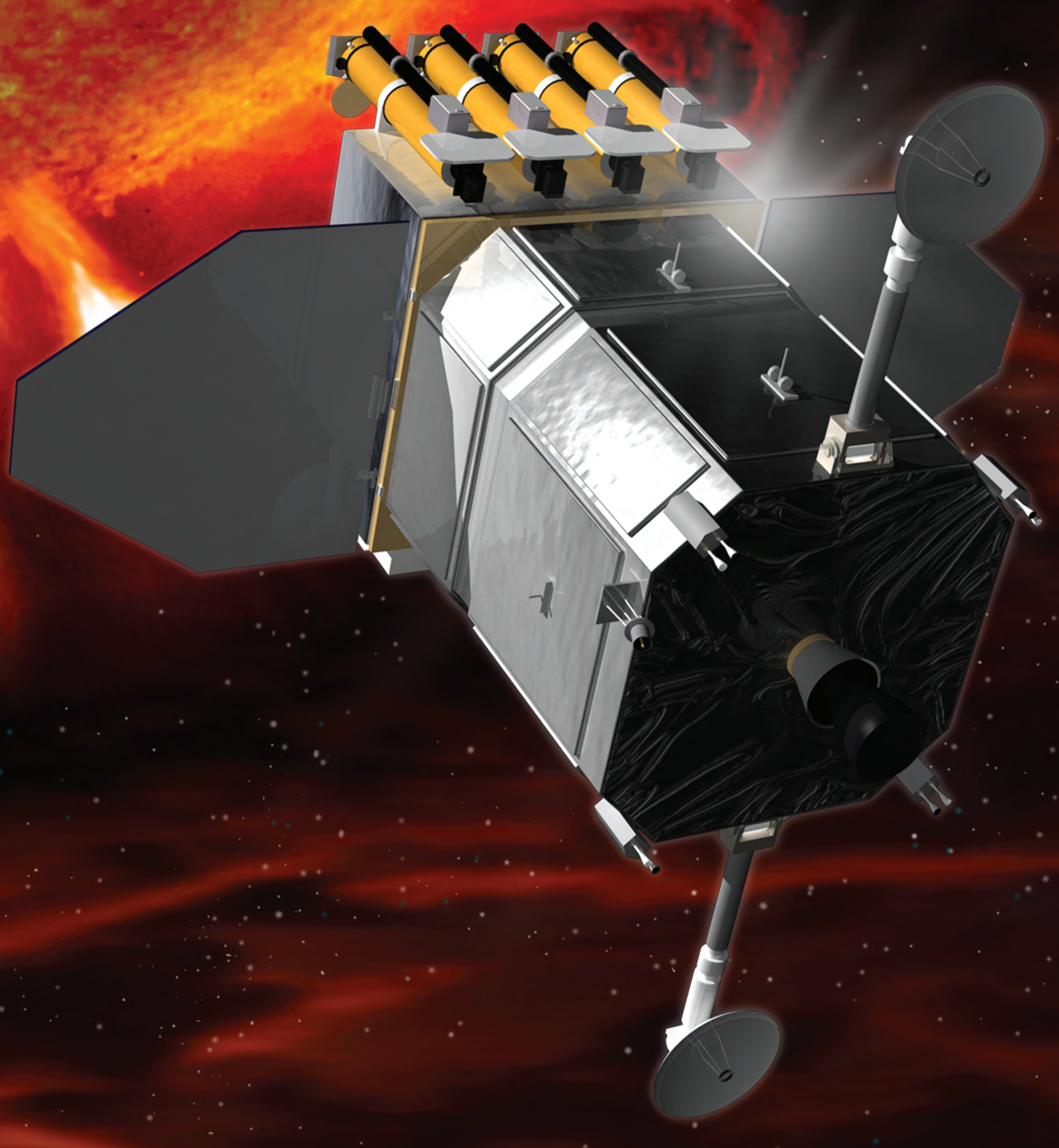
National Aeronautics and Space Administration

OUR EYE ON THE SUN

SDO



Solar Dynamics Observatory

SDO IS THE MOST ADVANCED SPACECRAFT EVER DESIGNED TO STUDY THE SUN AND ITS DYNAMIC BEHAVIOR. IT WILL PROVIDE BETTER QUALITY, MORE COMPREHENSIVE SCIENCE DATA FASTER THAN ANY NASA SPACECRAFT CURRENTLY STUDYING THE SUN AND ITS PROCESSES. SDO WILL UNLOCK THE SECRETS OF HOW OUR NEAREST STAR SUSTAINS LIFE ON EARTH, AFFECTS THE PLANETS OF OUR SOLAR SYSTEM AND BEYOND.

