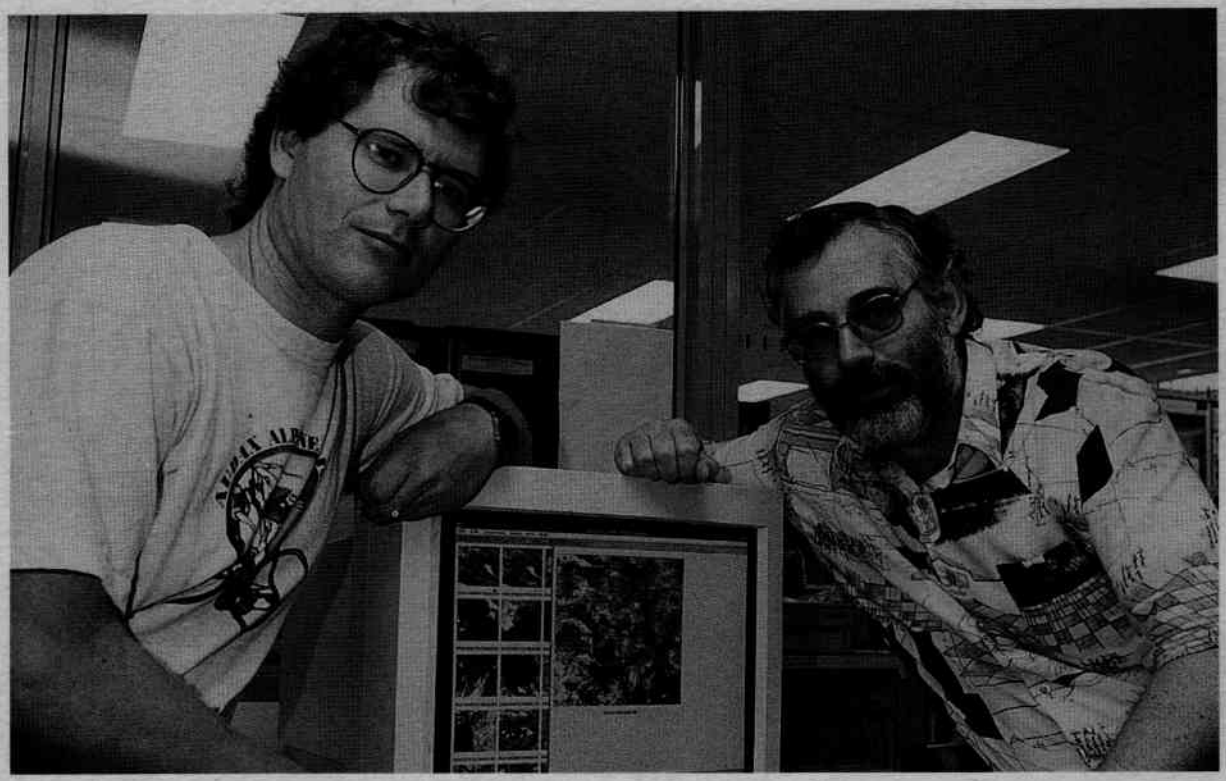
ACRES

UPDATE • MARCH 1996

ACRES Digital Catalogue goes live



ACRES PROJECT ENGINEER, KARL NISSEN AND EARTHWARE CONSULTANT, DAVE JOHNSON, PERFORM SOME FINAL CHECKS TO ACRES NEW DIGITAL CATALOGUE.

Since the last edition of the ACRES Update major progress has been made with ACRES Digital Catalogue system. Aspect Computing, CORE Software Technology, EarthWare Systems of Canberra and ACRES staff have been extremely busy and successful. This hard work resulted in the system being declared operational on Monday 19 February 1996 as planned.

Access to the catalogue can be achieved by several different means.

