Baltimore, Maryland

- Baltimore Zoo
- Druid Hill Park Lake
- Football Stadium
- Camden Yards
- Inner Harbor
- Lake Montebello
- Morgan State Univ
- Patterson Park
- Herring Run Park
- Fort McHenry
Landsat 7

About this Image
This false color image of the Baltimore, MD metropolitan area was taken on the morning of May 28, 1999, from the recently launched Landsat 7 spacecraft. It is the first cloud-free Landsat 7 image of this region, acquired prior to the satellite being positioned in its operational orbit. The image was created by using ETM+ bands 4,3,2 (30m) merged with the 15-meter panchromatic band. Using this band combination trees and grass are red, developed areas are light blue, and water is black. Landsat images of urban and suburban areas are utilized to study and monitor population growth patterns and the extent of such growth over time.

Landsat 7 Program
Landsat 7 is part of NASA's Earth Science Enterprise (ESE) program, a long term coordinated research effort dedicated to studying how our global environment is changing. It is the latest in a series of satellites that have provided a continuous set of calibrated Earth science data to users worldwide since the early 1970s. Landsat 7 will provide images of the land surface and surrounding coastal regions to national and international users conducting global change research, regional environmental change studies, national security activities and other civil and commercial purposes. Landsat 7 was launched on April 15, 1999, from the Western Test Range Vandenberg, Calif, on a Delta-II expendable launch vehicle. To learn more about Landsat 7 see http://landsat.gsfc.nasa.gov.

Program Objectives
Continuity of data with previous Landsat missions is a fundamental goal of the Landsat program. To accomplish this, images will be taken that are consistent in terms of data acquisition format, geometry, spatial resolution, calibration, coverage characteristics, and spectral characteristics with previous Landsat data, extending the consistent 26-year record of the Earth's continental surfaces. Landsat 7 will image large areas of the sunlit Earth daily, revisiting the same areas every 16 days to build a consistent archive of the Earth's surface. The data received by these three U.S.-operated satellites and Landsat 7 along the same ground track as previous Landsat satellites and Landsat 7 will fly over the same place on the globe every 16 days. Daily commands are sent to the spacecraft defining which images to record and to where to downlink data to U.S. or international ground stations. NASA Goddard Space Flight Center currently manages these day-to-day operations. On October 1, 2000, when flight operations will be turned over to U.S. Geological Survey (USGS).

The primary U.S. ground station receiving Landsat 7 data is located at the USGS's Earth Resources Observation Systems (EROS) Data Center (EDC). Supporting stations are located in Alaska and Norway. The ETM+ data received by these three U.S.-operated stations are all processed, archived, and distributed by EDC. The ETM+ data archive held by EDC provides global coverage of the Earth's continental and coastal surfaces on a scene-by-scene basis.

NASA's Earth Science Enterprise
Landsat 7 is an important satellite in a series of missions that comprise NASA's global-scale examination of the Earth. This multi-faceted research program is designed to investigate the interactions of all the components - air, water, land, and plant and animal life - that comprise the Earth's system. The goal of this program, called the Earth Science Enterprise (formerly known as Mission to Planet Earth), is to improve our understanding of the Earth and develop accurate predictive computer models that can help inform decision makers about global environmental trends, allowing us to protect the planet's and humanity's future.

The Earth Science Enterprise is NASA's contribution to the U.S. Global Change Research Program, a multi-agency effort to understand how our Earth changes over time. The U.S. program complements a larger international effort to study the environment, including the International Biosphere-Geosphere Program and the World Climate Change Research Program.

Objectives:
The students will be able to explain perspective, range, and resolution. They will also be able to explain how the optimal viewing zone varies with what it is they want to know.

Materials:
- A large, photograph or poster
- Metric ruler or measuring tape
- Chalk
- Magnifying glass
- Note pads to record discoveries

Procedure:
1. Set up a large sign, photograph or poster on in a location that allows students to view the item from a distance (20-30 m or more). You may want to have more than one poster, and/or have the students work in small groups.
2. Have the students approach the poster in one or two meter intervals, recording their observations at each interval. Instruct students to mark the distance where they could first identify the object on the poster. They should then approach the item when they are so close they can no longer tell what it is. Have them record that distance. Finally, have the students move right up to the item posted and observe the poster with a magnifying glass and record what they see.
3. Students then determine the two distances from the poster. These distances define the range or "window" within which their "remote sensors" (eyes) are capable of gathering the most useful information.

Discussion:
1. Engage students in a discussion about their observations and their perceptions of what they observed. What sort of information can be gathered from far-away observations? Close-up observations? Intermediate observations?
2. Explain that scientists gathering data by remote sensing do the same kind of exercise that your students just did. They figure out just how close or far away the camera needs to be to give them the information they want.
3. Discuss the types of data they think the Landsat 7 satellite will be able to provide to scientists.

Adapted with permission from the Aspen Global Change Institute's Ground Truth Student Teacher Handbook - second edition