SDO is the crown jewel in a fleet of NASA missions to study our Sun. The mission is the cornerstone of NASA's Living With a Star Program. A program to develop an understanding that will allow for predictive capability of the space weather conditions at Earth and in the interplanetary medium.

STARRING THE ATMOSPHERIC IMAGING ASSEMBLY (AIA), THE EXTREME ULTRAVIOLET VARIABILITY EXPERIMENT (EVE), AND THE HELIOSEISMIC AND MAGNETIC IMAGER (HMI)

COMING SOON

www.nasa.gov

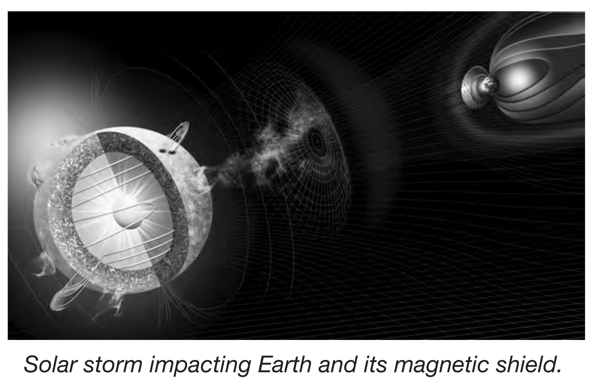
Solar Dynamics Observatory

SDO: Our Eye on the Sun

The Solar Dynamics Observatory is the first mission of NASA's Living With a Star Program. SDO will study how solar activity is created and how space weather results from that activity. Measurements of the Sun's interior, magnetic field, the hot plasma of the solar corona, and the irradiance will help meet the objectives of the SDO mission.

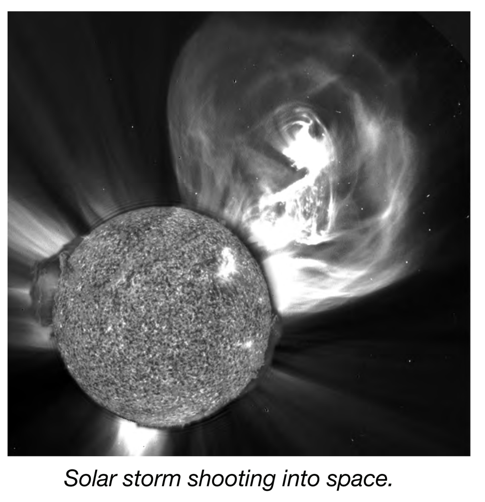
SDO will improve our understanding of the physics behind the activity displayed by the Sun's atmosphere, which drives space weather in the heliosphere, the region of the Sun's influence, and in planetary environments. SDO will determine how the Sun's magnetic field is generated, structured, and converted into violent solar events that cause space weather. SDO observations start in the interior of the Sun where the magnetic field that is the driver for space weather is created. Next, SDO will observe the solar surface to directly measure the magnetic field and the solar atmosphere to understand how magnetic energy is linked to the interior and converted to space weather causing events. Finally, SDO will measure the extreme ultraviolet irradiance of the Sun that is a key driver to the structure and composition of the Earth's upper atmosphere.

SDO Science



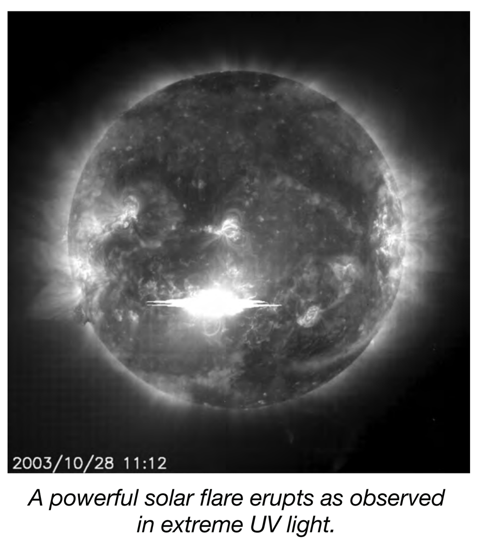
Solar storm impacting Earth and its magnetic shield.

Solar activity and variability are key concerns of our modern, increasingly technological society. Solar flares and coronal mass ejections can disable satellites, cause power grid failures, and disrupt communications. Furthermore, because the Sun is so powerful, even small changes in its irradiance could have effects on climate.



Solar storm shooting into space.

The Solar Dynamics Observatory (SDO) is designed to probe solar variability in a way that no other mission can match. High-speed cameras on SDO will take rapid-fire snapshots of solar flares and other magnetic activity. This will have the same transformative effect on solar physics that the invention of high-speed photography had on many sciences in the 19th century.



