The MISR Instrument

The MISR instrument is the size of a steamer trunk, and weighs 149 kilograms (328 pounds). To meet its scientific objectives, MISR will measure Earth's brightness in four color bands, at each of nine look angles spread out along the flight path in the forward and aft directions. The nine separate cameras within the instrument are arranged for compactness in the shape of a "V-9" engine. In the artist's rendition showing a cutaway view of the MISR instrument, the nine cameras appear as yellow cylinders. In this orientation, MISR would look down toward Earth.

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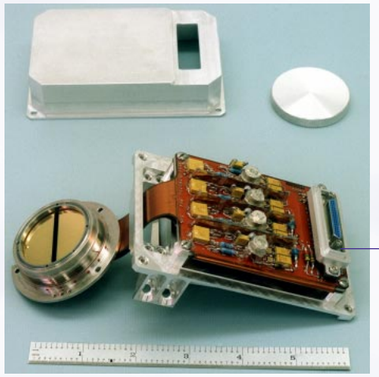
MISR will orbit the Earth about 705 kilometers (438 miles) above the ground. During a period of seven minutes, a 360-kilometer (224-mile) wide swath of Earth will successively come into the view of each of the nine cameras, as the instrument flies by. It takes nine days to cover the globe. MISR can see objects on the surface of Earth as small as 275 meters (902 feet), about the size of a major-league baseball stadium. (This is the "spatial resolution" of MISR.)

To improve the scientific value of the data, special attention has been paid to accurately measuring the instrument's sensitivity to light, which may change during its lifetime. This high absolute and relative radiometric calibration accuracy is achieved using onboard reflecting surfaces that, when commanded to move into position, will reflect sunlight into the cameras, and simultaneously into an additional set of light-detecting sensors designed to check the camera response.

MISR will fly together with four other instruments on NASA's EOS AM-1 satellite. Three of the instruments will measure quantities related to Earth's energy budget, covering aspects of both reflected sunlight and thermal energy emitted by Earth. When the satellite is on the day side of Earth, its orbit crosses the equator at about 10:30 A.M. local time. EOS AM-1 is scheduled for launch in 1999; the instruments are all designed to operate for at least six years.

Focal Plane Assembly



This is a detector from one of the MISR cameras (disk-shaped object with slit). The detector is attached to a rectangular "camera head" electronics package that is about 10 centimeters (4 inches) long. The cover for the electronics package can be seen in the background. This collection of parts is called the Focal Plane Assembly, since the detector belongs at the focus of the camera lens.

Beneath the detector slit are strips of light-sensitive, solid-state material. Each strip is divided into 1,504 light-sensitive spots called "pixels" that will produce line after line of a MISR image as the sweep of the satellite orbit carries MISR around the Earth. (For this reason, MISR is called a "push-broom" camera.) There are four closely spaced strips in each detector, one for each of the MISR color bands. Since there are nine cameras altogether, MISR produces 36 images simultaneously. (JPL-23831Ac)

Camera and Support Electronics

This is one of the nine MISR cameras, completely assembled, together with its support electronics. Each camera is a self-contained unit that was tested and calibrated independently before it was added to the MISR Optical Bench. The small rectangular box

attached to the side of the camera barrel, a part of the Focal Plane Assembly, is about 10 centimeters (4 inches) long. The camera in this image is one of the MISR "A" cameras, which have the shortest telescopes, and when mounted on the instrument, will look nearly directly down toward Earth. (JPL-28033Bc)

MISR Instrument Description

Parameter	Value
Camera View Zenith Angles at Earth's Surface	0.0 degrees (nadir) 26.1, 45.6, 60.0, and 70.5 degrees (both fore and aft of nadir)
Swath Width	360 kilometers (224 miles) (9-day global coverage)
Cross-Track × Along-Track Pixel Sampling (commandable)	275 × 275 meters (902 × 902 feet) 550 × 550 meters (0.34 × 0.34 mile) 1.1 × 1.1 kilometers (0.68 × 0.68 mile) 275 × 1.1 kilometers (0.17 × 0.68 mile)
Spectral Bands (Solar spectrum weighted)	446.4, 557.5, 671.7, 866.4 nanometers
Spectral Bandwidths	41.9, 28.6, 21.9, 39.7 nanometers
Charge-Coupled Device Sensor Architecture	4 lines × 1504 active pixels (each of 9 cameras)
Absolute Radiometric Uncertainty	3 percent (1 sigma) at maximum signal
Mass	149 kilograms (328 pounds)
Power (worst case)	83 watts (average); 131 watts (peak)
Data Rate	3.3 megabits per second (average)

"Family Portrait"

Here are the nine MISR cameras (plus one "spare" camera) in 1996, before they were attached to the MISR instrument. The two cameras designed to look at the steepest angles, called the "D forward" and "D aft" cameras, have the longest telescopes. A spare camera was used to build AirMISR, an instrument designed to fly in an airplane to help interpret the data from the spacecraft instrument. (JPL-28033Ac)

Optical Bench

This is the "science part" of the MISR instrument. It includes the cameras and calibration equipment. The photograph was taken in October 1996, as MISR was being assembled. Subsequently, the parts

that supply power, communications, and onboard data processing were added. The entire package was then encased in a protective housing, which was covered with highly reflective thermal blankets. The Earth-viewing orientation is up in this photograph. (JPL-28109Ac)