NASAfacts

THEMIS Mission to Determine the Cause of Disturbances in Geospace

On clear, dark nights at high northern latitudes, you may see shimmering bands of light, called the Northern Lights or the Aurora Borealis, stretching across the sky from the East to the West. Similar lights occur at high southern latitudes, near the South Pole, where they are known as the Southern Lights or the Aurora Australis. During the geomagnetically disturbed periods known as substorms, these bands of light brighten and expand poleward into the polar cap.

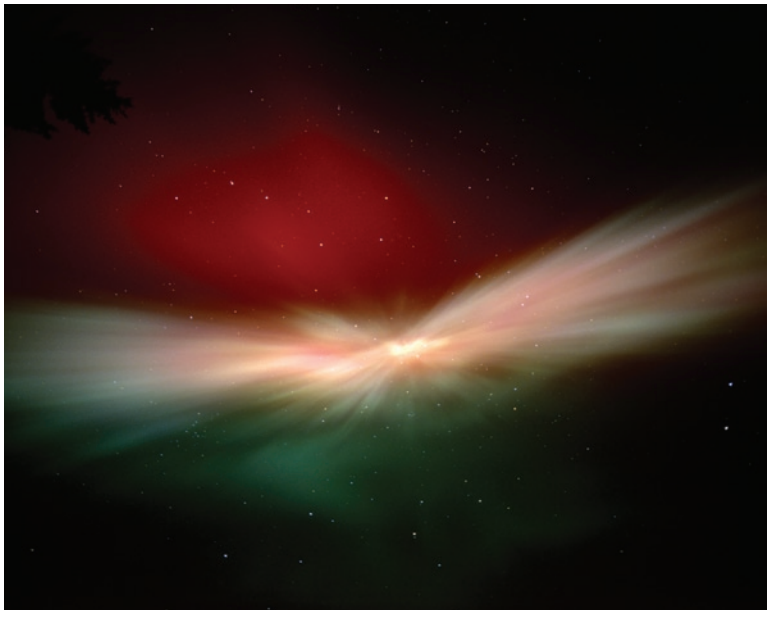
Researchers know that these shimmering multicolored light shows are generated when showers of high-speed electrons descend along magnetic field lines to strike the upper atmosphere. But now scientists want to learn when, where, and why solar wind energy stored within the Earth's magnetosphere is explosively released to accelerate the electrons into the Earth's upper atmosphere.

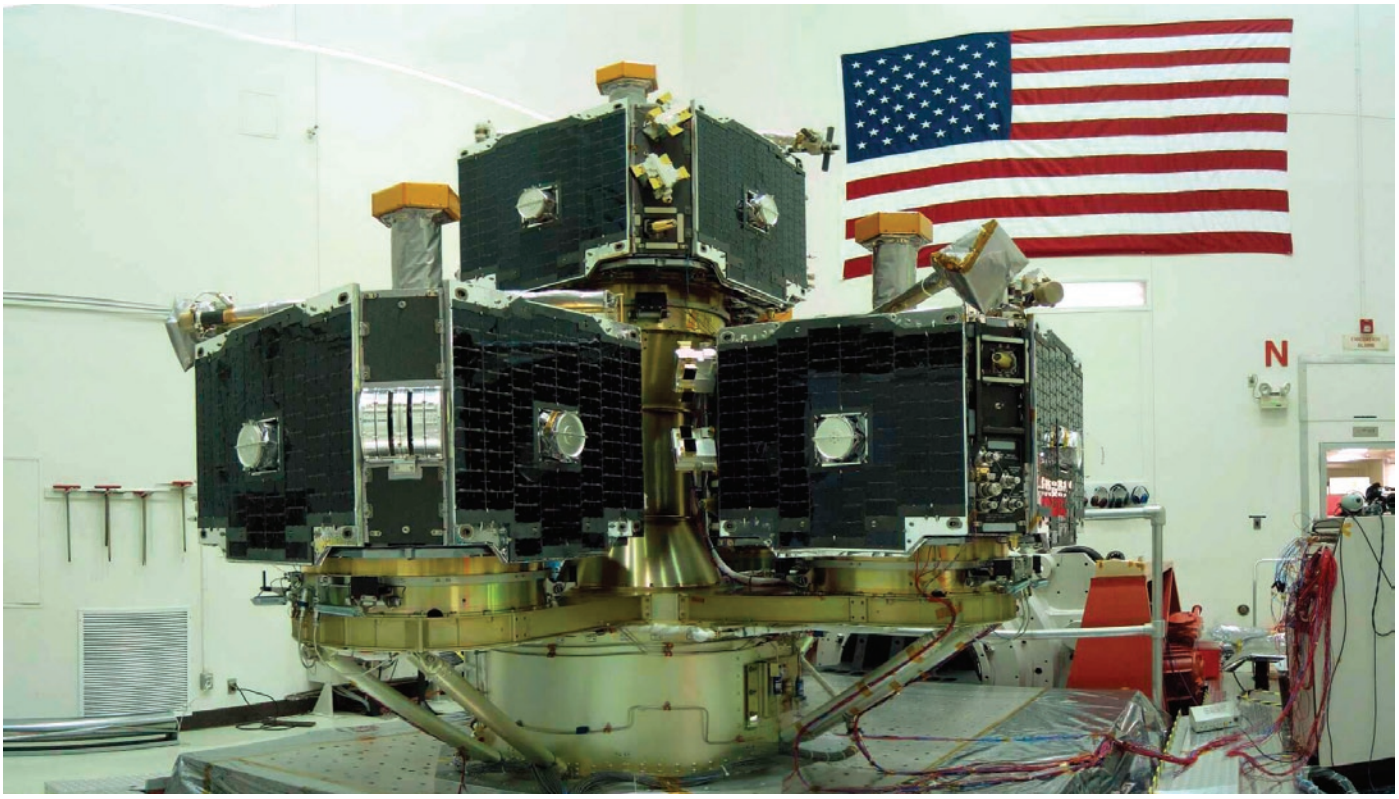
With NASA's Time History of Events and Macroscale Interactions during Substorms (THEMIS) mission, scientists will embark on a revolutionary journey to study the iridescent Northern Lights. During this 2-year mission, five identical probes will identify and track the magnetic field reconfigurations, accelerated flows, enhanced plasma waves, and energized particles that accompany the release of energy that occurs during substorms. In particular, the spacecraft will provide the observations needed to identify the mechanism that triggers substorms, which has thus far remained a scientific mystery. Previous single-spacecraft studies of the Earth's magnetosphere and space weather have been unable to pinpoint the origin of these substorms, leading to extended scientific debate. The mission, named for Themis, the blindfolded Greek Goddess of Order and Justice, will resolve this debate impartially.

