



LANDSAT 7 MONTHLY UPDATE

The Landsat 7 Mission, developed by the National Aeronautics and Space Administration, is managed by the U.S. Geological Survey under authority established by Presidential Decision Directive NSTC-3.

Program News

Landsat 5 Funding

Funding for Landsat 5 operations has been included in the fiscal year 2002 Department of the Interior appropriations bill that was signed November 6, 2001.

Landsat 5 Antenna

The USGS has installed a new 5.4m antenna at the EROS Data Center (EDC) to support multi-mission operations. The antenna has full S-Band receive and transmit capabilities, in addition to X-Band data downlink reception. The system is scheduled to initially support MODIS direct broadcast reception from Terra (AM-1), but support for other missions is planned. The antenna will be certified to support all L5 and L7 services, so EDC now has a backup capability in the event the main L7 antenna is unavailable.

Landsat Metadata

EDC began archiving metadata from Hartebeesthoek, South Africa (JSA) on September 26, 2001, and from Hatoyama, Japan (HAJ) on October 12, 2001. Metadata from Canada, Australia, and Europe continue to be archived successfully. As of October 29, 2001, there were 5,554 L7 IGS subintervals archived for 98,469 Landsat 7 Worldwide Reference System (WRS) scenes. These totals are lower than previously reported due to the deletion of duplicate metadata records from the EDC archive.

EOSDIS Core System

The EOSDIS Core System (ECS) has made significant progress this month in support of IGS metadata ingest. Ingest testing for the new station in Matera, Italy is now possible, and should commence in November. The Horizontal Display Shift field has been reset to optional in accordance with the IGS Interface Control Document. On October 25 EDC sent out a request to the IGSs to remove this field from their metadata if it is not being calculated. Thus far, IGSs in Canada and Australia have complied with this request. Lastly, WRS path/row searches for IGS metadata have been enabled using the EOS Data Gateway located on the Internet at <http://edcimswww.cr.usgs.gov/pub/imswelcome>. The ECS will implement tape ingest for IGS metadata and browse during the first quarter of next year.

200,000th Landsat7 Scene

The USGS is about to acquire the 200,000th Landsat 7 scene for the U.S. archive. Landsat 7 has proven to be a major success. In the 2½ years of operation there has not been a major spacecraft anomaly. Total earth coverage, including record numbers of repetitive coverage, exceeds 6.2 billion square kilometers. The data have provided new insights into natural and man made alterations of the Earth's surface, atmospheric phenomena, and insights into volcanic activity.

Technical News

Landsat 7 Delta 1

Landsat 7 successfully completed its third inclination correction maneuver (Delta I) October 9 through 11. In order to maintain a mission desired 10:00 am Mean Local Time (MLT) through October of 2002, two inclination maneuvers about the Descending Node (DN) were performed. To minimize the efforts, resources, and impacts that are associated with inclination maneuvers, they were planned together and treated as one large burn. The maneuvers were separated by two orbits in order to verify spacecraft performance and reestablish a converged attitude. Prior to the Delta I, Landsat 7 had a MLT of 10:01 am of the DN trending toward 9:30 am.

Maneuver planning also took into account Landsat 7's proximity to the Earth Observer 1 (EO-1) and other spacecraft in a formation called the AM constellation satellites. Landsat 7 is the lead spacecraft in this Constellation of four spacecraft following in the same orbit but with different DN crossing times. Earth Observer 1 trails just 1 minute behind Landsat 7, requiring cooperative planning between missions to avoid any possibility of collision.

“Caterpillar Tracks”

Recently the quality of Landsat 5 data has been in question due to the observance of “Caterpillar Tracks”. These tracks, a known and expected characteristic for this type of imager, occur while the Scan Mirror (SM) and Shutter become un-synchronized. Operationally, the instrument undergoes a short warm up period to allow for synchronization prior to any imaging event. During the past several months, however, Landsat 5 has exhibited periods where synchronization either exceeded the warm up period or did not occur at all. The Landsat 5 missions operations center has recently quantified a relationship between bumper wear, SM Turn Around Time (TAT), and Thermal operating conditions. The fundamental relationship between these items shows that the motion of the SM wears down the surface of the bumpers over time, thereby increasing the distance that the SM travels between strikes of the bumpers, which translates to a longer travel time. This pattern of aging is what we refer to as TAT growth. It has been predicted that at some time during the instrument life, the TAT growth would increase to a period in which the SM would not be able to sync with the Shutter and end the mission.