1. The simplest method to review metadata and view the browse images is via the Internet and World Wide Web access.

   The address of the web site is:

   http://www.auslig.gov.au

   This allows you to access the ACRES Digital Catalogue, browse images and metadata, and save images to disk. If you wish to view the catalogue in this manner please login using the login identification and password of 'guest'. If you intend becoming a frequent user of the catalogue please contact: Karl Nissen, e-mail: k.nissen@auslig.gov.au for a unique ID and password.

2. CORE Software Technology has developed a UNIX Client Viewer. This viewer is available for purchase – please contact ACRES if you are interested.

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INSIDE

AUSLIG

Manager's message

I am delighted that this issue of ACRES Update announces the arrival of ACRES Digital Catalogue system. On February 19th 1996 the system went live as planned and can now be routinely accessed via AUSLIG's World Wide Web site. The successful implementation of the catalogue is a great credit to the dedication and enthusiasm of the ACRES project manager, Karl Nissen. The professionalism and flexibility displayed by the contractors, Aspect Computing, CORE Software Technology and EarthWare Systems, was also most refreshing from my viewpoint.

While you are browsing the catalogue you would be well advised to have a look around the rest of the AUSLIG Web site. It includes a substantial amount of information about ACRES products. As reported in this newsletter, the latest addition is a revamped 'What's New' page. We will endeavour to update this page weekly with the latest news and views, including samples of new imagery as they come to hand.

The launches of Canada's RADARSAT-1 in November 1995 and India's IRS-1C in December 1995 offer exciting new possibilities for the Australian remote sensing community. RADARSAT is the world's first operationally-oriented SAR satellite. Its operational flexibility will undoubtedly open up a whole new range of SAR applications. IRS-1C's 6m PAN band offers the highest spatial resolution currently available to civilian users. ACRES has been conducting extensive market research over the past few months in an effort to assess whether there is sufficient demand in Australia for these new data sources to justify establishing a direct reception capability. We have also been negotiating with RADARSAT International and EOSAT over distribution arrangements and access fees. I hope to be in a position to make announcements on these issues within the next few months.

In the meantime, that reliable old workhorse Landsat 5 continues to deliver the goods. The completion of an orbit inclination adjustment manoeuvre by EOSAT in December 1995 means that the satellite is heading back towards its nominal equatorial crossing time. This is very welcome news for southern hemisphere Landsat data users who have suffered from the side effects of the orbital drift during the 1995 winter.

Paul Trezise

Editor's note

Jim Mollison

Please forward any relevant articles for publication to The Editor, ACRES Update at our address shown on the back cover. We are always looking for new and interesting articles.

The Editor wishes to thank those who contributed articles for this 8th ARSC Conference Edition of ACRES Update. In addition, thanks is also extended to Anton Albina and Col Ellis of ACRES for their continuing work in providing photographs for ACRES Update.

RADARSAT delivers imagery

Canada's first remote sensing satellite, RADARSAT, was successfully launched from the Vandenberg Launch Facility in California on November 4th 1995. After 3 months of initial commissioning the satellite is now entering its operational phase. ACRES has been in negotiation with RADARSAT International regarding possible direct reception of RADARSAT in Australia. In the meantime, RADARSAT data over Australia can be acquired by using the satellite on-board recorder with processing in Canada. RADARSAT has already delivered a number of sample images of Australian cities to ACRES. These look extremely impressive.

RADARSAT IMAGE OVER SYDNEY

NOTE: DATA RECEIVED DURING RADARSAT-1'S COMMISSIONING PHASE MAY DIFFER FROM DATA COLLECTED AFTER ITS COMPLETION.

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ACRES STAFF BEING TRAINED IN USE OF THE NEW DIGITAL CATALOGUE

The aims of the catalogue have all been achieved, including improving on-line search facilities, having information on remote sensing more widely accessible and replacing the costly and time consuming method of microfiche cataloguing.

The system is easily accessible through the Internet and WWW interfaces. Metadata and browse images are available within 4 days of data acquisition at Alice Springs. This will only enhance the use and commercial feasibility of the satellite imagery.

