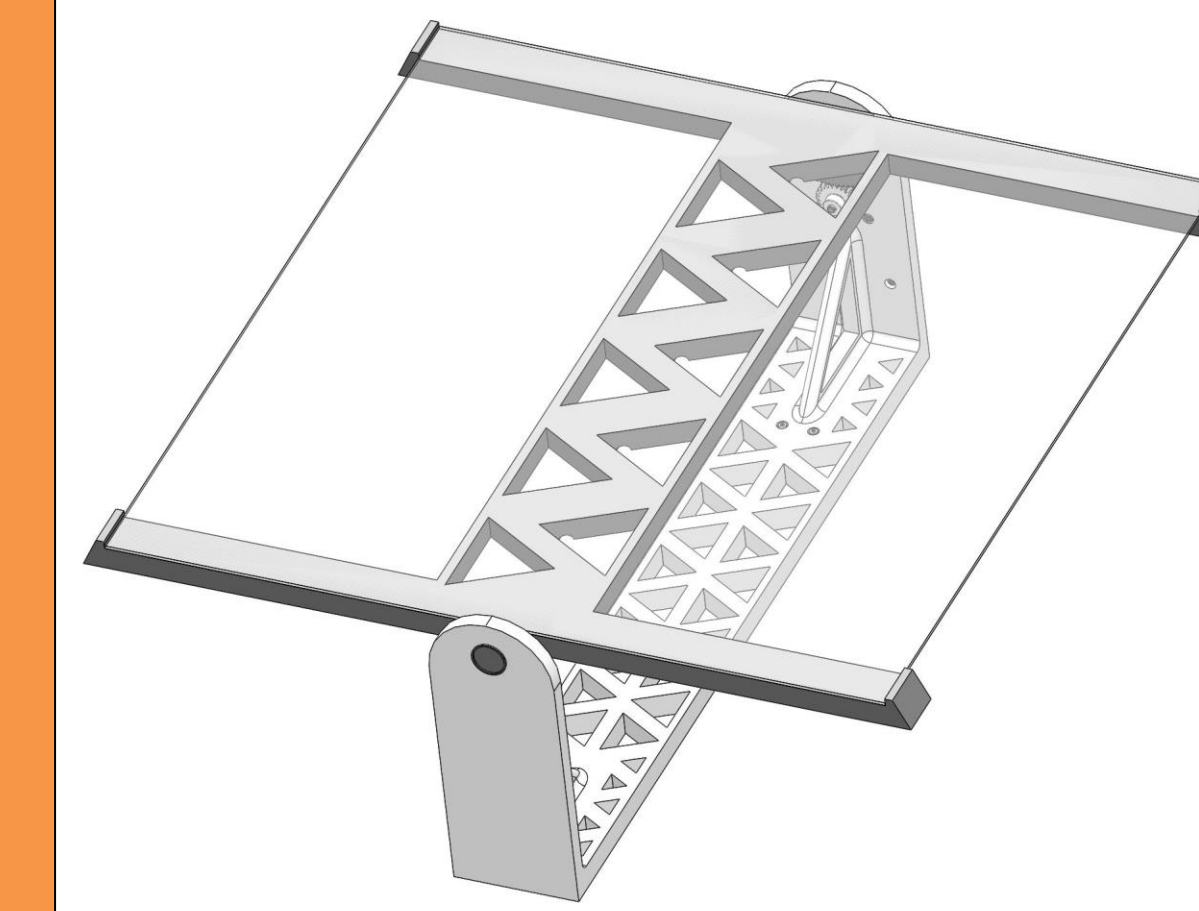


### Product Functionality

The heliostat is designed to effectively reflect the sunlight throughout the day. The setup in a single module is created so that there is minimal shading, while also allowing maximum reflection. That reflection is directed towards a solar tower that is designed to store that power for future use. Our goal is to be able to provide power for over 1000 homes with this eco-conscious, low cost, and modular design. The 3D printed reflective surface structure is created with a triangular design in order to keep the structural integrity while decreasing the amount of material needed for the job. With the chosen gearing, specifically the worm gear, the torque force can be amplified and allow for better functionality.

