Project Introduction

Inverted Metamorphic (IMM) solar cells have achieved high efficiency at very low mass, but integration of the thin crystalline photovoltaic device into a flexible panel has been a challenge. The objectives of this SBIR are to mechanically package the IMM cell into a flexible laminated panel, and to assemble modular building blocks of these panels into a deployable array structure. The thin module development includes optimizing multifunctional materials for the substrate and superstrate to provide appropriate structural support as well as properties for insulation, transparency, surface conductivity, emissivity and environmental durability. The laminated IMM panels build on electrical interconnection development from parallel programs to assemble body-mounted or deployable arrays using a modular concept. The emphasis on modularity and lamination objectives will provide enhanced consistency, qualification traceability, and manufacturing technology that is amenable to process control and lowered cost. In the Phase 1 effort selects the optimized material for each layer of the substrate and superstrate, validates the materials' predicted performance, laminates IMM coupons and submodules, and tests them in basic environments, such as thermal cycling and bend radius. Phase 1 also performs the conceptual design of the roll-out array using state-of-the-art deployable array structure such as those from the selected Phase 1 subcontractor, Deployable Space Systems of Goleta, CA. The Phase 2 effort will perform a full-scale array design, including deployable structure, and build a deployable engineering ground demonstration model, including flight qualifiable materials and some active IMM thin modules. Phase 2 also includes a set of ground verification testing on coupons, submodules and modules to show durability in other harsh space environments, such as VUV, protons, plasma, atomic oxygen, and life thermal cycling.
Primary U.S. Work Locations and Key Partners

<table>
<thead>
<tr>
<th>Organizations Performing Work</th>
<th>Role</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glenn Research Center (GRC)</td>
<td>Lead Organization</td>
<td>NASA Center</td>
<td>Cleveland, OH</td>
</tr>
<tr>
<td>Vanguard Space Technologies, Inc</td>
<td>Supporting Organization</td>
<td>Industry</td>
<td>San Diego, CA</td>
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</tbody>
</table>

Project Management

Program Director: Jennifer L Gustetic
Program Manager: Carlos Torrez

Technology Areas

Primary:
- TX03 Aerospace Power and Energy Storage
- TX03.1 Power Generation and Energy Conversion
- TX03.1.1 Photovoltaic

Closeout Documentation

Final Summary Chart
(https://techport.nasa.gov/file/15511)