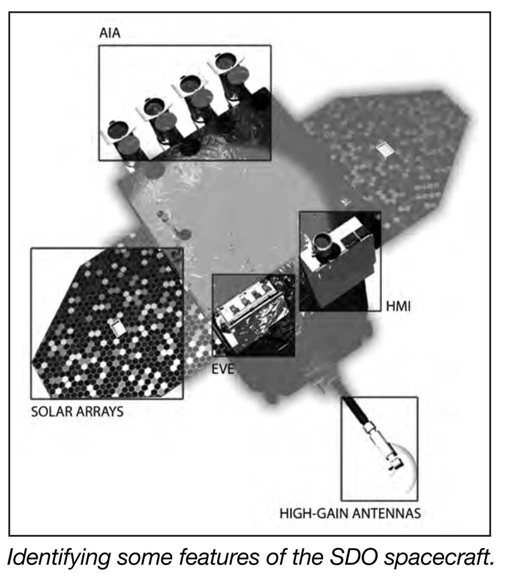
A powerful solar flare erupts as observed in extreme UV light.

SDO doesn't stop at the stellar surface. A sensor on the observatory can actually look inside the Sun at the very source of solar activity—the solar dynamo itself. There SDO will find vital clues to the mystery of the solar cycle and help scientists predict the future of solar activity.

The goal of NASA's Living With a Star (LWS) Program is to provide the scientific understanding needed for the United States to effectively address those aspects of Heliophysics science that may affect life and society. The ultimate goal is to develop an understanding that will allow for predictive capability of the space weather conditions at Earth and in the interplanetary medium.

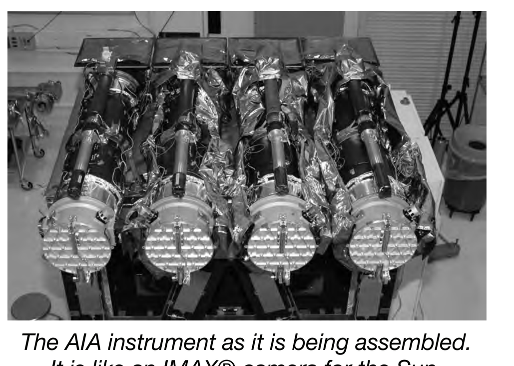
SDO Instruments

The Solar Dynamics Observatory has three main instruments.



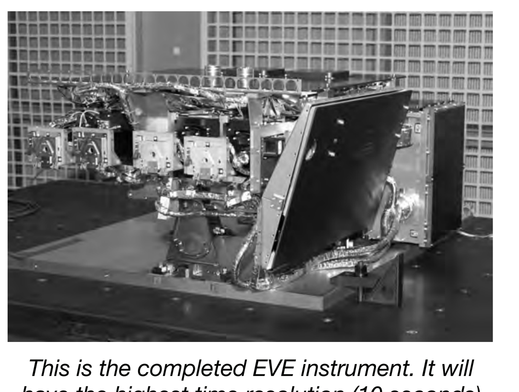
Identifying some features of the SDO spacecraft.

The **Atmospheric Imaging Assembly (AIA)** is a battery of four telescopes designed to photograph the Sun's surface and atmosphere. AIA filters cover 10 different wavelength bands, or colors, selected to reveal key aspects of solar activity. AIA was built by the Lockheed Martin Solar Astrophysics Laboratory (LMSAL), Palo Alto, California. AIA's Principal Investigator is Dr. Alan Title of LMSAL.



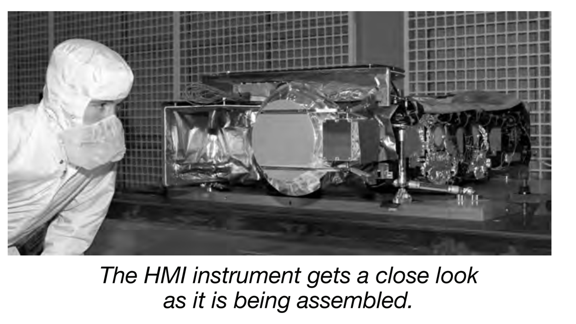
The AIA instrument as it is being assembled. It is like an IMAX® camera for the Sun.

The **Extreme Ultraviolet Variability Experiment (EVE)** will measure fluctuations in the Sun's ultraviolet output. The solar extreme ultraviolet (EUV) radiation has a direct and powerful effect on Earth's upper atmosphere, heating it, puffing it up, and breaking apart atoms and molecules. Researchers don't know how fast the Sun can vary at many of these wavelengths, so they expect to make many new discoveries about flare events. EVE was built by the University of Colorado, with Dr. Tom Woods of University of Colorado as the Principal Investigator.



