

SBIR Topic Number:
AF05-015

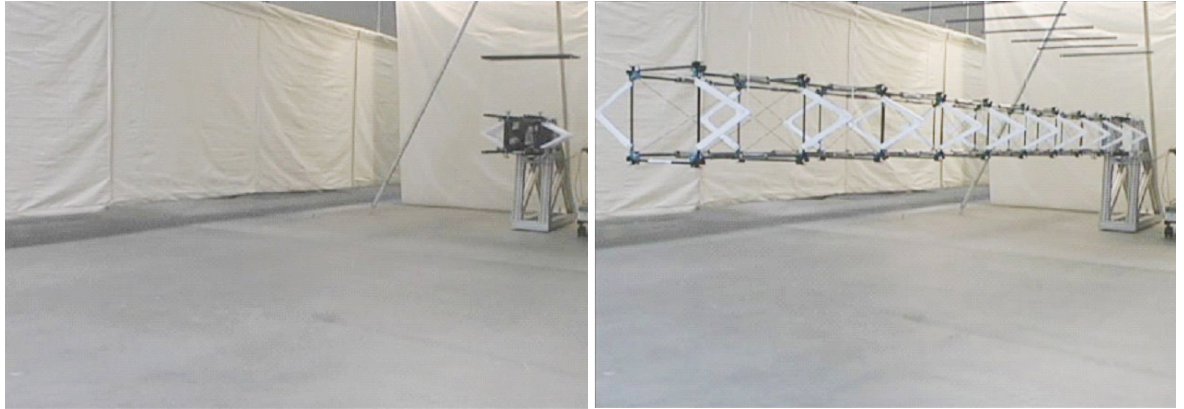
SBIR Title:
Electronically Scanned
Array Antenna Transmit/
Receive Module

Contract Number:
FA9453-06-C-0038

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: Boom in Stowed Condition. Right: Boom in Deployed Condition.

Jackscrew Deployed Articulated Boom

- The Air Force needs a robust, thermally stable, and low-cost deployable space structure
- Starsys, Inc. developed a state-of-the-art canisterless articulated boom system that provides full load and stiffness capacity throughout deployment
- The SBIR-developed Jackscrew boom successfully demonstrated the system's robustness and high-strength capability, while significantly reducing manufacturing costs
- Potential applications include the deployment of antenna systems, blanket type solar arrays, magnetometers, gravity gradient masses, attitude control thrusters, and optical instruments

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Air Force Requirement

Future Space Based Radar (SBR) constellations will use the most advanced transmitter/receiver designs for their payload. SBR performance necessitates the use of dimensionally stable support structures. The Air Force needs a robust and low-cost deployable space structure with exceptional dynamic and thermoelastic stability.

SBIR Technology

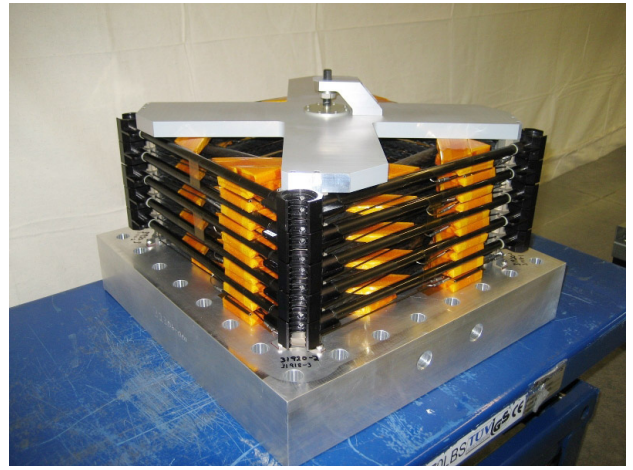
Starsys, Inc. developed a state-of-the-art canisterless articulated boom system that provides full load and stiffness capacity throughout deployment. A purely axial deployment trajectory, without rotating or ratcheting about the deployment axis, simplifies cable routing and payload attachment requirements.

The Jackscrew boom, as the name implies, utilizes motorized jackscrews to deploy the boom. The stowed boom is not enclosed in a canister and is exposed at all times throughout deployment enabling payloads to be easily incorporated along the length of the boom. A jackscrew is located at each corner of the stowed boom stack and these jackscrews are synchronously driven with an electric motor. The rotating jackscrews deploy the boom in a purely axial motion, just as a constrained nut is driven axially by a rotating bolt. This architecture substantially reduces the deployment system mass when compared to prior canister-driven boom systems.

Potential Air Force Application

The SBIR-developed Jackscrew boom successfully demonstrated the system's robustness and high-strength capability, while significantly reducing manufacturing costs.

The Jackscrew boom's canisterless design and purely axial deployment trajectory greatly simplify payload integration. Payloads can be attached at the tip or at any point along the length of the boom. The Jackscrew deployer provides substantial axial deployment force capability and the articulated architecture allows for the use of high-strength and low Coefficient of Thermal Expansion (CTE) materials. All of these features combine to provide a robust and thermally stable platform for deploying a wide variety of payloads.



Boom stowed for vibration testing

Applications of such a boom include, but are not limited to, the deployment of antenna systems, blanket type solar arrays, magnetometers, gravity gradient masses, attitude control thrusters, and optical instruments.

Company Impact

This SBIR project provided Starsys the opportunity to develop and test an articulated boom system through Technology Readiness Level 5 (i.e., component and/or breadboard validation in relevant environment). Proof-load testing and random vibration testing retired the technical risk issues involved with bringing the Jackscrew boom systems to the aerospace market, while advances in manufacturing methods and processes were identified to ensure a cost-competitive solution.

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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