National Aeronautics and Space Administration

Landsat 7 and the Chesapeake Bay

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Landsat 7 A view of the Chesapeake Bay

Goddard Space Flight Center

About This Image

This image of the Chesapeake Bay region was acquired Oct. 5, 2001. The Washington, D.C. and Baltimore, Maryland metropolitan regions appear in purplish-gray hues on the western shore of the bay. The forested regions surrounding the cities show up as bright green. Cultivated fields covering much of the Chesapeake Bay's eastern shore appear as a range of colors from pink to green, indicating various stages of plant maturity and field harvesting late in the growing season. Landsat data are used around the world to monitor the annual cycle of crop development and to help predict agricultural yield, and for a myriad of other applications. This image uses Landsat 7 Enhanced Thematic Mapper Plus (ETM+) bands 5, 4, and 1. One inch equals 14 miles.

Landsat 7 Program

Landsat 7 is part of NASA's Earth Observing System, the world's most advanced and comprehensive capability to measure global climate change. Landsat 7 is the latest in a series of satellites that has provided a continuous set of calibrated Earth science data to users worldwide since the early 1970s. Landsat 7 provides 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 projects. Landsat 7 was launched on April 15, 1999, from the Western Test Range, Vandenberg Air Force Base, California, on a Delta-II expendable launch vehicle. To learn more about Landsat 7, please visit http://landsat.gsfc.nasa.gov.

33+ Years of Landsat

The first Landsat, originally called the Earth Resources Technology Satellite (ERTS-1), was developed and launched by NASA in July 1972. Subsequent launches occurred in January 1975 (Landsat 2) and March 1978 (Landsat 3). Meanwhile, a second generation of Landsat satellites was developed with an improved sensor, the Thematic Mapper. Landsat 4 was launched in July 1982. Landsat 5, launched in March 1984, has provided images for over two decades. Landsat 6, a commercially managed and built spacecraft / instrument package, failed to reach orbit in October 1993.

Continuity Counts!

Landsat's data continuity makes it possible to compare data and images throughout the 33+ years of the program. Consequently, continuity of data with previous missions is a fundamental goal of the Landsat program. Images are taken that are consistent in terms of data acquisition, format, geometry, spatial resolution, calibration, coverage characteristics, and spectral characteristics. A large global archive of cloud-free images of Earth's land surface has been acquired. Data are available through the United States Geological Service's (USGS) Global Visualization Viewer at http://glovis.usgs.gov.

Spacecraft and Instrument

The Landsat 7 satellite consists of a spacecraft bus provided under a NASA contract with Lockheed Martin Missiles and Space in Valley Forge, Pennsylvania, and the ETM+ instrument procured under a NASA contract with Raytheon (formerly Hughes) Santa Barbara Remote Sensing in Santa Barbara, California. The ETM+ acquires data for eight spectral bands in the visible, near infrared, short-wave infrared, and thermal infrared portions of the electromagnetic spectrum. The spatial resolution is 15 meters in the panchromatic band, 30 meters in the visible, near infrared, and short-wave infrared bands, and 60 meters in the thermal infrared band. The instrument images the Earth in 115-mile (183 km) swaths.

Operations

USGS and NASA work together to support the Landsat Project. NASA developed and launched the spacecrafts. USGS handles flight operations, maintenance, and management of all ground data reception, processing, archiving, product generation, and distribution. Landsat 7 flies at an altitude of 438 miles (705 km) in a sun-synchronous polar orbit, crossing the equator at about 10 a.m. on its southward track. Reaching and maintaining a precise orbit requires management by the Flight Operations Team located at NASA's Goddard Space Flight Center in Greenbelt, Maryland, who use the satellite's on-board propulsion system to make adjustments. Landsat 7 flies along the same ground tracks as Landsat satellites 4 and 5, and flies over the same place on the globe every 16 days. Daily commands are sent to the spacecraft defining which images to record and when to downlink data to the U.S. or international ground stations.

Landsat Improves Our Understanding of Earth

Landsat has become an established data source for addressing basic Earth science questions, and is a valuable resource for decision-making on land use and natural resource management. Landsat sensors have a moderate spatial-resolution combined with a wide field of view. You can see man-made features such as highways and center-pivot irrigation fields distributed over a 115-mile-wide landscape in each image. This perspective is important because it is wide enough for global coverage every season of the year, yet detailed enough to characterize human-scale processes such as urban growth, agricultural irrigation, and deforestation. Scientists and resource managers have made great use of the unique perspective and vast amount of information this series of satellites has provided. As one measure, the Science Citation Index records some 3,200 peer-reviewed articles making use of Landsat data since 1972.

By establishing baseline knowledge about Earth, Landsat allows scientists to evaluate environmental changes over time. For example, Landsat provides measurements of changes in tropical forests, coral reefs, and Antarctica's glaciers. Data are helping people to manage forests, grasslands, and agriculture around the world. Forest and Park Rangers use Landsat to map wildfire scars for recovery efforts. Geologists use Landsat to map faults and fracture zones, to locate unmapped volcanic fields, and to provide the basis for tectonic activity maps. Landsat-derived maps have also been used to aid in navigation of poorly charted regions. In the Antarctic, Landsat data were used to find unknown mountains in southern Victoria Land and at the head of the Lambert Glacier.

Educators Use Landsat Too

The legacy of Landsat's educational efforts is long. Many educators have embraced and used Landsat in the classroom for subjects as diverse as history, geography, environmental education, physics, and Earth science. Museums, planetaria, parks, and other informal education venues also find Landsat imagery and science to be of value. A rich array of resources for learning and teaching about land remote sensing can be accessed at the Landsat education website, http://landsat.gsfc.nasa.gov/education.