American-Made Solar Prize

Technical Assistance Request

U.S. DEPARTMENT OF ENERGY

FLOATING SOLAR BOX

Provide sustainable power to energize internet of things (IoT) devices in the ocean and the blue economy

Changzheng Huang, changzhengh@hotmail.com

Founder & CEO, First Principle Engineering Solutions LLC, Irvine, California

1. What Is Floating Solar Box?

A floating solar box is a floating, water-proof box that contains solar panel on the top surface, and has internal rechargeable batteries and power control electronics inside, as shown in Figure 1.A solar box collects solar power at daytime, stores solar energy internally, and supplies sustainable power to external maritime sensors and devices. Solar boxes can also be deployed on the ocean surface as array, as shown in Figure 2.

2. Why to Use Floating Solar Box?

Federal agencies such as NOAA and Navy deploy large networks of unattended sensors in the ocean. Ocean related universities and industries also have observation and navigation devices operating in the ocean. These sensors and devices require small, sustainable power supply. Batteries have limited time. Wave or wind-based power supplies are bulky and costly. Floating solar box fills a gap in this niche market.

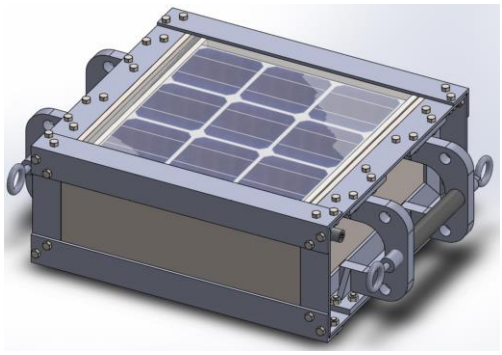

Figure 1. A floating solar box.

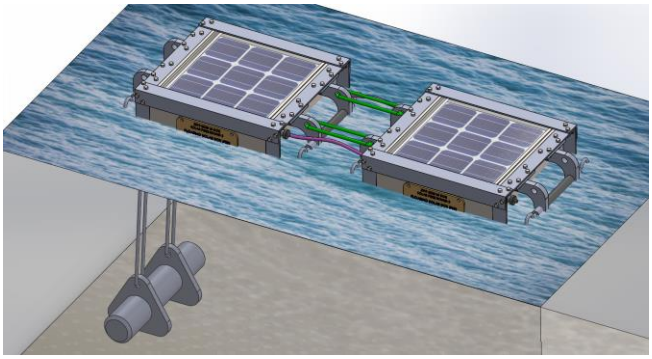

Figure 2. Floating solar boxes deployed as array.

3. Technology Assistance Request

The team has submitted the solar box innovation to compete for American-Made Solar Prize. We are seeking technical assistance from the American-Made Network to help us expedite the process from technology innovation to marketable product. We have the following prototyping and manufacturing opportunities for network partners.

3.1 Prototype Design

3.1.1 Power control electronics design. A solar box takes solar power as input, stores the solar energy in internal battery, then output regulated power to external devices. To ensure high reliability, there are redundant power components and multiple power flow paths. The power control electronics must be designed to handle power conditioning and monitoring, fail-safe operation, circuit protection, and thermal management.

3.2 Prototype Build

3.2.1 Printed circuit board (PCB) build. Based on the power electronics design, build a customized PCB board. The PCB board should come with micro-controller and embedded control software.

3.2.2 Build the mechanical part of the solar box. The solar box wall material may be marine grade aluminum alloy or figerglass. The important thing is to make sure the solar box is water-proof in harsh marine environment. The possible leak points are the power outlets to external devices, and the sealing lines between the acrylic cover sheet and the solar box wall.

3.3 Prototype Test

3.3.1 Design and build a test rig for solar box. On Demo Days, the solar box will be tested on a seawater tank. To simulate ocean waves, the solar box will periodically go from floating position to submerged position. Need a test rig that can do this type of test and output real-time sensor values from the solar box on pressure, temperature, strain, voltage, current, and battery power level.

3.4 Mass Production Manufacturing Process Design

3.4.1 Need advanced manufacturing process design for mass production. The solar box is designed to be modular. The mass production process can be made highly automatic or robotic for low-cost and high quality manufacturing. We look for manufacturers to provide solutions for automatic or robotic manufacturing of solar boxes.