"There are few more awe inspiring sights than the colorful and dynamic beauty of the Northern Lights," remarked Frank Snow, Goddard THEMIS Project Manager. "THEMIS is a challenging project employing 5 satellites, 25 scientific instruments and 20 ground observatories that will replace old myths with scientific explanations for a spectacular light display - visible evidence of Earth's magnetosphere protecting us from the fatal effects of the Solar wind."

When the five identical probes align over the North American continent, scientists will collect coordinated measurements along the Sun-Earth line, allowing the first comprehensive look at the onset of substorms and how they trigger auroral eruptions. Over the mission's lifetime, the probes should be able to observe some 30 substorms

A rare red aurora fills the overhead sky as seen from Homer, Alaska, January 2005.
Image courtesy: Dennis C. Anderson





THEMIS satellites mounted on the Probe Carrier during vibration testing of their launch configuration at NASA's Jet Propulsion Laboratory. The five satellites will be launched together and released near simultaneously once in orbit. They will then be placed on their individual, final orbits using their own propulsion. Image Credit: SSL/UCB

– sufficient to finally know the origin of these powerful energy releases.

"Substorm processes are fundamental to our understanding of space weather and how it affects satellites and humans in Geospace," says Vassilis Angelopoulos, THEMIS Principal Investigator at UC Berkeley's Space Sciences Laboratory, in Berkeley, Calif. But relevant as these phenomena may be to human endeavors, they provide insight into fundamental physical processes that occur on other planets, such as Mercury, Jupiter and Saturn, as well as in other astrophysical systems. The Earth's magnetosphere is the only place where we can routinely encounter these processes 'in situ'.

Towards that end, each of the five probes will carry identical sets of five low- and high-frequency magnetic field and electric field instruments as well as thermal and super-thermal ion and electron detectors, for a total of 25 instruments in all.

When the probes align and magnetically map to the North American continent– every four days for about 15 hours – 20 ground stations in Northern Canada and Alaska with automated, all-sky cameras will document the auroras from Earth. This will give scientists the first comprehensive look at the phenomena from Earth's upper atmosphere to far into space, enabling them to pinpoint where and when substorm initiation begins. In addition, research-grade magnetometers have been placed in 11 rural schools in the Northern United States to monitor the large-scale effects of the electric currents in the Earth's magnetosphere. These educational and scientific instruments are bringing the excitement of space research right into the classroom.

THEMIS is a NASA-funded mission managed by the Explorers Program Office at Goddard Space Flight Center in Greenbelt, Md. The Space Science Laboratory at the University of California at Berkeley is responsible for the project management, science instruments, mission integration, post launch operations and data analysis. Swales Aerospace of Beltsville, Md., manufactured the THEMIS spacecraft bus.

The THEMIS mission is targeted for launch in late 2006 or early 2007 aboard a Boeing Delta II launch vehicle from Cape Canaveral Air Force Station, Fla.

More information:
http://www.nasa.gov/themis
http://sprg.ssl.berkeley.edu/themis