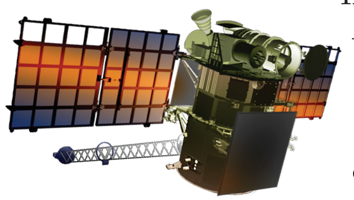
NOAA Satellite and Information Service

DSCOVR:

Deep Space Climate Observatory

Tracking Earth's Space Environment

NOAA's Deep Space Climate Observatory (DSCOVR)



The National Oceanic and Atmospheric Administration's (NOAA) Deep Space Climate Observatory (DSCOVR) spacecraft will orbit between the Earth and sun, measuring the properties of particles and magnetic fields – also called solar wind – emitted by the sun. Solar wind ebbs and spikes depending on the activities of storms within and on the solar surface. A significant burst of solar wind and magnetic fields directed towards Earth can affect power grids, communications systems and satellites close to Earth.

From its position situated approximately one million miles from Earth, DSCOVR will also observe our planet and provide measurements of the radiation reflected and emitted by Earth and images of the sunlit side of Earth for science applications. NOAA leads the DSCOVR mission, in partnership with NASA and the U.S. Air Force.

NOAA is responsible for the DSCOVR mission, providing program management, spacecraft operation and distribution of all mission data. DSCOVR will succeed NASA's Advanced Composition Explorer's (ACE) role in providing data used to produce solar wind alerts and warnings from NOAA.