The database (at time of writing) holds metadata for all of 1996, 1995, 1994 and for the last six months of 1993. Landsat TM browse images are available from July 95 to the present, while SPOT browse images are available from December 1995 to the present. Metadata and browse images for the remainder of the ACRES archive will continually be ingested progressively over the next six months. The 'What's New' page of the ACRES World Wide Web site includes up to date information about the progress of the ingest process.

Landsat 5 Thematic Mapper Band 5 Saturation

The Landsat 5 satellite has fixed gain settings established pre-launch. These settings will give the best dynamic range for most scenes; however, there are certain circumstances that can cause overloading of some or all of the sensors.

Scenes containing bushfires with an intense fire front can cause saturation of certain sensors that may be manifested by bright streaks continuing in the direction of the scan. In desert areas with sparse vegetation and high soil reflectance a similar phenomenon can occur that may cause sensor saturation over the full scene. This appears to have the most profound affect on the Thematic Mapper Band 5 detectors and can produce an image with very high to saturated data.

Scenes most likely to be affected are those acquired in summer over desert or salt lakes. As the raw data is affected, it is not possible to correct this problem during processing; a scene acquired in another season may be the only alternative.

World Wide Web update

Jenny Weissel

What's new?

We have implemented a new format ACRES' 'What's New?' Page on our Web site. The previous page contained a description of the ACRES catalogue demonstration via a hyperlink to the CORE Technology Pasadena site. This link is now terminated due to the release of the 'live' catalogue via ACRES WWW Digital Catalogue system page.

The new format 'What's New?' page contains current news items about ACRES, remote sensing technology developments and updates about our sales network and products. Occasionally, there will be links to example images (eg. our 19th February page linked to both IRS and RADARSAT images over Australian locations). 'What's new?' is usually updated weekly, so be sure to check it out!

Upcoming events

New pages are currently under construction. These will describe ACRES' Satellite Operations, a satellite status update via "ACRES' Facts" page, a description of satellites and sensors, and product specifications.

ACRES' Digital Catalogue system - it's here!

Try out a search for a satellite image over your area of interest via our Digital Catalogue system page. For details, please refer to the cover story in this ACRES Update edition.

Aspiring World Wide Webbers

Have you constructed an interesting application demonstration using ACRES' satellite imagery? Perhaps it may be suitable for us to publish on our Web site. If so please contact the Manager, ACRES, to arrange to submit your demonstration for evaluation.

Sunrise and Sunset

AUSLIG's Geodesy unit have provided a means for you to obtain sunrise and sunset times for any location. From the AUSLIG home page go to 'Products' and select 'Geodetic Services'. Open the 'Geodesy Table of Contents' and select item 11 'Astro Information'. Go to 'Compute the Time of Sunrise/Sunset for any Date or Place'. Input the requested criteria and obtain the sunrise and sunset times for your selected location. This information has proven useful for many purposes.

ACRES "Site" visit by MDA's Senior Software Engineer, Pat Campbell

Paul Gardner

For two weeks in January 1996 ACRES received a site visit by one of MacDonald Dettwiler's senior software engineers Ms. Pat Campbell. Pat has been connected with ACRES current SPOT and Landsat processing systems since their original installation.

On this occasion Pat was here to install the latest versions of both the cataloguing system (MQS) and the main product generation system (GICS) software. The upgrade to the MQS system comprised minor modifications to the existing processing software (important for continuing support) while the upgrade to the GICS processor gave us two significant new features. These were the ability to produce product histograms at the quality assurance stage and the ability to produce disk products. The latter enables us to write products to disk in our standard CCT formats (ie volume directory file, leader file, imagery file(s) and trailer file) giving us the potential of producing such products on CD-ROM in the future.

Pat also helped resolve numerous technical problems that we have been experiencing.