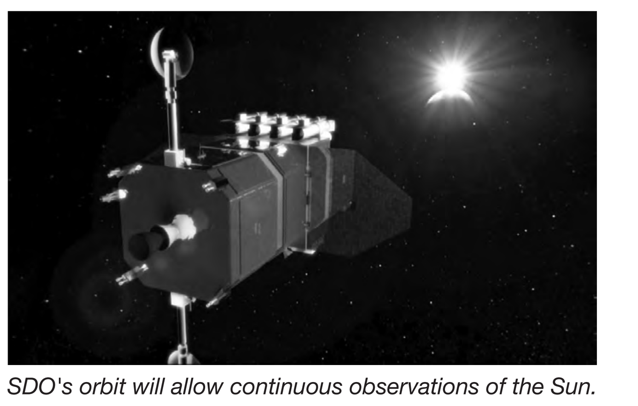
This is the completed EVE instrument. It will have the highest time resolution (10 seconds) and the highest spectral resolution (better than 0.1 nm) ever achieved by a space-based solar observatory.

The **Helioseismic and Magnetic Imager (HMI)** will map solar magnetic fields and peer beneath the Sun's opaque surface using a technique called helioseismology. A key goal of this experiment is to decipher the physics of the Sun's magnetic dynamo. HMI was built by the Lockheed Martin Solar Astrophysics Laboratory (LMSAL), Palo Alto, California. The Principal Investigator for HMI is Dr. Phil Scherrer of Stanford.



The HMI instrument gets a close look as it is being assembled.

An Avalanche of Data



SDO's orbit will allow continuous observations of the Sun.

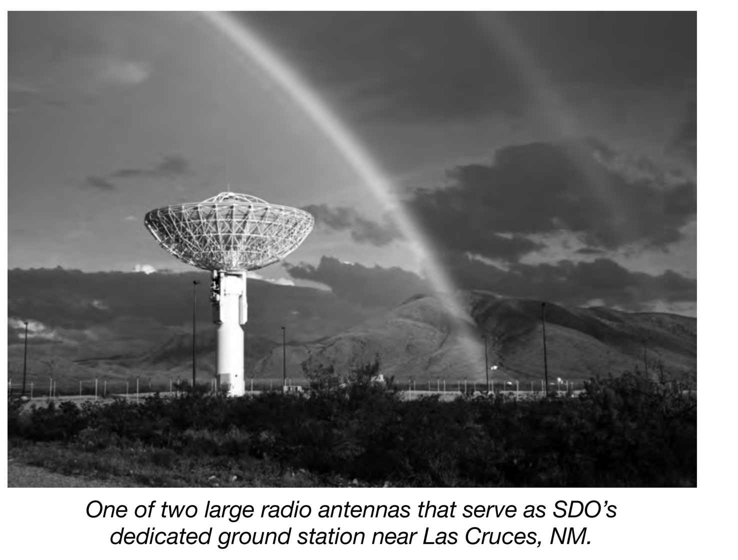
Imagine watching a high-definition movie that never stops. The enormous screen is filled with the raging Sun, unleashing huge solar flares and billion-ton clouds of hot plasma. The amount of data and images SDO will beam back per day is equivalent to downloading half-a-million songs each day.

SDO will beam back 150 million bits of data every second

By some estimates, SDO will transmit as much as 50 times more science data than any mission in NASA history. Images with 10 times greater resolution than high-definition television recorded every 0.75 seconds will reveal every nuance of solar activity. Because such fast cadences have never been attempted before by an orbiting observatory, the potential for discovery is great.

The data rate is equally great. To handle the load, NASA has set up a pair of dedicated radio antennas near Las Cruces, New Mexico. SDO's geosynchronous orbit will keep the observatory in constant view of the two 18-meter dishes around the clock for the duration of the observatory's five-year prime mission. Not a single bit should be lost.

Data for Everyone



One of two large radio antennas that serve as SDO's dedicated ground station near Las Cruces, NM.

Each day in orbit, SDO will gather as much as 1.4 terabytes of data. Scientists, educators, and members of the general public will be able to browse this huge volume of data giving researchers and others a powerful new way to view the Sun.

SDO Web Sites for More Information:

http://www.nasa.gov/sdo
http://sdo.gsfc.nasa.gov

OUR EYE ON THE SUN
SOLAR DYNAMICS OBSERVATORY
NASA
HMI • AIA • EVE

SDO Instrument Web Sites:

http://hmi.stanford.edu
http://aia.lmsal.com
http://lasp.colorado.edu/eve

COMING SOON

NP-2009-12-112-GSFC