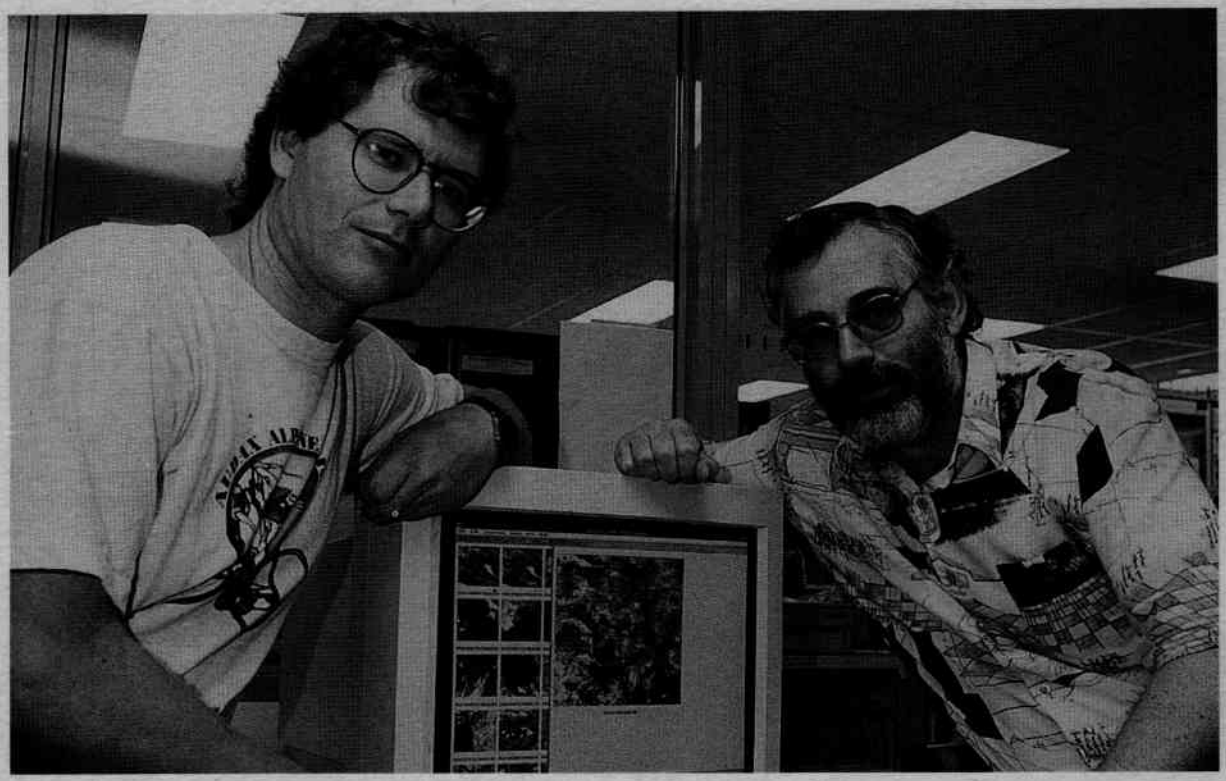
ACRES

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:

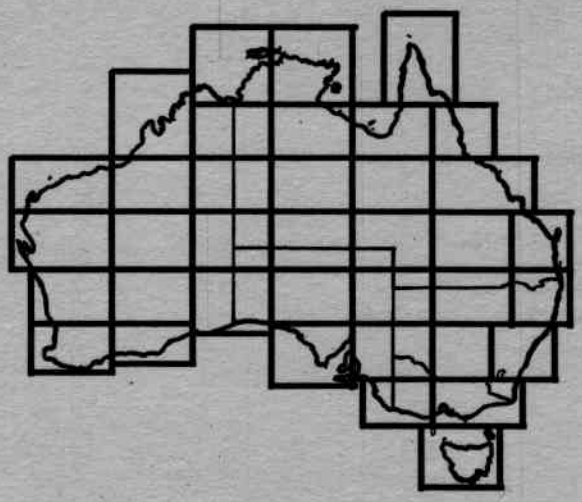
- ASCII GRID format as output by the ARC/INFO
- An ASCII x,y,z output.

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.

ESA's recent ERS-1 and ERS-2 Tandem SAR acquisition campaign

Steve Alder, ACRES Satellite Operations Section.

During the period 6 November 1995 to 14 January 1996 ACRES and the Tasmanian Earth Resources Satellite Station (TERRS) at Hobart supported the first ESA ERS tandem operation to gather coherent "C" band SAR data. A total of 456 ERS-1 and ERS-2 orbits within the visibility circles of both stations were scheduled by ESA and this placed a heavy load on the ACRES data acquisition program and acquisition resources at both Alice Springs and Hobart.