The three problems with the MQS system that were resolved were:

1. The TM catalogue images being too large (385 swaths instead of 358);
2. The first scene disappearing from the start of SPOT passes; and
3. Random East West shifting (by a few kilometres) of the framing of SPOT scenes.

The most significant problem with the GICS that was overcome was radiometric calibration problems caused by the slow deterioration of the Landsat satellite. A custom modification means that the calibration process can now use the calibration data from the reverse swath if the forward data can not be found, where as before, pre-launch data had to be used. It was also discovered that the specified reference detectors had deteriorated with age and were consequently producing less than optimum results. The specified reference detectors used for bands 3 and 4 have thus been changed with improved results experienced so far. For the GICS system, Pat also corrected several minor CCT format errors.

In addition Pat also gave the technical and operations staff some valuable training on the calibration process and the interpretation of the corresponding pages of the GICS product reports. This will enable us to better monitor the situation with the ageing Landsat satellite.

ACRES ENGINEER, PAUL GARDNER, AFTER A SUCCESSFUL VISIT FROM PAT CAMPBELL OF MDA.

LANDSAT-5 orbit adjust successful

In early December we received the very welcome news that the Landsat 5 orbit inclination adjustment manoeuvres had been successfully completed by EOSAT. This means that the satellite is heading back towards its nominal equatorial crossing time and should eliminate the problems we have experienced with some data acquired during the 1995 Australian winter caused by poor illumination. The EOSAT press release follows:

The eleven-year-old Landsat 5 proved to be a robust satellite, performing well during a series of three orbit inclination adjust maneuvers that EOSAT successfully performed between 27 October and 29 November, 1995. Over time the spacecraft's orbit inclination decreased, as expected, and its equator crossing time became earlier. Normal orbital drift is common to all healthy satellites; four sets of maneuvers have been previously executed during the life of Landsat 5, the last of which was done three years ago. The recent maneuvers will ensure that future data collected will have similar solar illumination conditions as the data in our extensive archive, thus providing continuity with this data set and allowing users to continue with current data analysis procedures.

Careful and thoughtful discussion among NOAA, NASA and EOSAT about the proposed scenarios for the maneuvers, the spacecraft status and potential outcomes resulted in the decision to maneuver the satellite. "We are pleased with the way the EOSAT Operations Staff planned for and handled the maneuvers and are very satisfied with the outcome," said Mike Mignogno, NOAA's Landsat Program Manager.

"The performance of the Landsat 5 spacecraft subsystems was nominal during the execution of the maneuvers and we are extremely pleased with the results," said Neil Dennehy, Director of Operations. "Our CSC Flight Operations team did an outstanding job in both preparing for and conducting these important maneuvers," Mr Dennehy added.

LANDSAT 5 Thematic Mapper noise

The following is an extract from a fax sent by Mark Altman of EOSAT referring to information about a 'picket fence' type pattern that has been observed in some Landsat 5 TM data. This noise is most apparent in data with a small dynamic range, such as southern imagery acquired during the Winter of 1995.

"My preliminary investigation leads me to believe that the scenes are experiencing a severe coherent noise problem. Coherent noise is a known within-scan, sample location dependent noise problem that was originally documented by John Barker in the 'Proceedings of the Landsat 4 Science Characterisation Early Results Symposium'. Barker's Fourier analysis identified the Landsat 5 instruments coherent noise pattern as occurring within most channels of the primary focal plane at a frequency of 8.5 Khz or multiples of this frequency. The 8.5 Khz occurrence rate relates to a pixel spatial period of about 12.5/n pixels.

A similar Fourier analysis of the Landsat 5 periodic noise was documented by R C Wrigley, C A Hlavka, D H Card and J S Buis in their paper 'Evaluation of Thematic Mapper Interband Registration and Noise Characteristics' in volume 51 number 9 of the Photogrammetric Engineering and Remote Sensing periodical. Their analysis demonstrated a coherent pixel noise problem at spatial frequencies of 18.87, 11.36, 5.75 and 4.69 pixels in most TM bands. Their results also demonstrated that the worst case coherent noise was in band 5 for the 11.36 spatial frequency at a magnitude of 2.5 digital numbers (DN) and the best case coherent noise was in band 4 for the 11.36 spatial frequency at a magnitude of 0.2 DN.

