Power

A fundamental requirement is ensuring that the spaceborne radar has enough power to detect the weak return echo from the rain drops when seen from TRMM's orbital height of 215 miles (350 kilometers) above the Earth.

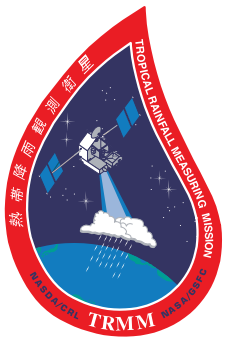
3-D Resolution

Another challenge is to gather high resolution three-dimensional maps of the rain during the brief time that the satellite overflies local storms. To meet these demands, Japan's Communications Research Laboratory elected a radar frequency about three times higher than that of a typical ground-based radar. Despite the restrictions on the size of the antennas in space, the use of a higher frequency provides good resolution and high quality images of storms. An active-phased array antenna, and sophisticated signal- processing techniques are used to scan the antenna beam electronically and rapidly, while ensuring that the transmitted and received radar pulses are synchronized. Solid state power amplifiers (128) are used both to conserve power and to provide a design that is robust.

Focusing the Radar Beam

Another problem to be overcome for the spaceborne radar was the need to produce a narrow radiating beam so that the target area would be small enough to bring out the features of interest on the ground—that is, good ground resolution. And still another problem was to be able to make the beam sweep out a path on the ground that would be wide enough to give good coverage as the satellite moves along its orbit. All of these design considerations were met through developments at Japan's Communications Research Laboratory. Both the narrow beam size and the ability to steer the beam are achieved through the design of a "phased array" antenna, which uses electronic steering of the beam.

The Tropical Rainfall Measuring Mission is NASA's first mission dedicated to observing and understanding the tropical rainfall and how this rainfall affects the global climate. It is a joint mission with NASDA of Japan. The primary instruments for measuring precipitation are the Precipitation Radar, the TRMM Microwave Imager, and the Visible and Infrared Scanner. Additionally, TRMM will carry the Lightning Imaging Sensor and the Clouds and the Earth's Radiant Energy System Instrument. These instruments all can function individually or in combination with one another.

More information on the Precipitation Radar is available via the Internet at:

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