STEVE ALDER AND MELISSA ROWE ON THE JOB IN ACRES' SATELLITE OPERATIONS SECTION

Tandem mission background

During 1994 it became quite clear that the performance of the ERS-1 satellite would last well beyond the nominal design life of three years. Support from the scientific and application oriented users rapidly emerged for the possible use of the ERS-2 satellite, which was due for launch in 1995, for simultaneous operations with ERS-1. ERS-1 and ERS-2 carry identical sensors and with the same orbital configurations they could collect data over exactly the same area from each satellite. This coherent data can be used to generate Digital Elevation Models (DEMs), using interferometry, with an accuracy of within 10 metres.

Following the successful launch of ERS-2 and the mandatory commissioning phase the satellite was positioned one day behind ERS-1 on the same track. ESA quickly moved to plan the first of the proposed tandem campaigns to a acquire a unique world wide interferometric data set. ACRES was then formally approached to support the campaign and the acquisition plan was sent to ACRES in October 1995.

The acquisition plan.

The ESA acquisition schedule covered two complete 35 day cycles for both satellites. SAR coverage included descending coverage of all of Australia and New Zealand plus ascending passes over New Zealand and most of NSW and Victoria. ACRES Satellite Operations Section planned the acquisition schedule several weeks before the start of the campaign to share the acquisition load between the Alice Springs Data Acquisition Facility (DAF)and TERRS receiving sites.

The TERRS Board agreed to participate in the campaign and TERSS was assigned all the descending passes over the Australian eastern seaboard, the ascending passes over Australia and all the New Zealand passes for a total of 252 orbits. DAF was scheduled the remaining 204 descending passes over Australia, but 14 of these had to be rejected due to identified conflict with higher priority acquisitions. Given that ERS-2 is 35 minutes behind ERS-1, imaging slots for the other satellites were carefully selected where possible to fit in with the tight daily acquisition time frame requirements for the single antenna at the DAF. The changing descending node time for LANDSAT 5 also made accurate long term conflict analysis difficult.

The acquisition result.

DAF successfully acquired 189 orbits representing approximately 31 hours of recording time whilst TERRS acquired 245 orbits for a total of 12 hours. We consider this to be an outstanding result. Both stations were kept extremely busy, with the DAF daily acquisition schedule sometimes reaching a total number of 13 passes, with ERS averaging three passes per day. TERRS averaged four ERS passes per day during the period. The data is currently being prepared for shipment to ESA to add to their extensive world wide database of SAR data. ACRES also has a copy of the data in our archive ready for sale. This latest imagery will be an extremely valuable resource to both the scientific and operational communities.

Price change for Australian SPOT data

Over three years ago SPOT prices for Australian data were reduced by 50%, despite no changes in our cost of supply. This measure was intended to stimulate the market, and history has shown that this was successful. Since this price reduction, the selling prices have remained unchanged until 31 December 1995. During this time, costs have been increasing, and so as of 1 January this year we (ACRES and SIS) have found it necessary to increase Australian SPOT prices by about 10%. Despite this increase, SPOT data over Australia is by far the cheapest of any ground station in the world, and well below the prices charged for overseas data.

Please contact ACRES, SPOT Imaging Services or your SPOT distributor should you require the new price list.

SIS appoints new distributors

SPOT Imaging Services of Sydney has appointed two new distributors to its network. They are NGIS (National Geographic Information Systems Pty Ltd) of Perth and Technical and Field Surveys Pty Ltd of Bathurst.

ACRES captures imagery of flooding

Steve Alder, ACRES Satellite Operations Section

ACRES has recently acquired extensive cloud free SPOT multispectral imagery of near record flooding in the Macintyre, Barwon and Darling rivers in NSW.

Commencing in late January 1996, ACRES Satellite Operations Section organised urgent programming of both SPOT satellites to provide initial coverage in the Goondiwindi/Mungindi area when the flood level was near its peak. During the ensuing month the passage of water was progressively monitored at Walgett, Brewarrina, Bourke and Wilcannia and imagery acquired on an opportunity basis. The programming of the sensors onboard each satellite ensured that each double swath overlapped as particular areas were imaged. Many complete passes were acquired cloud free on numerous occasions thus providing comparative cover, and initial examination of the imagery dramatically reveals the extent of the flooding.

This data set will be invaluable for future flood mitigation purposes for the rural and urban communities around the many river systems. A comparison with the archived data of the May 1983 flooding in exactly the same areas will also provide an interesting study.

NARGIS 97

The Far North Queensland GIS Group (FNQGIS) invites you to participate in the third North Australian Remote Sensing and Geographic Information Systems Forum in 1997 (NARGIS 97).

