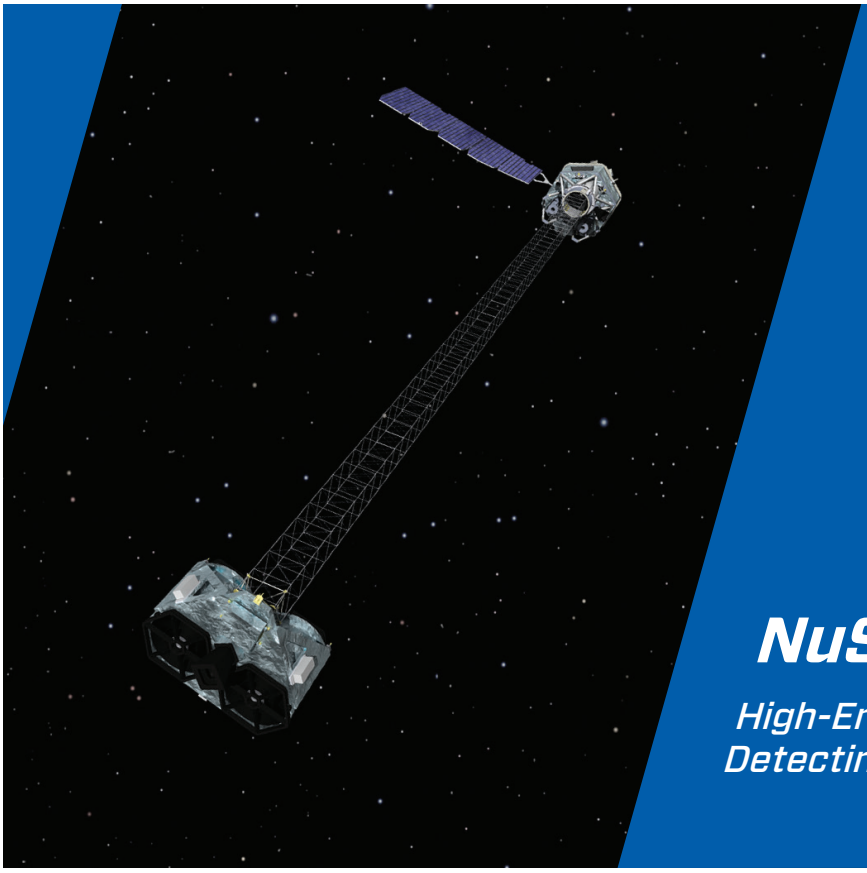


THE VALUE OF PERFORMANCE.

NORTHROP GRUMMAN

NuSTAR

High-Energy X-Ray Observatory Detecting Black Holes

Northrop Grumman designed, manufactured, integrated and tested the Nuclear Spectroscopic Telescope Array (NuSTAR) scientific satellite under a contract from the California Institute of Technology and the Jet Propulsion Laboratory. The NuSTAR observatory uses high-energy X-rays to detect black holes and other energetic phenomena in the universe.

The NuSTAR program is being led by Principal Investigator Dr. Fiona Harrison of Caltech. Its mission is to help scientists answer fundamental questions about the universe, such as:

- How black holes are distributed throughout the cosmos
- How the elements of the universe were created
- What powers the most extreme active galaxies

With answers to these and other questions, NuSTAR will expand our understanding of the origins and destinies of stars and galaxies.

Spacecraft

The NuSTAR spacecraft is based on Northrop Grumman's proven LEOStar™-2 design. NuSTAR is the seventh satellite to be based on this platform, taking advantage of a growing heritage of excellent in-orbit performance from previous missions. Other LEOStar-based satellites that Northrop Grumman has designed and built for previous NASA scientific missions include SORCE, GALEX, AIM, OCO-2, TESS and ICON.

Facts At A Glance

- NuSTAR has more than 500 times the sensitivity of previous instruments to detect black holes.
- NuSTAR is the first focusing hard X-ray telescope in space

Mission

Expanding our understanding of the origins and destinies of stars and galaxies

Customer

Jet Propulsion Laboratory

Specifications

Spacecraft

Mass:	360 kg (793 lb.)
Redundancy:	Single String
Solar Arrays:	750 W, Articulated
Stabilization:	3-axis stabilized, Zero Momentum Bias
Pointing:	60 arcsec control, 42 arcsec knowledge
Orbit:	600 km, 6° inclination
Mission Life:	2 Years

Launch

Launch Vehicle:	Pegasus® XL
Launch Site:	Reagan Test Site, Kwajelein Atoll
Date:	June 13, 2012 (CONUS)

Instrument

The NuSTAR instrument consists of an array of two co-aligned hard X-ray telescopes. The mirrors focus onto two shielded solid-state detectors, separated by a 10 meter mast that was extended from the spacecraft after launch. A laser metrology system will monitor the mast alignment. The Cadmium Zinc Telluride (CdZnTe) detectors provide excellent spectral resolution and high efficiency without requiring cryogenic operation.

NuSTAR in Northrop Grumman's Dulles, Virginia satellite manufacturing facility

Mission Partners

Jet Propulsion Laboratory

Program management

California Institute of Technology

Principal Investigator: Dr. Fiona Harrison; mission management

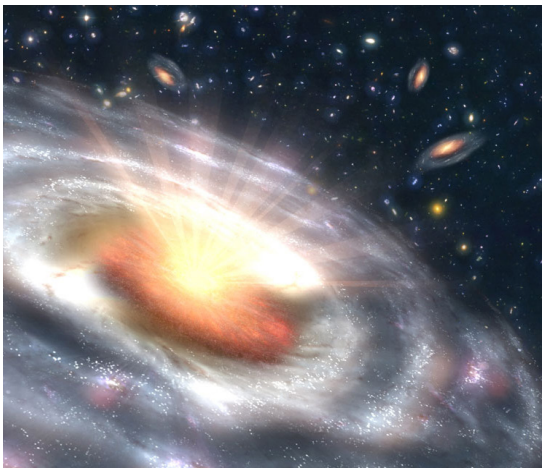
Northrop Grumman

Spacecraft development, satellite integration and testing, launch vehicle

Black Holes

Two types of black holes are known to exist. Stellar-mass black holes form when a very massive star (at least 25 times heavier than our Sun) runs out of nuclear fuel. The star explodes as a supernova and what remains is a black hole, usually only a few times heavier than our Sun since the explosion has blown much of the stellar material away.

We know less about the birth of supermassive black holes, which are much heavier than stellar-mass black holes and live in the centers of galaxies. Using high energy X-rays to see through the massive clouds that surround them, NuSTAR will provide a first ever census of supermassive black holes throughout space and time.



A growing black hole, called a quasar, can be seen at the center of a faraway galaxy in this artist's concept.
(Photo courtesy NASA/JPL/Caltech)

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