

SBIR Topic Number:
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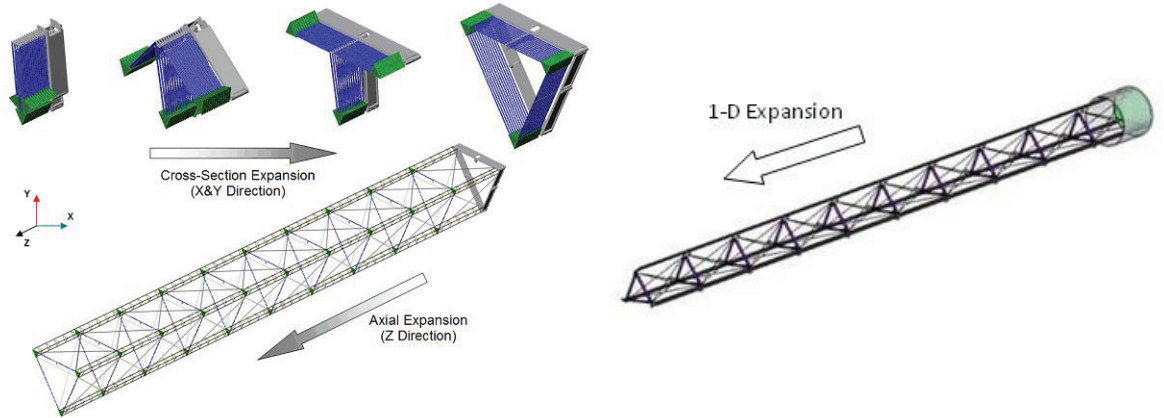
SBIR Title:
Space Radar
Reflector Producibility

Contract Number:
FA9453-07-C-0063

SBIR Company Name:
Starsys, Inc.,
Louisville, CO

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

This Air Force SBIR/STTR Innovation Story is an example of Air Force supported SBIR/STTR technology that met topic requirements and has outstanding potential for Air Force and DoD.



Left: 3-D Deployable Articulated Boom System. Right: 1-D Deployable Boom.

Three-Dimensional Deployable Articulated Boom System

- Future Air Force space missions will require unprecedented size and dimensional stability from information gathering and broadcasting instruments
- The Starsys Three-Dimensional Deployable Articulated Boom System (3DABS) is an innovative new technology that will enable Air Force mission planners and instrument designers to provide space-based capabilities
- The 3DABS structure expands in width, height, and length as it deploys, providing a large area system that is structurally deeper than traditional systems
- At the heart of the 3DABS lies the Starsys Jackscrew Deployed Boom, the applications of which include the deployment of antenna systems, blanket type solar arrays, gravity gradient masses, attitude control thrusters, and optical instruments
- The 3DABS expands on this innovative technology to provide stable, large-scale structures with depth that exceeds the traditional capacity of modern launch vehicles

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Air Force Requirement

Future Air Force space missions will require unprecedented size and dimensional stability from information gathering and broadcasting instruments. Increased length and area in military spacecraft instruments provide increased information gathering and more focused and higher bandwidth information down to the ground or to other spacecraft. Simply increasing the size of the instrument is not enough; the instrument must be held in a stiff, stable, predictable position in order to perform its function and thus support the warfighter.

SBIR Technology

The Starsys Three-Dimensional Deployable Articulated Boom System (3DABS) is an innovative new technology that will enable Air Force mission planners and instrument designers to provide space-based capabilities. The 3DABS structure expands in width, height, and length as it deploys, providing a large area system that is structurally deeper than traditional systems. The improved thermal stability and structural stiffness (EI) allows for relaxed material requirements and ultimately a lower cost and better performing structure.

The structural system is launched in a compact, well constrained state. Once on orbit, launch restraints are released and the structure unfolds laterally and vertically to form the macroscopic structure that is the full cross-sectional footprint of the system. The expanded system then deploys axially in a known kinematic controlled fashion, providing full structural stiffness at every stage of the deployment. This deployment approach is made possible through the use of Starsys' Jackscrew Deployed Booms, a unique technology that enables innovative architectures such as the 3DABS.

Potential Air Force Application

The Jackscrew Deployed Boom provides a purely axial deployment trajectory, without rotating or ratcheting about the deployment axis. The canisterless design exposes all attachment points at all times so payloads, or superstructure elements, can be attached with ease at any location along the length of the structure. Applications of such a boom include, but are not limited to, the deployment of antenna systems,

blanket type solar arrays, gravity gradient masses, attitude control thrusters, and optical instruments.

The 3DABS expands upon the Jackscrew Deployed Boom technology to provide stable, large-scale structures with depth that exceeds the traditional capacity of modern launch vehicles. The 3DABS reduces launch vehicle costs by relaxing payload envelope constraints and enabling a more efficient mass-driven selection process. Moreover, the 3DABS supports future Air Force and Department of Defense space missions that will require unprecedented size and performance from information gathering and broadcasting instruments.

The critical problem that the 3DABS structure addresses is the deployment of structural depth. Traditional deployable boom systems expand in one dimension only, growing in length as they deploy. Despite efficient axial stowage of these structures, their fixed cross-section envelope can drive, or be constrained by, the envelope requirements of the launch vehicle payload fairing. Launch vehicle selection driven by envelope requirements can be significantly more costly than a mass-driven vehicle selection. Thus, in a cost-constrained mission, payload fairing selection bounds the available envelope for the stowed structure and ultimately bounds the performance capabilities of the structure. Larger deployed structures are desirable because thermal stability and structural rigidity both scale with the cross-sectional depth of the structure.

Company Impact

The Phase II program included detailed design of a representative large-scale commercial 3D Articulated Boom System with development and testing of critical components. The associated design and manufacturing refinements have reduced or retired technical risks and lowered costs involved in bringing the 3DABS system to the aerospace market.

Starsys designs, engineers and manufactures mechanical systems, structures, and mechanisms that open, close, release, and move components on spacecrafts. Starsys merged with SpaceDev in 2006, and in 2008 SpaceDev became a wholly owned subsidiary of Sierra Nevada Corporation (SNC – www.sncorp.com).



SBIR/STTR

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