### Subsystems

#### Reflective Surface



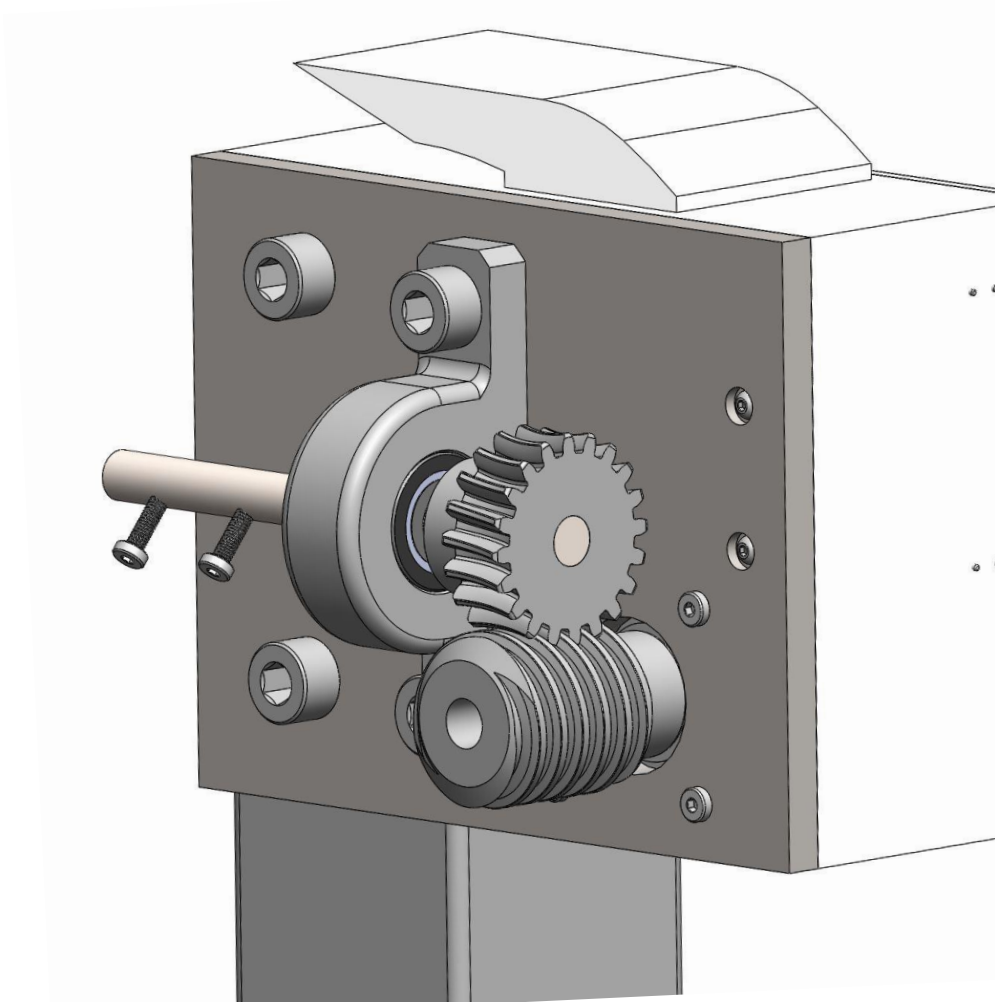
- Four mirrors with 0.25 m<sup>2</sup> surface area each
- Mylar film surface with 92% reflectivity
- 10-year lifetime
- Design provides the equivalent power of 7,360 suns
- ABS plastic backing for structural support and rigidity

#### Base Structure



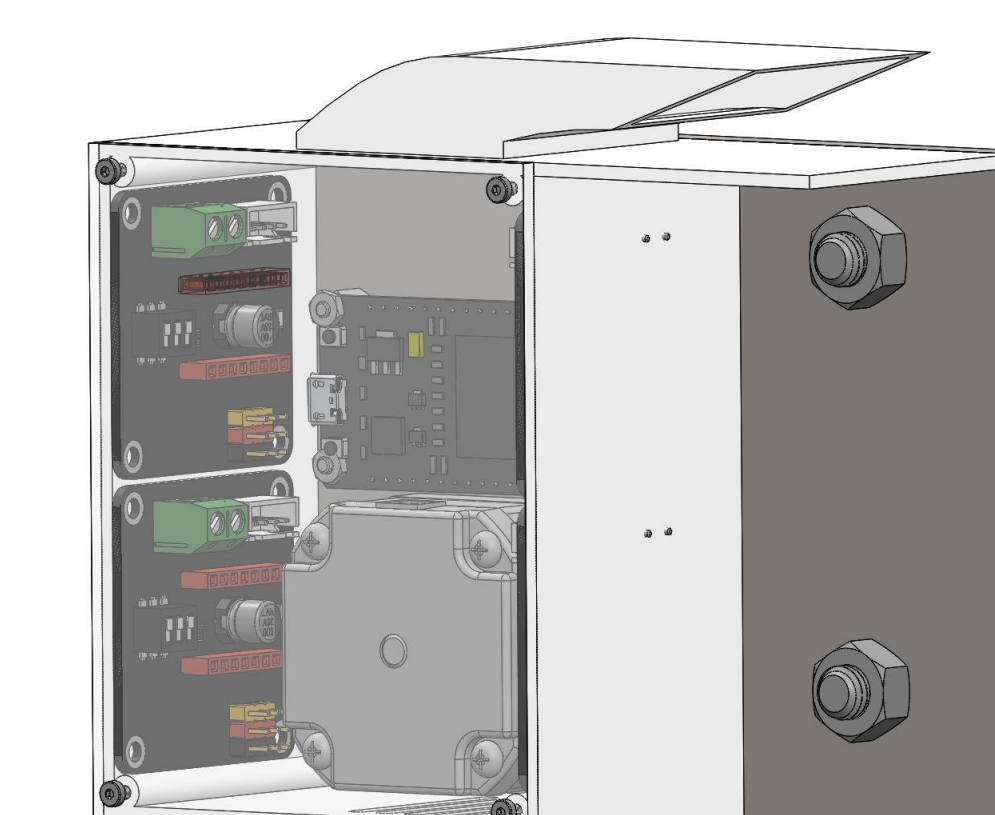
- Steel square tubing support, laid in poured concrete for reinforcement
- Modular design for easy future adjustments
- 3D printed cover covering top of tubing to prevent animals nesting in and water filling the structure.

#### Motor Actuation



- 1 NEMA stepper motors allow for 360° rotation about the main shaft about the horizontal axis of the heliostat
- 2 NEMA stepper motors allow for rotation about the vertical axis
- ABS plastic casing to keep sand out of gears and motors

#### Control System



- ESP 32 microcontroller allows the motors to be controlled locally to track the sun
- Wireless transmission allows for over-the-air updates
- Low-cost and reliable design



