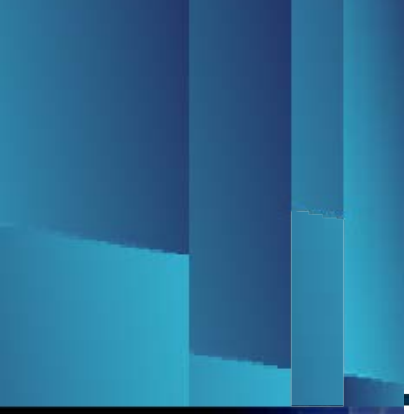

Space Vehicles Directorate

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AFRL
THE AIR FORCE RESEARCH LABORATORY

Air Force Research Laboratory Space Vehicles Directorate Roll-Out Solar Array (ROSA)

Description of Technology:
Traditional solar panels used over the last four decades use large area, honeycomb structures that accordion fold and use motor driven, synchronized mechanical hinges to deploy on-orbit. The Roll-Out Solar Array, or ROSA, breaks that paradigm by using stored strain-energy in composite slit-tube booms to deploy a flexible array thereby eliminating a significant portion of the complex, expensive, and heavy components used on traditional panels.

Image of Space systems Loral 150 Kilowatt class solar electric propulsion vehicles with Roll-Out Solar Array.

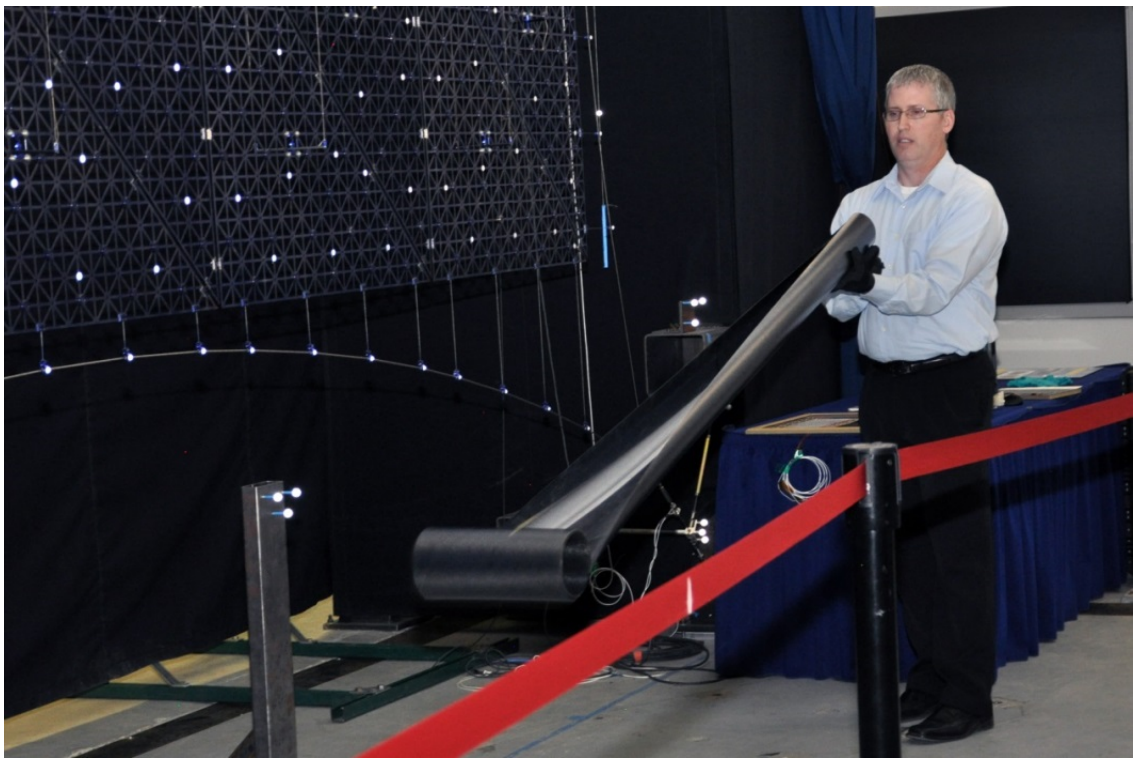
As its name states, ROSA deploys by rolling out from its stowed configuration. Current solar arrays unfold large panels and are restricted in size because these panels occupy a large portion of the launch volume when stacked. This gives ROSA greater scalability allowing for use on small, 1 kilowatt satellites up to large 30 kilowatt satellites with virtually no added complexity. Other concepts based on ROSA have the potential for significantly higher power (such as the concept shown in the image).

Unrolling a flexible blanket rather than unfolding conventional array panels, shrinks the stowed volume by a factor of six, reducing launch costs. Its thin mesh blanket and composite boom structure help to improve mass efficiency by 25 percent, increasing satellite mission performance. It is estimated that this technology advance could potentially enable nearly a billion and a half dollars in savings for U.S. Air Force communication and navigation programs.

The ROSA design works with any solar cell technology, but looks to the future by taking advantage of new, high efficiency, flexible solar cell technology. ROSA promises to deliver higher performance at a reduced cost to government, Department of Defense and industry partners' ongoing efforts in space.

Need for Technology:
Developing and flying satellites in space is a challenging and expensive endeavor. The high cost to launch these systems into orbit coupled with the harsh operating environment and remote operation has led to the necessity for extremely volume- and mass-efficient systems. One of the largest support systems is the power system that relies almost exclusively on solar panels to generate electrical power for the spacecraft. These panels require a large area to generate sufficient power for modern day satellites. Solar panels for geosnychronous communication satellites have a wingspan of about 150 feet. The launch vehicles diameter is limited to 16 feet, which requires arrays to be stowed for launch and then deployed on-orbit using a complex system of hinges and motors. The high cost of launch and the requirement for 100 percent reliability are conflicting design goals that require new technologies to meet future power needs.

Collaboration:
AFRL researchers conceived and developed the high strain composite mechanisms and support structure. Two companies, Deployable Space Systems (DSS), Inc. located in Goleta, CA and LoadPath, LLC located in Albuquerque, NM worked with AFRL to advance the technology and bring it to the market. The successful development has led to interest from a number of commercial and government customers in adopting ROSA for current and future satellites and spacecraft.



AFRL scientist Paul Hausgen demonstrates deploying the composite Roll-Out Solar Array slit-tube boom. The booms do not require external power but deploy under their own stored strain energy.

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