

Project Description

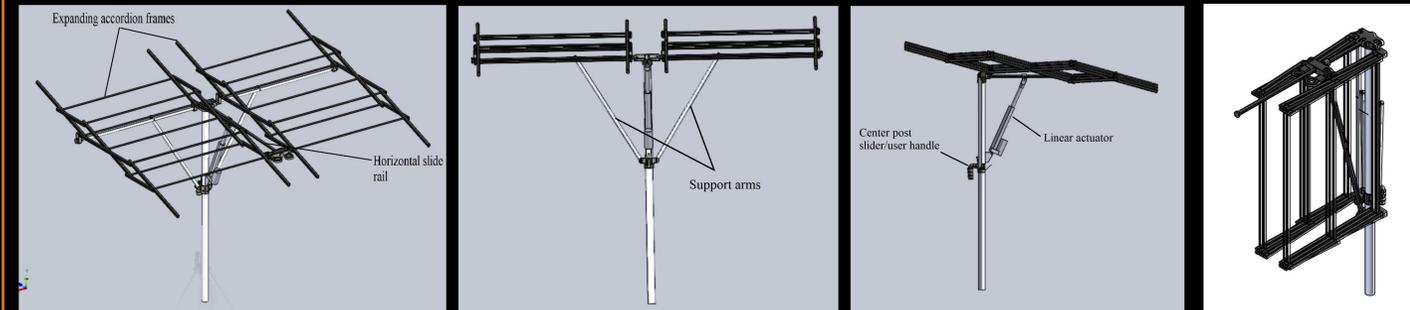
Our sponsor, Nick Flann (pictured), has developed a solar panel device that also provides a shaded area for people to enjoy. This device, called the Suncatcher, can be adjusted to maximize shade and energy production, but cannot be easily moved from location to location. Our goal as a team throughout this project was to create a portable version of the Suncatcher. The team and sponsor agree that making the device portable expands the potential product market to the outdoor industry. People who frequently travel or camp need energy to power appliances and shade to keep cool. The portable Suncatcher solves problems that popular roof or ground-mounted solar panels do not.

The constraints and requirements for the design, as decided by the team and sponsor are:

- **Solar generation capacity** Minimum solar PV capacity of 200W
- **Shade area** Provide shade for at least four people
- **Weight** Shall weigh no more than 50 lbs., ideally less than 30 lbs.
- **Ease of Deployment** Should not exceed a 7-minute setup time and should have less than 15 steps
- **Packability** When undeployed shall not exceed a side length of 4.5 ft.
- **Stability** Should be able to withstand winds up to 20 mph.
- **Operation** The force required to adjust the device shall not exceed 30 lbs.
- **Adjustability** Device should be able to adjust to meet sun angle ranges from 30° to 70°



Design Description



E X P A N D E D / D E P L O Y E D

COMPACTED/
UNDEPLOYED

The above renderings display the Portable Suncatcher without solar panels for easier viewing purposes.

The compaction and expansion aspect that makes the Portable Suncatcher effective can largely be attributed to the expanding accordion frames. The accordion frames collapse by sliding along the horizontal slide rail and fold inwards with user adjustment of the center slider, making the support arms parallel with the center post. The combination of these actions decreases the open area of the device in multiple dimensions when undeployed. When deployed, the linear actuator allows for automated, easy adjustment of the device to many different sun angles. The separated & tiered panel planes allow for a contiguous shade area while allowing wind to pass through the device.

Performance Review

Constraints:	Weight of the Suncatcher (lbs.)	Power Capacity (W)	Shaded Area (no. of people)	Wind speed to withstand (mph)
Target:	30	800	6	20
Threshold:	50	200	4	10
Predicted Performance:	32	300	4	20
Actual Performance:	51	300	4	20

Constraints:	Force required to adjust (lbs.)	Time to set up (min)	Adjustable tilt to meet sun angle range (degrees)	Difference in ground levels (at each leg of Suncatcher) (in.)
Target:	20	2	40	12
Threshold:	30	7	20	3
Predicted Performance:	25	6	40	N/A
Actual Performance:	40	6.5	40	N/A

Constraints:	Steps to set up	Height Settings (ft.)	Maximum side length of carrying case (ft.)
Target:	5	10	4.5
Threshold:	15	5	5.5
Predicted Performance:	7	N/A	5.25
Actual Performance:	7	N/A	5.208

(1) Design/CAD Phase Results

Constraints:	Weight of the Suncatcher (lbs.)	Power Capacity (W)	Shaded Area (no. of people)	Wind speed to withstand (mph)
Target:	30	800	6	20
Threshold:	50	200	4	10
Predicted Performance:	32	300	4	20
Actual Performance:	27.38	360	4	20

Constraints:	Force required to adjust (lbs.)	Time to set up (min)	Adjustable tilt to meet sun angle range (degrees)	Difference in ground levels (at each leg of Suncatcher) (in.)
Target:	20	2	40	12
Threshold:	30	7	20	3
Predicted Performance:	25	6	40	N/A
Actual Performance:	22.4	0.53 (31.6 seconds)	51	N/A

Constraints:	Steps to set up	Height Settings (ft.)	Maximum side length of carrying case (ft.)
Target:	5	10	4.5
Threshold:	15	5	5.5
Predicted Performance:	7	N/A	4
Actual Performance:	5	N/A	3.71

(2) Manufacturing/Assembly Phase Results

To verify the performance of our device along the design process, the team evaluated each of the design criteria (1) during the design/CAD modeling phase through SolidWorks analysis methods and (2) during the manufacturing/assembly phase by taking physical measurements using equipment available in USU's Metal Factory. The above figures show the overall results from the two evaluations, respectively.

Conclusion

Overall, the team is satisfied with how the Portable Suncatcher design has performed in meeting the requirements and constraints. As can be seen from the latest performance review, the design was able to come in accordance with the threshold and target for most design aspects. A major theme of the requirements and constraints throughout this project involved the team and sponsor working together to establish bounds for constraints and find satisfactory solutions to aspects that were somewhat dynamic throughout the process.

Throughout the course of this project, the team has learned many lessons that are applicable to both the academic and professional worlds. Most notably, the team learned that it is often the case—especially when working with prototypes or new products—for the design to be continually evolving throughout the course of the project. New issues arise, new constraints or requests from the customer or sponsor become necessary, and more efficient solutions to problems materialize as the project moves forward.

As this capstone project concludes, the team recommends that the sponsor continue to refine the design to improve the overall build quality, operational ease, and stability/durability of the Portable Suncatcher. The team was able to work with the sponsor to generate many innovative ideas regarding this device, and there is much potential for the prototype to transform into a real product with market appeal and value.