NASA Facts

National Aeronautics and
Space Administration

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Huntsville, Alabama 35812

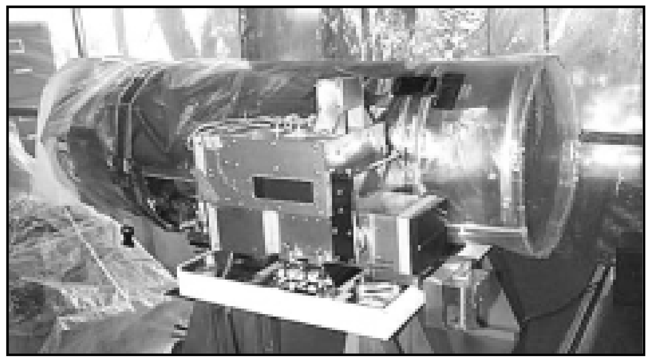
01-198 June 2001

The Solar X-ray Imager

The Solar X-Ray Imager -- to be launched as part of the Space Environment Monitor suite of instruments on the GOES-M weather satellite -- will be used to aid National Oceanic and Atmospheric Administration (NOAA) and U.S. Air Force personnel in issuing forecasts and alerts of "space weather" conditions that may interfere with ground and space systems. Turbulent "space weather" can affect radio communication on Earth, induce currents in electric power grids and long distance pipelines, cause navigational errors in magnetic guidance systems, upset satellite circuitry and expose astronauts to increased radiation.

The first in a series of instruments, the Solar X-Ray Imager will observe solar flares, coronal mass ejections, coronal holes, and active regions in the X-ray region of the electromagnetic spectrum from 6 to 60 A (Angstroms). These features are the dominant sources of disturbances in space weather that lead to, for example, geomagnetic storms. The Imager will also examine flare properties, newly emerging active regions, and X-ray bright points on the Sun.

NOAA and the Air Force will use Solar X-Ray Imager data for solar forecasting and monitoring solar storms, and to develop a better understanding of Sun-related phenomena that affect the Earth's environment.

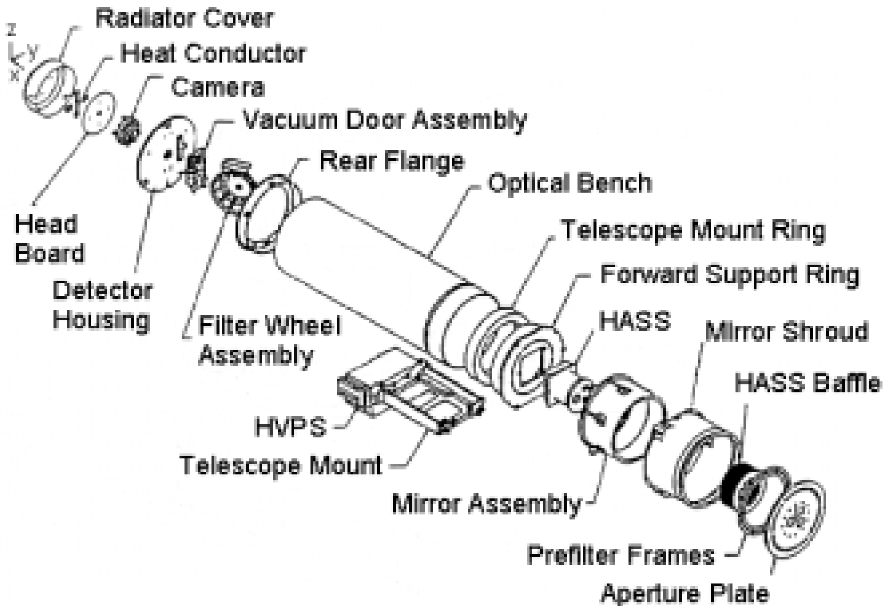


The Solar X-Ray Imager

The imager was developed, tested, and calibrated by NASA's Marshall Space Flight Center in Huntsville, Ala., in conjunction with the NASA Goddard Space Flight Center in Greenbelt, Md., NOAA, and the Air Force.

The imager instrument consists of a telescope assembly with a 6.3-inch (16-centimeter) diameter grazing incidence mirror and a detector system. Incoming X-rays graze the mirror's surface at very shallow angles and are brought to a focus on the detector system.

As long as the grazing angles are very shallow, about one degree, the X-rays do not penetrate the surface but are reflected, just like visible light. The detector system contains a micro-channel plate which converts the X-rays to visible light which is then recorded



using a CCD camera. Resulting data is electronically packaged for transfer to NOAA ground stations in Suitland, Md., and Boulder, Colo. The images are processed and distributed to space weather forecast centers by the NOAA Space Environment Center in Boulder. The images are made immediately available to the public via the World Wide Web by the NOAA National Geophysical Data Center, also in Boulder.

The imager will provide continuous, near real-time observation of the Sun's corona, acquiring a full-disk image every minute. The images cover a 42 arc-minute field of view with five arc-second pixels. The Sun, as viewed from Earth, is approximately 32 arc-minutes in diameter.

By recording solar images every minute, NOAA observers will be able to detect and locate the occurrence of solar flares. This is the name given to the explosive releases of vast amounts of magnetic energy in the solar atmosphere. Since scientists are not yet able to predict the occurrence, magnitude or location of solar flares, it is necessary to continually observe the Sun to know when they are happening.

When a flare erupts, it throws out large clouds of ionized, or electrically charged, gas. A small fraction of the cloud is very energetic and can reach the Earth within a few minutes to hours of the flare being observed. These energetic particles pose a hazard to both astronauts and spacecraft.

Coronal mass ejections, which are often associated with flares, take several days to reach the Earth. Fast, powerful ejections give rise to geomagnetic storms, which can disrupt radio transmissions and induce large currents in power transmission lines and oil pipelines. They have resulted in large-scale failures of the North American power grid and greatly increased pipeline erosion. SXI also will monitor coronal holes -- persistent sources of high-speed solar wind. As the Sun rotates every 27 days, these sources spray across the Earth like a lawn sprinkler and cause recurring geomagnetic storms.

The first Solar X-Ray Imager instrument is scheduled for launch on NOAA's GOES-M weather satellite. GOES stands for Geostationary Operational Environmental Satellite. That name refers to the fact that the satellites are "parked" in a geostationary orbit, 22,300 miles (35,890 kilometers) above the Earth's equator. The orbital velocity of these satellites matches the Earth's rotation, so they remain in the same position in the sky.