

AEROSPACE PRODUCTS AND SERVICES

Northrop Grumman is a leading designer, producer and supplier of spacecraft components that power and enable satellites of all classes for commercial, civil and government missions. Our products are on most U.S. satellites built in the last 35 years.

Bus Structures, Towers and Subsystems

Composite bus structures and subsystems feature high stiffness-to-weight ratios, high precision and thermal dimensional stability — factors that are critical in space applications. Capabilities include design, manufacture, testing and integration of radome structures, antenna production, composite missile components, precision composite structures, composite reflectors, antennas, waveguide, feed elements and related hardware.

Structural Panels

Northrop Grumman has a proven development approach to design-to-

performance or build-to-print structural panels. These structural panels, including optical solar reflectors, are made using graphite-cyanate ester honeycomb and can include embedded heat pipes. Panels are consolidated and precision machined. Inserts are bonded reinforcement for locally concentrated loading, application of optical coatings, contamination control, ultrasonic and radiographic testing, thermal performance and cycling testing, static load, vibration and acoustic testing.

Deployables

Northrop Grumman is the satellite industry's premier source for deployable booms, masts and backing structures. Deployable solutions have been developed for a broad range of large space structure applications, including global mapping and communication antennas and space telescopes, plus high-sensitivity instrumentation such as particle detectors and magnetometers.

COILABLE BOOMS — Continually refined to serve new applications, including those enabled by ultra-lightweight carbon fiber.

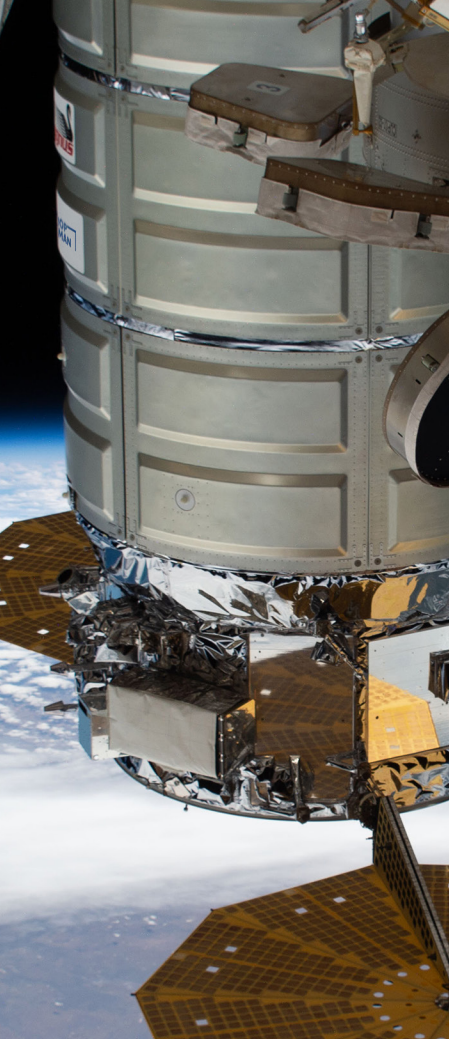
TELESCOPING BOOMS — Built for ultra-high-cycle life and reliability; design-optimized for mass, strength and placement precision.

ARTICULATING MASTS — Notable applications include the International Space Station, Shuttle Radar Topography Mission (SRTM) and the NuStar X-ray imager.

DEPLOYABLE REFLECTORS — Configurable reflectors provide scalable designs that are inherently stiff and incredibly light with unmatched surface accuracy for almost every offset space antenna application.

Precision Optical Structures

Northrop Grumman's composite optical-support structures perform with uncompromising precision in cryogenic temperatures, providing spacecraft telescopes and imaging systems the stability required for unprecedented astronomical observations. These precision optical structures are critical components of the Hubble Space Telescope, the Chandra X-ray Observatory, the James Webb Space Telescope, the Mars Exploration Rover Camera and the Space Tracking and Surveillance System.



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Solar Arrays

Northrop Grumman is the industry leader for design, development and production of a variety of unique turnkey solar array systems.

PUMA PANEL ARRAYS – High-heritage, rigid panel scalable from 200W to over 10kW per wing. Compatibility with all solar cell types, high recurring production rates and interchangeable standards parts and designs.

ULTRAFLEX – An accordion fanfold flexible-blanket solar array comprising interconnected, triangular-shaped ultra-lightweight substrates (gores). Compatible with all solar cell technologies.

COMPACT TELESCOPING ARRAYS (CTA) – Utilizes a telescoping boom system to deploy an accordion-folded flexible solar array blanket, enabling a compact stowage volume that creates enough space for multiple spacecraft to be launched aboard a single rocket.

Propellant Tanks

Northrop Grumman is the world's leading producer of titanium propellant tanks used in spacecraft and launch vehicles, with more than 600 designs qualified. The tanks have been a part of most U.S. launch vehicles and geosynchronous earth-orbit satellites, with 100 percent reliability. They have landed on Mars, Venus and the Moon and have visited every planet in the solar system. Launch vehicles with Northrop Grumman tanks have included Delta III and Delta IV, the space shuttle, the entire Atlas family of vehicles and Vulcan Centaur.

Extendible Support Structures

Stiff and stable deployment of large sensors is best accomplished with a purpose-built folding truss, and Northrop Grumman is a world leader in producing such systems. For example, our Reflector Deployment Assembly built for the Global Precipitation Measurement Microwave Imager for Ball Aerospace, exceeded the stringent requirements for placement repeatability (<0.001 inches, 3-sigma, more than 10 deployments) and thermal stability (<0.01 inches and 18 arcsec each axis over each orbit).

Thermal Technologies

Northrop Grumman is the world's leader in two-phase thermal management of spacecraft. Capabilities include design, manufacture, testing and integration of complete two-phase thermal-control systems such as heat pipes (-260 C to +175 C); heat pipe radiators and structural equipment panels; two-phase-loop heat pipes (LHPs); deployable radiator assemblies; phase-change materials (PCM); multi-layer insulation (MLI) blankets; thermal preparation; cryogenic cooling applications; and composite structures.

Microelectronics

The Northrop Grumman Microelectronics Center harnesses the immense power of microelectronic technologies to offer efficient and effective capabilities to our customers. Northrop Grumman is paving the way for advanced, flexible, and mission-tailored solutions to microelectronics needs. Trusted processes are in place for production, using an array of materials and advanced packaging differentiators to enable all-domain missions that range from advanced satellite communications and complex astrophysics systems to technologies enabling next-generation technologies and commercial applications.

Foundry Services

The Northrop Grumman Space Systems Foundry in Redondo Beach, Calif., processes heterojunction bipolar transistor and high electron mobility transistor monolithic microwave and millimeter-wave integrated circuits. The foundry focuses on products that are microscopic, modular, high speed, and low in power consumption and temperature.

Cryocoolers

Northrop Grumman's cryocoolers offer high reliability for critical space missions, including missile defense, climate science, astronomy, and weather tracking and prediction. Our pulse tube cryocoolers have more than 300 combined years of on-orbit operation, often exceeding their design life many times over with no degradation in performance.

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