

Jackscrew Deployed Boom

Design Description

Sierra Nevada Corporation's (SNC) Space Systems Jackscrew Deployed Boom, shown at right under test, is a motor-deployed, high-stiffness and high-strength articulated truss. The jackscrew boom deploys in a purely linear/axial manner without the use of deployment canisters for de-spin as required for motorized coilable booms. Therefore, the jackscrew boom provides multiple payload or cabling attachment points along the length of the boom with a deadband-free, high mechanically advantaged deployment without the parasitic mass of a canister. The jackscrew drive system offers mass and volume efficiency improvements over canister-deployed booms.

The jackscrew boom deployment method also provides full structural integrity throughout deployment, thus allowing mid-deployment spacecraft maneuvering or other loading without the risk of collapsing the boom. The jackscrew boom can be re-stowed after deployment by reversal of the deployer motor.

The main components of the boom system, illustrated below, consist of the deployable boom assembly and the deployer assembly. The deployer assembly uses a system of redundant belts driven by an electric motor to synchronize and drive a series of jackscrews. The deployer also includes four structural tubes that position the stowed boom and enclose the jackscrew drive shafts, a detent at each corner of the deployer, and four foldable jackscrews.

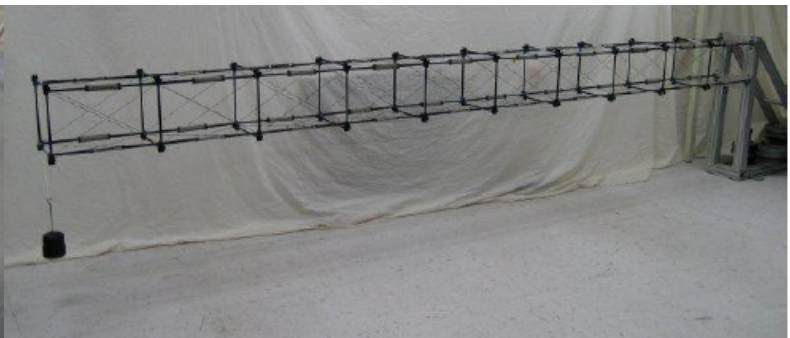
Triangular cross-section booms are also available using three jackscrews. During deployment, the jackscrews (aka elevator screws) and deployment detent work together to sequentially expand and form each bay of the boom as it is deployed. At least one batten frame of the boom is engaged with the jackscrews at any point in time during deployment providing full structural integrity throughout deployment. The deployer jackscrews are restrained in their folded, stowed configuration during launch and prior to boom deployment. Following a signal to initiate deployment, the jackscrews are released and transition to their deployed, locked configuration. A brushless dc motor provides power to the system and limit switches identify first motion and successful deployment of the boom.



Jackscrew Deployed Boom Under Test



10-Bay Jackscrew Deployed Boom (stowed)



Deployed Boom Cantilevered with 11-lb Tip Mass (no offloading)

Features	
• Purely linear/axial deployment	• High-force deployment/retraction
• Highly tailorable for thermal stability, strength, and stiffness	• Highly scalable and mass optimized
• Simple, high-reliability, high-tension deployment	• Full stiffness and strength during deployment
• Exposed payload interfaces throughout deployment and during pre-flight integration	

Applications	
• Solar array and solar-sail deployment and retraction	• Instrument deployment and retraction
• Antenna deployment/retraction	• Gravity gradient mass deployment and retraction
• Synthetic Aperture Radar (SAR) deployment and retraction	• Spacecraft separation

Product Specifications for a 10-Bay Jackscrew Boom		
• Dimensions: 190-in long x 15.5-in diameter	• 1st Bending Mode: 6.9 Hz	• Tip Torsion Stiffness: 13,594 in-lb/rad
• Mass: 11.7 lb	• 1st Torsion Mode: 16.4 Hz	• Tip Shear Stiffness: 25 lb/in