Development of a Low Cost Concentrating Solar Energy System Using Solar Sausages
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Industry Partner: Hunter and Harp Holdings (HHH)

Beginning in late 2010, weekly meetings have been held at HHH offices in Tallahassee that include representatives of the several entities involved in deploying the "Solar Sausage" concentrating system at the Yulee St. site in Tallahassee. The entities include Pro Solar Inc., Barkley Consulting Engineers Inc., Winton Engineering PA, and Applied Research and Design Inc. A series of 50-foot long prototype sausages were made and inflated on site. Many issues were identified that needed to be resolved before manufacturing and deploying several hundred solar sausages on site including methods of constructing, mounting, and operating the balloons, distribution of air and electricity, and removal of heat.

Specific accomplishments:

- We have identified the correct adhesives for bonding the PET polyester films to each other and the correct bond geometry for minimizing the pealing stresses on the adhesive.
- We have designed and partially built the actuation system for rotating the balloons to track the sun.
- We have streamlined the process of producing the balloons such that a team of 16 workers can produce about 1 balloon per hour. Currently 150 of 336 balloons have been produced. While our current manual process produces balloons of 50-foot length, HHH is investing in machinery that will produce balloons of continuous length, to be cut to the length desired. This will reduce the number of "balloon ends" in the final application. Balloon ends are undesirable from the standpoint of electrical distribution, air distribution, solar-tracking actuation, and optical end effects.
- We have designed and are generating the software required to control absolute pressure in the balloons, to control differential pressure between the compartments of the balloon to maintain the optic, and to make astronomical predictions and control the rotation of the balloons. (Specifically, an FSU led portion of the project – resulting in an in-kind cash match from HHH to FSU to purchase instrumentation from National Instruments for this part.)
- We have developed procedures for mitigation of damage during high-wind and catastrophic-wind events which include increasing the pressure in the balloons, securing the photovoltaic modules with a tensioned retainer cable, and (if time allows) removing the photovoltaic modules.
- We have identified the need for photovoltaic material with greater concentration ratios.
- We have identified a variety of alternative methods by which the balloons could be rotated to track the sun.
- We have identified several of these scenarios that eliminate the need for counterweights.
- In the future, with higher concentration PV material and longer balloons, costs may be scientifically reduced using the centralized-elevated-receiver concept.

As can be seen in the accompanying photographs, the project is well along in terms of deployment of the technology on the Yulee St. site.

The project has involved full and part-time employment of approximately 100 individuals over the last 8 months doing construction, site development, and manufacturing.

FIRST FULL-SIZED INFLATABLE MIRROR

VIEW OF THE YULEE ST. SITE FROM THE NORTH EAST CORNER

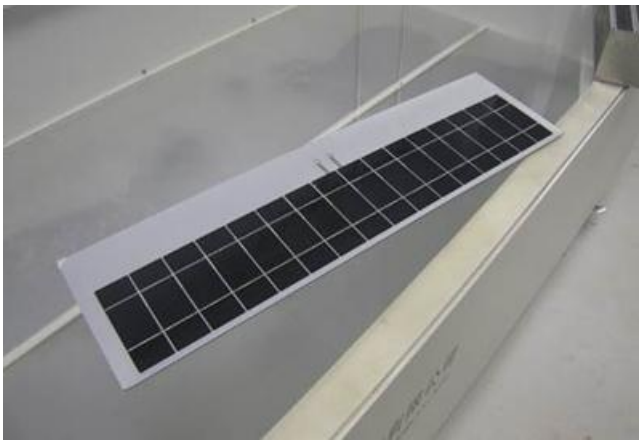
PLANT STREET FACILITY FOR PRODUCTION REHEATING THE GLUE TO BOND THE MEMBRANES TOGETHER

GLUE MACHINE APPLYING GLUE TO THE SOLAR SAUSAGE FORMING AND GLUE MACHINE

LOAD-ADHESION TESTING OF A 50-FOOT BALLOON

A 50-FOOT BALLOON

STREET VIEW OF THE YULEE ST. SITE FROM THE EAST



ENCAPSULATED PHOTOVOLTAIC CELLS