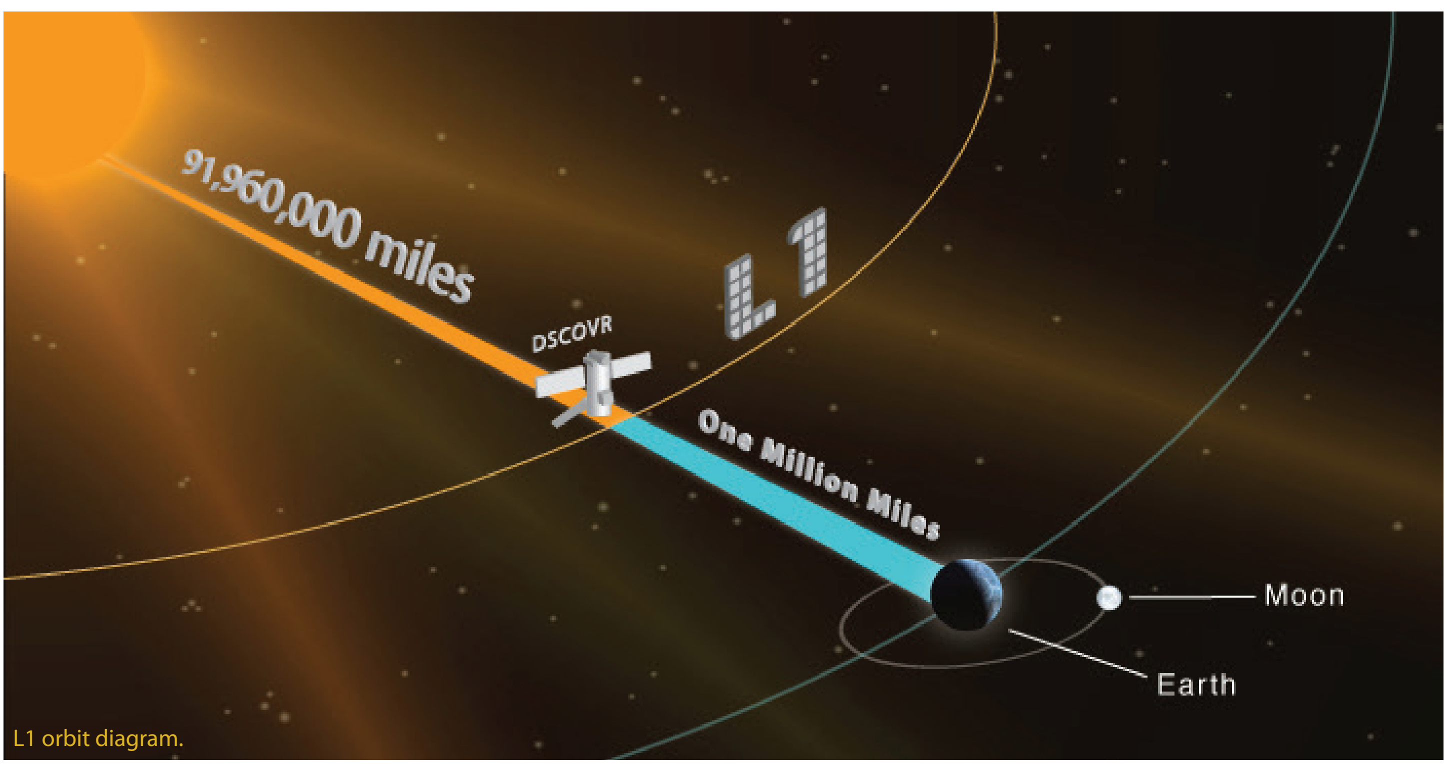
Importance of Solar Wind for Earth

Space weather and the resulting geomagnetic storms have demonstrated the potential to disrupt virtually every major public infrastructure system, including transportation systems, power grids, telecommunications and GPS. With timely and accurate alerts produced from DSCOVR data, infrastructure managers can take action to avert the greatest damage. NOAA's geomagnetic storm warnings are critical for these key industries.

Measurements from L1 Between Earth and Sun

DSCOVR will be stationed in orbit around the first sun-Earth Lagrange point (L1). The L1 point is on the direct line between Earth and the sun located 1.5 million kilometers (930,000 miles) sunward from Earth, and is a neutral gravity point between Earth and the sun. The spacecraft will orbit the sun, not Earth, positioned on the sun-Earth line. At this location, DSCOVR will have a six-month orbit with a spacecraft-Earth-sun angle varying between 4 and 15 degrees.

The particles that stream as the solar wind move extremely fast. Depending on particle velocity, DSCOVR at L1 will measure the strength of waves of energy and particles from storm events up to an hour before they strike Earth. This satellite location is the only place to obtain a 15 to 60-minute lead time for geomagnetic storm warnings.



L1 orbit diagram.

For the NASA Earth science mission, the L1 vantage point also offers a unique continuous view of the entire sunlit half of Earth in a "snapshot," as opposed to other Earth observing satellites situated closer to Earth that capture an image strip that is later "stitched" together.

Currently ACE is the only satellite providing real-time solar wind observations from the L1 orbit and it is well past its design life of two to three years. NOAA and its partners are working to refurbish and launch DSCOVR in order to continue these critical observations.

Instruments Flying on DSCOVR

PlasMag – Plasma-Magnetometer measures solar wind activity to provide highly accurate and rapid warning of geomagnetic storms with lead times of up to one hour. Measurements of solar wind are central to better determining how solar events affect Earth and its near-space environment, and will provide data allowing NOAA's National Weather Service Space Weather Prediction Center to issue space weather warnings.

The PlasMag will measure the magnetic field and the velocity distribution functions of the electron, proton and alpha particles (Helium nuclei) of solar wind with higher time resolution than existing instruments. The instrument suite was developed at NASA's Goddard Space Flight Center in Greenbelt, Maryland, and the Massachusetts Institute of Technology, in Cambridge, Massachusetts, and optimized for small size, low power, simplicity and dynamic range.

EPIC – Earth Polychromatic Imaging Camera instrument provides spectral images of the entire sunlit face of Earth, as viewed from an orbit around L1. EPIC is able to view the entire sunlit Earth from sunrise to sunset.

EPIC's observations will provide a unique angular perspective, and will be used in science applications to measure ozone and aerosol amounts, cloud height, vegetation properties and ultraviolet reflectivity of Earth. The data from EPIC will be used by NASA for a number of Earth science developments including dust and volcanic ash maps of the entire Earth.

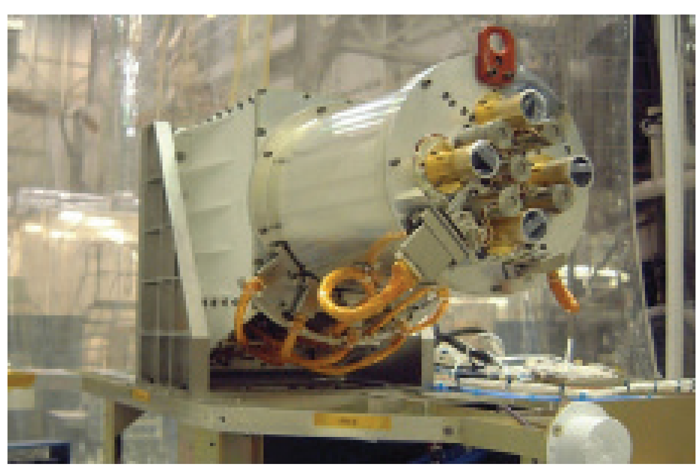
EPIC makes images of the sunlit face of Earth in 10 narrowband spectral channels. As part of EPIC data processing, a full disk true color Earth image will be produced about every two hours. This information will be publicly available through NASA Langley Research Center in Hampton, Virginia, approximately 24 hours after the images are acquired.

