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**NORTHROP GRUMMAN**

## *Fermi*

### *Orbiting Gamma-Ray Observatory*

**F**ormerly known as the Gamma-Ray Large Area Space Telescope (GLAST), the Fermi Gamma-Ray Space Telescope (Fermi) is a next generation, high-energy gamma-ray orbiting observatory designed to probe black hole particle jets, gamma-ray bursts, dark matter, and other energetic phenomena by observing gamma rays. Fermi makes observations of celestial gamma-ray sources in the energy band extending from 10 kiloelectron volt to more than 300 gigaelectron volt; the broadest energy coverage ever provided by a single spacecraft for gamma-ray studies. It follows in the footsteps of the Compton Gamma-Ray Observatory and joins its orbiting sister, the Swift Gamma-Ray Observatory.

#### **Spacecraft**

Under contract to NASA Goddard Space Flight Center (GSFC), Northrop Grumman designed and manufactured the spacecraft, integrated the NASA-furnished payload instruments, and performed full system testing of the observatory, including EMI-EMC and environmental tests. This follows a similar effort at Northrop Grumman for the development of NASA's highly successful Swift Gamma-Ray Observatory, launched in 2004. The spacecraft design was based on Northrop Grumman's flight-proven LEOSTar™-3 standard bus. Northrop Grumman continues to provide on-orbit sustaining engineering support and Fermi has achieved availability levels of nearly 100 percent at five year mission life, and is currently improving on this metric as of today.

#### **Facts At A Glance**

- Fermi represents a collaboration of astronomers, physicists, and engineers at NASA, the U.S. Department of Energy, U.S. universities, and institutes and universities in France, Germany, Italy, Japan, and Sweden
- Spacecraft design based on Northrop Grumman's flight-proven LEOSTar-3 standard bus
- 565 km circular Low Earth Orbit mission
- Fermi carries two instruments: the Large Area Telescope (LAT) and the GLAST Burst Monitor (GBM)
- The LAT weighs over 6,000 lb with almost a million channels of electronics, but it uses less than half the power of an ordinary hair dryer
- Fermi orbits the Earth every 96 minutes. It is oriented to point the instruments upward at all times, so the Earth does not block the view. On alternate orbits, Fermi rocks to the left and right, allowing the instruments to survey the entire sky in two orbits

#### **Customer**

NASA Goddard Space Flight Center

## Specifications

### Spacecraft

Mass:	4,303 kg (9,486.5 lb.)
Solar Arrays:	Triple junction GaAs cells; 3122 W EOL
Orbit:	565 km circular @ 25.6°
Stabilization:	3-axis, Zero Momentum Bias
Pointing:	65 arcsec control, 42 arcsec knowledge
Data Storage:	160 Gbits BOL
Data Downlink:	Ku-band, 40 Mbps
Propulsion:	>360 kg (794 lb.) of blowdown monopropellant hydrazine with (12) 22N thrusters located in four clusters
Mission Life:	5 years, 10 year goal
Launch	
Launch Vehicle:	Delta II 7920H-10
Launch Site:	Cape Canaveral Air Force Station, Florida
Date:	June 11, 2008

### Instruments

#### *Large Area Telescope (LAT)*

The LAT is an imaging high-energy gamma-ray telescope covering the energy range from about 20 MeV to more than 300 GeV.

#### *GLAST Burst Monitor (GBM)*

The GBM complements the LAT in its observations of transient sources and is sensitive to X-rays and gamma rays with energies between 8 keV and 40 MeV.

### Objectives of the Fermi Mission

- Explore the most extreme environments in the universe, where nature harnesses energies far beyond anything possible on Earth
- Search for signs of new laws of physics and what composes the mysterious dark matter
- Explain how black holes accelerate immense jets of material to nearly light speed
- Help crack the mysteries of the stupendously powerful explosions known as gamma-ray bursts
- Answer long-standing questions across a broad range of topics, including solar flares, pulsars and the origin of cosmic rays

## Mission Partners

### NASA Goddard Space Flight Center

Procuring agency, project/contract management, mission systems engineering

### Stanford University SLAC National Accelerator Laboratory

Lead developer of the LAT instrument

### Marshall Space Flight Center

Lead developer of the GBM instrument

### International Sponsors

France: Commissariat à l'Energie Atomique; CNRS/ Institut National de Physique Nucléaire et de Physique des Particules

Italy: Agenzia Spaziale Italiana; Istituto Nazionale di Fisica Nucleare; Istituto Nazionale di Astrofisica

Japan: Ministry of Education, Culture, Sports, Science and Technology; High Energy Accelerator Research Organization (KEK); Japan Aerospace Exploration Agency

Sweden: K. A. Wallenberg Foundation; Swedish Research Council; National Space Board

### Northrop Grumman

Development of the spacecraft, integration of the GBM and LAT instruments, testing of the satellite, and launch vehicle integration



Fermi in final checkout. (NASA photo)