These analyses results almost seem to directly relate to the characteristics of the 'picket fence noise' that you have seen in some TM images. According to these analyses, most cases of coherent noise image effects are of only in the order of 1 DN. I believe that the low dynamic range of DN values contained in your data is exaggerating the effect (on the human eye) of the inherent noise problem when the suspect scenes are stretched and displayed. Any scene, when stretched beyond a 6 to 1 ratio, will exaggerate all radiometric errors, including the known coherent noise, within the 1 DN detector to detector system specification that is resident in all TM images".

This advice confirms ACRES' belief that the 'picket fence' patterns experienced in some recent TM data are not due to data degradation or processing problems. Rather, they are due to a previously existing anomaly which has been accentuated by the low winter sun angle and lower illumination caused by the earlier Landsat 5 equatorial crossing time.

A copy of the latter paper referred to in this article is available from ACRES.

IRS-1C launched

On December 28th 1995 the Indian Space Research Organisation (ISRO) announced the successful launch of its second generation remote sensing satellite, IRS-1C, from the Baikonur Cosmodrome in Kazakhastan.

IRS-1C incorporates more advanced features than its predecessors. It has enhanced capabilities in terms of spatial resolution, additional spectral bands, stereoscopic imaging, wide field coverage and a revisit capability. It carries a tape-recorder on board for recording the data when data is not being transmitted in real time. It has three cameras on board:

- A Panchromatic camera (PAN), which is a high resolution camera operating in Panchromatic band with a resolution of 5.8m and swath of 70km; it can be steered up to ± 26 deg across-track, thus enabling stereoscopic imagery and better revisit capability.
- A Linear Imaging Self-scanning Sensor (LISS-III) operating in four spectral bands – three in Visible/Near Infrared (VNIR) and one in Short Wave Infrared (SWIR) ranges. It provides a ground resolution of 23.5m in VNIR bands and 70.5m in the SWIR band, with a swath of 141km and 148km respectively.
- A Wide Field Sensor (WiFS), a coarse resolution (188.3m) camera covering a wide swath of 810km.

IRS-1C was designed and built by the ISRO Satellite Centre, Bangalore, which is the lead Centre for all ISRO satellite projects. Besides ISRO, several R&D and academic institutions and industries, both in public and private sectors, have actively participated in the realisation of IRS-1C.

Remote sensing date from IRS is received by the data reception centre of National Remote Sensing Agency (NRSA) at Shadnagar near Hyderabad. The data is processed and provided to the users by NRSA at Balangar, Hyderabad.

EOSAT will also receive the data from IRS-1C and supply to the world community under a commercial contract with the Antrix Corporation of the Department of Space.

ACRES has been conducting market research into the potential demand for IRS data in Australia while at the same time negotiating with EOSAT over access conditions. Sample imagery can be viewed at the AUSLIG booth at the 8th Australian Remote Sensing Conference.

Total relief in nine seconds

Damian Carroll, AUSLIG's Digital Data Product Manager

The Australian continent has one of the oldest terrains in the world and never before has it been portrayed with so much detail and accuracy as in the soon to be released GEODATA 9 SECOND DEM product. The DEM has a grid spacing of nine seconds in latitude and longitude (approx. 250m), a resolution which is superb for national, state or regional applications such as geological research, environmental management and regional planning. Data for DEM will be available on CD-ROM in easy to access formats and hard copy images at various national scales.