NISTAR – National Institute of Standards and Technology Advanced Radiometer is a cavity radiometer

Instrument	Measurement	Responsible Agency
Solar Wind Plasma Sensor (Faraday Cup) and Magnetometer (MAG) (PlasMag)	Measures solar wind velocity distribution and the magnitude and direction of the solar wind magnetic field to provide rapid warning of geomagnetic storms	NOAA
National Institute of Standards and Technology Advanced Radiometer (NISTAR)	Measures whole absolute irradiance integrated over the sunlit face of Earth for climate science applications	NASA
Earth Polychromatic Imaging Camera (EPIC)	Provides images of the sunlit side of Earth for science applications such as ozone, aerosols and clouds	NASA
Electron Spectrometer (ES)	Provides high temporal resolution (< 1 sec) solar wind electron observations.	NASA
Pulse Height Analyzer (PHA)	Provides real-time measurements of particle events that may impact DSCOVR's electronics	NASA

designed to measure the reflected and emitted energy (in the 0.2 to 100 micron range) from the entire sunlit face of Earth. This measurement is intended to improve understanding of the effects of changes in Earth's radiation budget caused by human activities and natural phenomena.

The information from NISTAR can be used for climate science applications by NASA. NISTAR will measure the amount of reflected sunlight and the thermal radiation of Earth in the direction towards the sun. These quantities are key ingredients of current climate models.



NISTAR.

NOAA's Deep Space Climate Observatory spacecraft, or DSCOVR is being unwrapped for the New Year and prepared for launch. In this photo, DSCOVR, wrapped in plastic, comes into view as the protective shipping container is lifted from around the spacecraft at the Astrotech payload processing facility in Titusville, Florida, near NASA's Kennedy Space Center. Photo credit: NASA

ES – Electron Spectrometer is an electrostatic analyzer (ESA) designed to measure solar wind electron in the energy range of 5 electron volts and 1 kiloelectronvolts. The solar wind is composed of equal number of positive and negative charged particles. The Faraday Cup measures the positive ion and the ESA observes the negative electron components yielding independent determinations of the bulk properties of the solar wind. The ESA electron measurements will also provide information for scientists about heating processes that take place as the solar wind streams away from the sun.

PHA – Pulse Height Analyzer is an engineering instrument designed to measure energy deposited by energetic heavy ions, typically of solar origin, in microelectronic devices.

Path to DSCOVR

DSCOVR (formerly known as Triana) was originally conceived in the late 1990s as a NASA Earth science mission that would primarily provide a near continuous view of Earth and measure Earth's albedo. Space physics sensors were added to the mission's payload. The Triana program was suspended and the satellite went into storage in 2001.

NOAA funded NASA to remove DSCOVR from storage and test it in 2008. The same year, the Committee on Space Environmental Sensor Mitigation Options performed an interagency assessment requested by the White House Office of Science and Technology Policy. The Committee determined that DSCOVR was the optimal solution for meeting NOAA and U.S. Air Force space weather requirements.

NOAA funded NASA to refurbish the spacecraft, recalibrate the space weather sensors, prepare the spacecraft for launch; develop the ground systems and operations; and provide technical management of the space segment. In 2012, NASA brought the spacecraft out of storage at NASA's Goddard Space Flight Center in Greenbelt, Maryland, where the spacecraft was originally built. NASA inspected the instruments, tested the mechanisms, provided new electrical components and conducted environmental tests of the observatory.

DSCOVR Launch Vehicle

DSCOVR will launch in February 2015, aboard a SpaceX Falcon 9 v 1.1 launch vehicle from Cape Canaveral Air Force Station, Florida. The U.S. Air Force is providing the SpaceX Falcon 9 launch vehicle through its launch services contract with SpaceX. The satellite will weigh 570 kg (1,256 pounds) at launch, with a size of 54 inches by 72 inches.

Distribution of DSCOVR Data

NOAA will operate DSCOVR from its NOAA Satellite Operations Facility in Suitland, Maryland, and distribute the data to its users and partner agencies. NOAA will process the space weather data, providing products and forecasts through the NOAA Space Weather Prediction Center in Boulder, Colorado, and archive the data at the NOAA National Geophysical Data Center in Boulder, Colorado. NASA is responsible for processing the Earth sensor data.

The Earth science data will be processed at the DSCOVR Science Operations Center at NASA Goddard Space Flight Center and publicly distributed through the NASA Langley Atmospheric Science Data Center.

For more information, please visit:
www.nesdis.noaa.gov/DSCOVR/index.html

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