Solar Collector Research & Development Phase II

Overview
Solar Dynamic is a small organization with the hopes of producing an affordable, low-maintenance solar collector that can output competitive efficiencies with respect to current solar concentrators. A team of engineering students are to engineer a prototype design to the sponsor’s specifications with the vision of commercial use.

Objectives
This phase of research and development should focus on developing a new prototype design, improving testing strategies, and making additions to an ASAP user manual to aid in future phases of the project.

Approach
- Gathered and weighed customer needs in categories such as safety, cost, materials, environmental impact, ease of use, efficiency, and durability
- Visited sponsor on site to build relationship and to understand their vision in greater detail
- Conducted preliminary research exploring areas like lenses, photo voltaic, and material properties
- Produced initial batch of concept generations
- Consulted as whole in narrowing down concept generations and chose two models to consider: a parabolic box design and a narrowed tangential fin design
- Bench-marked conceptual designs by performing a patent search which proved to provide several areas of concern, but no direct similarities and therefore the team continued with both designs
- Researched compatibility of models with current light pipes and fiber-optics on the market
- Created CAD models to specifications in Solidworks for both designs
- Analyzed light ray simulations in the optics software ASAP that were used for theoretical testing
- Designed a test rig for experimental testing results using an LED flood light as source for results that could closely compare to the theoretical efficiency data collected from ASAP
- Concluded that the parabolic box design was most efficient and should be model chosen to be fabricated
- Altered last phase prototype to roughly resemble tangential fin design for data collection using the test rig; due to unforeseen circumstances the parabolic box design could not be fabricated

Outcomes
- Theoretical testing proved the parabolic box design to be roughly 42% efficient, being a huge improvement from phase I efficiency of 14%
- Additions were made to ASAP user manual in modelling normal light
- Test rig with LED flood light as source proved to provide a good correlation between theoretical and experimental data.