Although bumper wear is the leading contributor to this anomaly, it is prematurely precipitated by a decrease in operating temperatures. The operating temperatures of the TM recently changed as direct result of significant changes in its tasking profile. The Landsat 5 missions operations center recently implemented an operational strategy that maintains the optimum thermal conditions the instrument requires. This is still under investigation the anomaly but so far this methodology has removed all traces of the “Caterpillar Tracks” from the image data. USGS still believes that the TAT will continue to grow and eventually be uncorrectable, but USGS is hopeful that that may not happen for quite some time.

Calibration Parameter File Update

The USGS recently released updated and new calibration parameter files (CPF). A July 2001 CPF release, used in processing to characterize how the Landsat 7 sensor is performing, has been changed. Striping in band 6 data was noticed and required changes to the band 6 high gain. The changes correct the striping and a 0.1 % difference between the high and low calibrated images.

The October 2001 Calibration Parameter File release makes a change to band 7 gains, but only for detector 5. A 3 % drop in relative gain was noted for detector 5 beginning in January 2001; therefore, the change is only for CPF's for the period after December 31, 2001.

Modulation Transfer Function Compensation

New Modulation Transfer Function Compensation (MTFC) parameters for the Landsat 7 Calibration Parameter File were submitted for inclusion in the October 2001 CPF release. The new coefficients used in the CPF are derived from on-orbit estimates of the ETM+ along- and across-scan MTF and replace the previous coefficients, which were based on prelaunch MTF measurements in the along-scan direction only. The MTF describes how the sensor optics and electronics modulate the original signal (image), as a function of spatial frequency, in the conversion of input radiance at the ETM+ aperture to an output digital image. The goal in MTFC resampling is to partially compensate for the system response by boosting the higher spatial frequencies attenuated by the MTF. This enhances fine spatial detail (e.g., edges) but has the side effect of also increasing the image noise somewhat. Because of this, MTFC images usually exhibit sharper edges but also have a grainier appearance. Users should evaluate the relative importance of image sharpness versus noise to their applications in deciding whether MTFC processing is appropriate. An example of the new MTFC processing has been posted on the Landsat 7 Data Quality web site at: http://edcwww.cr.usgs.gov/l7dhf/ias_folder/mtf.html.

LOR Validation

The Beijing, China and the Prince Albert, Canada ground stations have both provided LORp data for the biannual validation activities and were validated successfully. The use of ftp capabilities has also been quite useful to reduce the time and costs of delivering validation data to the USGS at EDC. At this time 13 of the 16 cooperating international ground stations have been successfully validated.

Leonid Activity

In anticipation of Leonid activity on Nov 18, 2001, both Landsat 5 and 7 will shutdown operations for the 19-hour period of the Shower/Storm. The flight operations team will operate the instrument while the spacecraft is behind the Earth and away from the Leonids. This will help maintain a nominal thermal balance of the ETM+. The user community and the International Cooperators will be notified of the details of the plan as they are developed.

Meetings

LGSOWG Meeting

The Landsat Ground Stations Operations Working Group 30 meeting, originally scheduled for September, will be held in Orlando, Florida on November 12-16, 2001. The LGSOWG consists of ground station management from the USGS, NASA, and the Landsat International Cooperator community. The November meeting topics include cloud avoidance, implementation of a multi-level priority system, DAAC metadata ingest, spacecraft and sensor performance for Landsat 5 and 7, ground systems, data exchange, USGS program restructuring, station reports, and the planned USGS/NASA Millennium Assessment Program.

Related News

Three New Publications Highlight Landsat Data

KUNSTWERK ERDE: SATELLITENBILDER AUS DEM ALL, published for GEO in Germany by Frederking and Thaler offers views of the planet's surface, many of the images are reproductions of Landsat data.

The summer 2001 **Hardrock**, published by the South Dakota School of Mines and Technology Alumni office, carries a simulated view of the South Dakota Black Hills developed from Landsat 7 data and from digital terrain data.

The journal, **Remote Sensing of the Environment**, October 2001 issue, is dedicated to Landsat.

The Landsat monthly update is an informal communication tool, prepared monthly and distributed electronically to USGS Landsat partners, to provide information about Landsat activities and related topics of interest. Comments, corrections, and queries may be directed to Ronald Beck, USGS Landsat team, at the following e-mail address: beck@usgs.gov.

**U.S. Department of the Interior
U.S. Geological Survey**