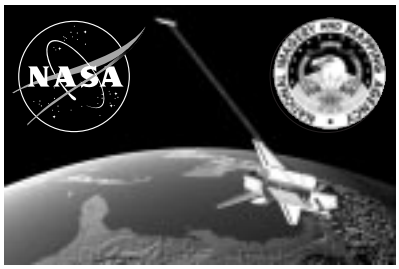


Seeing Earth's Surface in 3–D

Jet Propulsion Laboratory *February 1998*

SHUTTLE RADAR TOPOGRAPHY MISSION

***D**uring the last 15 years, the National Aeronautics and Space Administration (NASA) space shuttle has been used to study many aspects of space and Earth. Now the shuttle, with an instrument called an imaging radar, will be used to provide the most precise "picture" ever of Earth's land surface. The radar will bounce signals off the surface; these signals will be received by two onboard antenna systems and combined by computers at a ground facility to produce three-dimensional (3–D) images. Because the shuttle will fly over most of the globe's surface, enough data will be acquired to generate the most complete topographic map of Earth's land surface ever produced.*

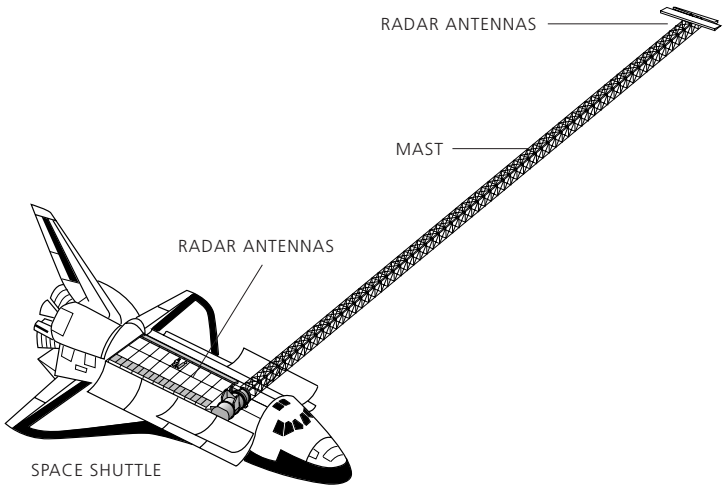
Working toward a Common Purpose

The Shuttle Radar Topography Mission (SRTM) will collect these important data during an 11-day space shuttle mission in 1999. The mission is a partnership between NASA and the Department of Defense's National Imagery and Mapping Agency (NIMA). In addition, the German and Italian space agencies are contributing an experimental high-resolution imaging radar system. Analysts will use the SRTM data to generate 3–D topographic maps called digital elevation models. These digital topographic maps can be combined with other data for analysis.

The SRTM data will also be used to generate 3–D pictures — called visualizations — of Earth's surface that scientists will use for studies of flooding, erosion, landslide hazards, earthquakes, ecological zones, weather forecasts, and climate change. The data's military applications include mission planning and rehearsal, modeling, and simulation. Other possible uses include optimizing locations for cellular phone towers and improving topographic maps for backpackers, firefighters, and geologists.

How the Radar Works

SRTM will build on technology used during two shuttle flights of the Spaceborne Imaging Radar–C/X-Band Synthetic Aperture Radar (SIR-C/X-SAR). These missions tested the radar technology and used imaging radar as a tool for improving our understanding of how Earth's surface is changing. A key SRTM technology is *radar interferometry,* which compares two radar images taken at slightly different locations to obtain elevation or surface-change information. Unlike earlier missions, SRTM will use single-pass interferometry, which means that the two images will be acquired at the same time — one from the radar antennas in the shuttle's payload bay, the other from the radar antennas at the end of a 60-meter (200-foot) mast extending from the shuttle. Combining the two images produces a single 3–D image.



