Air Force SBIR/STTR

Air Force SBIR/STTR Transition Story

Transition

SBIR Topic Number:
United Solar Ovonic, LLC (USO) AF03-032 & Energy Conversion Devices, Inc. (ECD) AF99-031

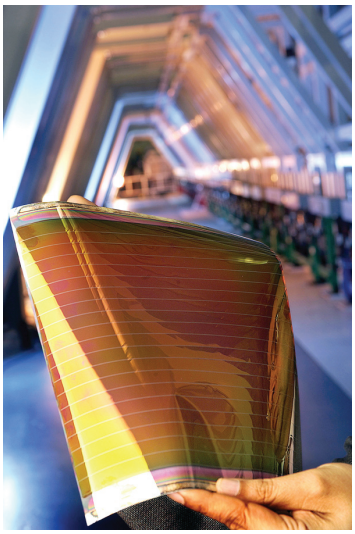
SBIR Title:
High Specific Power Solar Array Using Multijunction Amorphous Silicon Alloy Solar Cells

Contract Number:
F29601-03-M-0244 (USO) & F29601-00-C-0024 (ECD)

SBIR Company Name:
United Solar Ovonic, LLC Auburn Hills, MI

Technical Project Office:
AFRL Space Vehicles Directorate, Kirtland AFB, NM

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.



Left: United Solar Ovonic thin-film photovoltaic (PV) material is flexible, durable, and lightweight. Right: UNI-SOLAR® PV material being produced.

Lightweight and High-efficiency Solar Cells for Airship and Space Applications

- SBIR program funds research on solar array using multijunction amorphous silicon alloy solar cells
- Next generation solar arrays for Air Force missions need to be cheaper, lighter, and more stowable than what are currently available
- UNI-SOLAR® space photovoltaic (PV) products offer an ultralight, low-cost alternative to conventional space PV modules made of crystalline silicon or gallium arsenide
- Expanding on earlier SBIR R&D findings, AFRL contracts with United Solar Ovonic to develop solar cell technology to be used in space and airship vehicles

Commercialization Pilot Program Series

PRS-08-095

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Air Force Requirement

The Air Force has a need for high efficiency, ultra-lightweight amorphous silicon (a-Si) solar cells. The Air Force Research Laboratory (AFRL) Space Vehicles Directorate at Kirtland AFB, New Mexico – in cooperation with United Solar Ovonic LLC – established a program to build on technology developed under previous Air Force SBIR projects.

Taking full advantage of the R&D findings gleaned from SBIR projects accomplished by Energy Conversion Devices, Inc. (ECD) and United Solar Ovonic, AFRL leveraged United Solar Ovonic's existing terrestrial solar cell product (a solar cell optimized for use on earth and deposited on a heavy 5 mil stainless steel substrate) to develop a product applicable for space use.

SBIR Technology

Since May 2003, United Solar Ovonic has been working with the Advanced Space Power Generation Group in the AFRL Space Vehicles Directorate to develop ultra-lightweight solar arrays on thin stainless steel foils and polymers for use in space and airship vehicles. Solar cells on thin stainless steel foil are already being tested in AFRL experimental missions such as TacSat-2 satellite, which was launched in December 2006.

UNI-SOLAR® space photovoltaic (PV) products offer an ultralight, low-cost alternative to conventional space PV modules made of crystalline silicon or gallium arsenide. UNI-SOLAR® triple-junction modules, originally developed for terrestrial applications, are made of amorphous silicon-based thin-film alloys, which are deposited on a 5-mil flexible stainless steel substrate. By utilizing a polymeric substrate, space cells have already been developed that have a specific power greater than 1000 Watts per kilogram (W/kg), which is significantly higher than what is currently available. A high specific power is required for space and airship application. The radiation hardness and superior high-temperature performance of amorphous silicon make it an attractive material for space application.

Transition Impact

In March 2007, United Solar Ovonic announced that the AFRL Space Vehicles Directorate had exercised an 18-month contractual option for approximately $9 million with its firm to develop new solar cell technology to be used in space and airship vehicles addressing defense and homeland security applications. "Next generation solar arrays for Air Force missions need to be cheaper, lighter and more stowable than what are currently available," said John Merrill, Program Manager of the AFRL Advanced Power Generation Program at Kirtland AFB. "We are impressed with the work that United Solar Ovonic has been carrying out under AFRL contracts to address these goals."

While crystalline multijunction solar cells still are and will remain the choice for the majority of satellite builders, the power levels achievable in space are typically limited to ~30 kW due to the rigid nature of these arrays and the volume constraint within a typical launch fairing. The efficiencies of thin-film solar cells are significantly lower than state-of-the-art multijunction solar cells (~10% versus 30%), but because they can be deposited on thin, flexible, lightweight substrates, solar arrays can be fabricated which have a much higher stowed power density than crystalline multijunction solar arrays (~10 kW/m3 versus 80 kW/m3). For this reason, thin-film solar cells have promise of enabling high power platforms for space use.

In addition, thin-film solar cells are inherently radiation hard. In high radiation environments, crystalline multijunction cells would require a coverglass so thick as to make it impractical. The inherent radiation hardness of thin-film solar cells should enable missions in extremely high radiation orbits where crystalline multijunction cells degrade too quickly. Lastly, because thin-film solar cells are deposited using large area deposition techniques, they are projected to be 3-5 times less costly than crystalline multijunction solar cells, and so may be more suitable for large power requirements.

Company Impact

"We are delighted to collaborate with AFRL to develop products for this rapidly expanding market," said Dr. Subhendu Guha, President and Chief Operating Officer of United Solar Ovonic. "The new funding will accelerate our commercial goal of supplying solar cells for satellite and airship applications."

United Solar Ovonic, building on technology invented and pioneered by ECD Ovonics, is the world leader in thin-film amorphous photovoltaics. Because of characteristics unique to the USO solar cell technology, such as lightweight, ruggedness and flexibility, it is ideal as building-integrated photovoltaic roofing systems for residential and industrial customers. ECD Ovonics and United Solar Ovonic hold the basic patents covering the continuous roll-to-roll manufacturing of thin-film amorphous-silicon alloy multi-junction solar cells and related products. More information is available at www.uni-solar.com.

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