NRL develops low cost, high efficiency solar sensor

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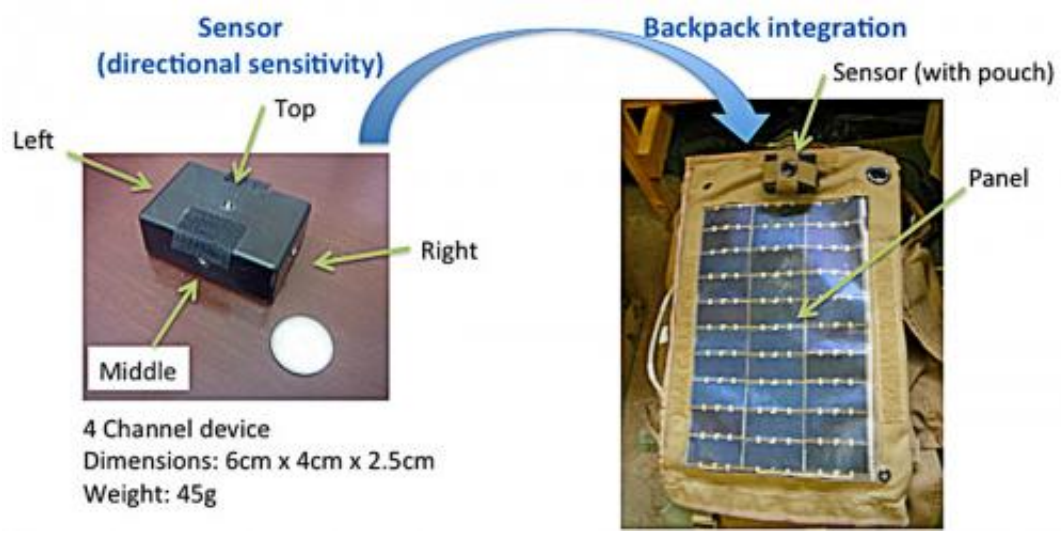

Solar sensor boxes attached to the top of mobile solar power unit packs directly measure the amount of solar irradiation (sunlight) visible to the photovoltaic panels. Credit: US Naval Research Laboratory

Research scientists at the U.S. Naval Research Laboratory (NRL) Electronics Science and Technology Division have developed a novel low cost, highly efficient spectral sensor for field analysis of solar cell irradiance performance and spectral distribution.

Mobile solar power units have been recognized as a promising route toward decreasing the dependence of the military on fossil fuel generated power. To date, a multitude of mobile solar powered systems

are under development that range from man portable highly flexible photovoltaic blankets, solar powered aircraft, trailer based hybrid power units and underwater sensor applications.

Spectral radiometers are widely used to measure the spectrum of emitted, transmitted or reflected light of a given material. Current spectral radiometers generally require sophisticated optical components for beam forming and diffraction, refined electronic components for the signal readout or moving parts that contribute to inefficient power consumption and high production costs.

"We have invented a novel minimum size, ultra-low power spectral radiometer unit with integrated data storage functionality and a battery lifetime of up to several years," said Dr. R. Hoheisel, NRL Solid State Devices Section. "In addition, the system can be produced at the expense of under $20 and features very high sensitivity and linearity."

The sensor system can be used in remote solar radiation monitoring applications such as mobile solar power units as well as in long-term environmental monitoring systems where high precision and low power consumption is a necessity. Because of the modularity of the system, adjustment to different wavelength bands as well as different light intensities is easily possible, providing a tailored solution to suit the needs of the end-user.

"A challenge to research of long-term expeditionary devices was we had no information regarding when, and how long, mobile solar power units were in the sun," Hoheisel said. "These units have a dynamic range of 0.01 - 2 suns measured in 30-second intervals, a data capacity of 128 megabytes (MB), an average power consumption of 100 microwatts (uW) and an independent real time clock."

Due to its minimum size combined with an extremely long lifetime, this

completely autonomously operational sensor system paves the way for a dramatically wider operational range of solar radiation measurement units leading to not only a better understanding but also a highly reliable and precise forecast of available solar power for various mission profiles.

The U.S. Marine Corps (USMC) Expeditionary Energy Office (E2O), have developed and prototyped this photovoltaic system to meet the unique needs of USMC expeditionary power for robust, high-efficiency solar panels suitable for adaptation to rechargeable batteries in the field. USMC E2O and the Office of Naval Research (ONR) Expeditionary and Irregular Warfare Office have contributed to this research.

Provided by Naval Research Laboratory

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