Production of the GEODATA 9 SECOND DEM has been a co-operative effort involving the Australian Surveying & Land Information Group, the Australian Geological Survey Organisation, the Australian Heritage Commission and the Centre for Resource and Environmental Studies at the Australian National University. The data is already being used by AGSO to improve national gravimetric databases and by AHC as a fundamental input to evaluate the naturalness of Australia's river system.

AUSLIG and AGSO, both Commonwealth government agencies, have combined their massive data sets of elevation and topographic information to produce this national digital elevation model. The source data used to produce this DEM has an accuracy of better than 10m and the gridding algorithm has rigorously enforced drainage by using Australia's drainage network as part of the source data.

The DEM was created using the ANUDEM algorithm developed by Dr Mike Hutchinson of the Australian National University. As well as elevation data, the program uses watercourses and large waterbodies to enforce hydrological accuracy, ie. sinks which are often a problem in other DEMs have been resolved by forcing the drainage where preset parameters have been met. Each value in the DEM is at the centre of a 9" x 9" grid square and represents the average elevation covered by that pixel. As a result of this approach the actual elevation of hill tops may not appear in the data.

The DEM was derived using the following AUSLIG data:

- GEODATA TOPO-250K Relief theme which consists of more than 5 million spot elevations taken from contours or observed during 1:100 000 map production. These points have an accuracy better than 10m.
- GEODATA TOPO-250K Hydrography theme. This contains watercourses and waterbodies from 1:250 000 mapping. Watercourses were flipped so that the sequence of points run in the direction of flow.
- Coastline derived from 1:250 000 mapping.

AGSO provided elevation data from its national gravimetric database and its airborne geophysical surveys.

The data will be held in a compressed format on a CD-ROM in files which approximate the coverage of 1:1 million map sheets. The CD-ROM is for distribution purposes and the data needs to be downloaded on to an IBM compatible PC. There are 37 separate areas (as shown in the sketch) and each file is around 30 Mbytes when held in an ASCII Grid format.

Data can be downloaded in the following formats:

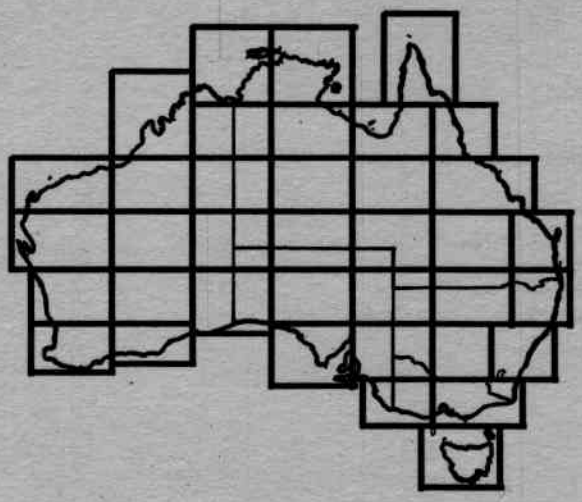
- ASCII GRID format as output by the ARC/INFO
- An ASCII x,y,z output.

A one-time payment secures an ongoing licence to use GEODATA 9 SECOND DEM for non-commercial purposes within an organisation. Some conditions apply.

Single 1:1 million area	$250
National coverage	$5500

Bulk discounts apply.

The data will be available from AUSLIG's National Data Centre (1800 800 173) and from AGSO.



THE 37 DISTRIBUTION TILES FOR GEODATA 9 SECOND DEM.

Orthocorrection of imagery with DEM's

When the AUSLIG 9" DEM of Australia is fully available ACRES will be able to use this as the basis for producing orthocorrected imagery. Landsat and SPOT scenes could then be ordered processed to 'level 10' which means precision geocoded and orthocorrected.

A pricing premium for the level 10 over the current level 9 product will apply but the amount is yet to be determined.

ACRES is in the process of evaluating the improvement in accuracy of the orthocorrected product under the varying conditions of terrain and viewing angles of Landsat and SPOT. A report on this evaluation will be given in a later edition of ACRES Update.