

Department of the Navy SBIR/STTR Transition Program

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Topic # N14A-T003

Light-Weight Solar Cells with High Specific Power and Conversion Efficiency

Agiltron Corporation

WHO

SYSCOM: NAVAIR

Sponsoring Program: Not Specified

Transition Target: High Altitude Long Endurance (aircraft) (HALE)

TPOC:
(760)939-0240

Other transition opportunities:

Small Unmanned Aerial Vehicles (SUAVs) to provide persistent Intelligence, Surveillance, Reconnaissance and Communication (ISRC) capabilities

in extended and uninterrupted flight missions; portable and reliable renewable energy for dismounted soldiers, reducing their need for carrying extra batteries.

Notes: Agiltron worked closely with Lockheed Martin Aeronautics Company, Fort Worth, Texas on SBIR Topic N04-002 for a Fiber Optic Repair Set (FORS) using a mechanical splice tool that was developed and produced by Agiltron specifically for polyimide based fiber that is used on the F/A-18 Super Hornet



<http://www.altenergymag.com/article/2015/11/solar-for-uav-index/21978>

WHAT

Operational Need and Improvement: Unmanned aerial vehicles (UAVs) have become crucial for the military as they can provide intelligence, surveillance, reconnaissance and communication (ISRC) without exposing personnel to risks. The long-endurance mission requirements pose a very difficult challenge to large and small UAVs with either internal combustion engine-based or electrical motor-based propulsions. SUAVs with combustion engines typically cannot carry enough fuel to meet long endurance requirements without refueling. Likewise, SUAVs with electrical motors also need recharging as the energy density of on-board batteries is lower than that of chemical or fossil fuels. That requires the SUAVs returning to the base every few hours for recharging and hence drastically limits their field ISRC capabilities. Current state-of-the-art solar power and energy systems for SUAVs are far from being adequate for any continuous, persistent ISRC applications. In spite of the recent advances for efficient electrical propulsion systems and light-weight composite materials for air frames, there is still a critical need for efficient, light-weight, deployable and renewable energy source, in the form of solar cells that can be integrated with the UAVs' exterior surfaces, to meet the SUAVs' 24/7 operational challenges.

Specifications Required: Design, fabricate, characterize and deliver a solar cell array prototype that produces over 1.2kW/kg specific power at over 37% conversion efficiency. It is also critical to incorporate manufacturing cost reduction as part of the design criteria for the scalable solar cell array throughout all the phases of this program.

Technology Developed: Inverted metamorphic four-junction solar cells combined with wide-angle broadband hybrid antireflective coating on flexible substrate that are specifically tailored for UAVs in flight.

Warfighter Value: Solar cells with high conversion efficiency and high specific power will increase both the operation duration and range by enabling the UAVs to fly uninterrupted longer with bigger payload; powering SUAVs for future Naval 24/7 persistent ISRC, and autonomous operations.

WHEN

Contract Number: N68335-16-C-0136 **Ending on:** May 10, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Epitaxial growth of four-junction solar cell layers designed for UAVs	Low	> 38% conversion efficiency	4	December 2016
Hybrid antireflective coating	Low	>95% transmission	5	April 2017
Fabrication of complete solar cells	Med	>1.7 KW/Kg power density	6	December 2017

HOW

Projected Business Model: For over 25 years Agiltron Incorporated has focused on the development and manufacturing of photonic components and systems. Agiltron leads the market in all optical switches, variable optical attenuators, high power optical components, optical polarization and time controls, PbS/PbSe infrared detectors, and Raman spectrometers. These products are protected by over 40 issued or pending US patents. For this product, Agiltron would license and/or technology transfer for the mass-production of solar cells, as Agiltron is not a solar cell manufacturer.

Company Objectives: In Phase II, Agiltron will continue to partner with NREL to manufacture the proposed IMM solar cell product as part of its expanding optical components product lines. Specifically, we will refine and produce a prototype of a solar cell module suitable for providing performance metrics and marketing feedback. We will work with our customers to ensure that the product developed will meet the market needs. We have already identified Boeing as a potential partner for this program. We will work closely with UAV manufacturers. This effort will lay the foundation for the production representative design of the solar cell array in Phase III. The final efficiency and specific power will be tested with the certified characterization equipments at NREL. In our Phase II Option and Phase III effort, Agiltron will investigate the use of a foundry for pilot and volume production of the solar cells. Several III-V foundries have been identified as potential collaborators for large defense and commercial markets.

Potential Commercial Applications: All Solar Cell applications that require high efficiency. Agiltron's innovative solar cells have numerous other direct and indirect DOD and civilian applications such as UAV, ground vehicles, space vehicles, satellite, and various portable and wearable electronic devices.

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