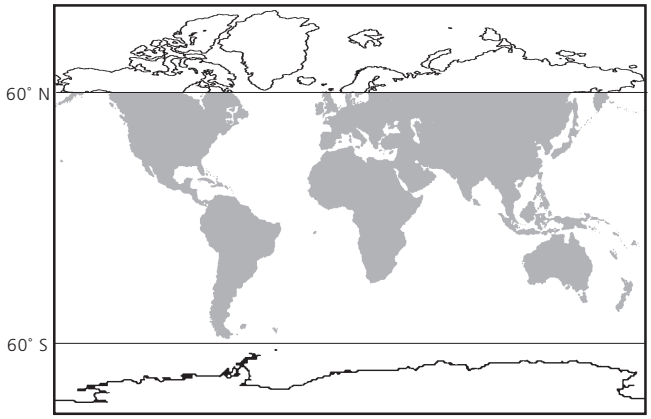
Seeing through the Clouds

Topographic maps can be produced by combining two photographs taken by aircraft or satellites, but these images are sometimes difficult to obtain when clouds obscure the surface. A key advantage to radar is that it can "see" the surface through clouds and in darkness. Imaging radar was used by NASA's Magellan spacecraft from

1989–1994 to produce spectacular pictures of the cloud-covered surface of the planet Venus. SRTM's goal is to produce a similarly detailed map of Earth. The 11-day SRTM flight will yield enough data for a digital model of Earth that is more detailed than what is currently available.

A Global Perspective

SRTM will collect radar data over nearly 80 percent of Earth's land surface, home to nearly 95 percent of the world's population.

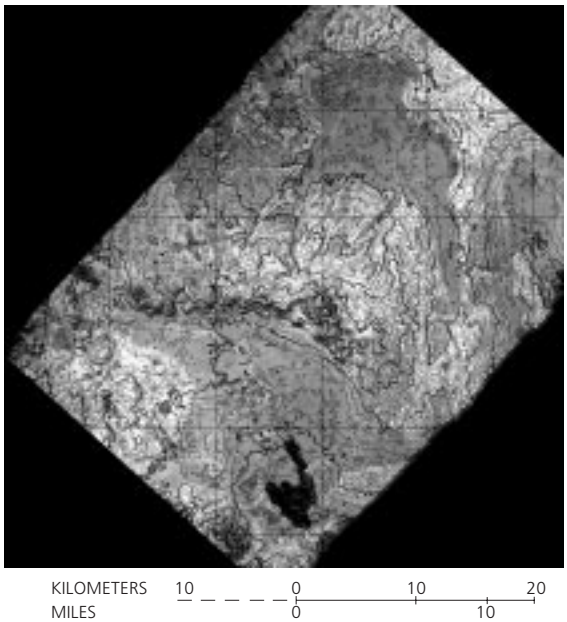


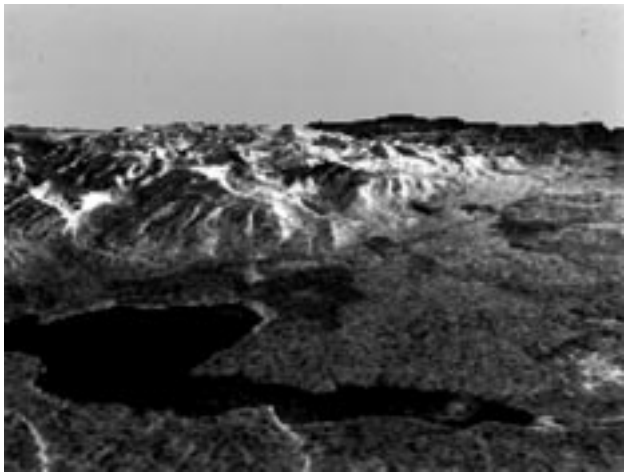
Because of the complexity in converting the raw radar data into topographic maps, data processing will require one year. The resulting data formats will be compatible with standard cartographic data-analysis software and tailored to the needs of the civil, military, and scientific user communities. Much of the data from the mission will be made available to these users in accordance with release guidelines mutually developed by NIMA and NASA.

The Jet Propulsion Laboratory, California Institute of Technology, manages the Shuttle Radar Topography Mission for NIMA and for NASA as part of its Earth Science program. This program uses data from satellites, aircraft, and ground research to help scientists better understand Earth's systems of land, water, air, and life, how they interact, and how they are changing.

Using Imaging Radar Data

These examples show how radar data are used to generate highly detailed maps and 3–D images. This topographic map (left image) of an area in the California Sierra Nevada was created using SIR-C interferometry data. The same digital data were used to create a 3–D visualization (right image) that can be used by scientists to help them understand drainage patterns and land-surface changes.





To Learn More about SRTM and Imaging Radar

We invite you to visit our World Wide Web site at http://southport.jpl.nasa.gov — or write to us at Jet Propulsion Laboratory, MS 186-113, 4800 Oak Grove Drive, Pasadena, California 91109-8099.

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JPL 400-714 7/98