Previously this forum has been held in Darwin, however the venue for April 1997 will be the Smithfield campus of James Cook University, just north of Cairns. The venue for the forum is the newly constructed Cairns Campus of the University and is nestled into the rainforest at the foot of the range.

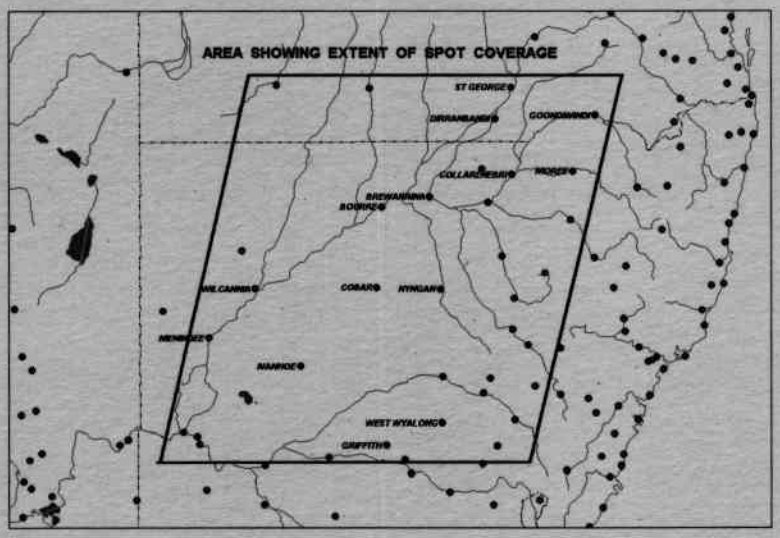
The forum will be held over three days, with papers being presented on GIS applications as they relate to:

- Marine Applications
- Mineral Exploration
- Commercial Applications
- Agri-business Applications
- Land and Resource Management
- Urban and Regional Planning
- Environmental Management

Expressions of interest are invited from people wishing to present a paper related to one of these topics. An abstract of up to 200 words should be sent to:

FUNGIS, 1 Norilla Close
Lake Placid 4878
e-mail: searlel@citec.qld.gov.au
taimalan@msn.com.

Whether you are presenting a paper or not, you are invited to come to sunny North Queensland and enjoy the reef and rainforest with people from diverse occupations who utilise GIS technology to support decision making. This is an opportunity to share experiences with others working in GIS in Northern Australia.



AREA SHOWING EXTENT OF SPOT COVERAGE.

Monitoring vegetation cover change and its impact on Queensland's greenhouse gas emissions

Tim Danaher, John Carter and Ken Brook, from the Qld Dept of Primary Industries, and Gail Kelly and Bruce Goulevitch from the Qld Dept of Lands

Queensland is committed to environmental and resource monitoring made under Ecologically Sustainable Development (ESD) and National Greenhouse Response Strategy and, as such, we need to monitor and document our land use changes and gas emissions. The 1994 National Greenhouse Gas Inventory has revised upward from 2% to 24% the estimate of the impact of land clearing for agriculture on total national emissions. Queensland has been identified as the largest source of land clearing emissions in Australia but current estimates of clearing range from 200,000 to 1,000,000 ha/year.

Over the next three years a satellite monitoring system will report the areas of land clearing and vegetation regrowth across the entire State. Landsat Thematic Mapper imagery will be used to compare the vegetation cover in 1988, 1991, 1995, 1996 and 1997. A more detailed 1991 baseline survey will also be undertaken. Ground survey teams will validate the accuracy of the satellite mapping.

Preliminary DPI research data indicate that woodland regrowth and thickening, which consequently increases the store of carbon in woody vegetation, may more than balance the carbon dioxide emissions from clearing. This thickening seems to be an indirect result of pastoral management of our woodlands but possibly also has components of CO_2 fertilisation and improved growth due to temperature change. Long term woodland monitoring sites will be established to confirm this trend across the State.

The QVLUMP project

The Queensland Vegetation and Land Use Monitoring Program (QVLUMP) will provide a means to monitor the change in Queensland's vegetation cover and to calculate greenhouse gas emissions related to change in vegetation cover. The main objectives of the project are:

- Develop a satellite based monitoring system which will be used to monitor the extent of land clearing and provide baseline vegetation and land use mapping.
- Establish permanent vegetation monitoring sites to assess the changes of vegetation biomass at decadal time scales.
- Assess the impacts of tree clearing and woodland regrowth on Queensland's greenhouse gas emission balance.
- Provide satellite imagery for natural resources and environmental management programs in DPI, DoL and the Department of Environment and Heritage (DEH).
- Develop a high capacity automated storage system that will both archive and rapidly retrieve the vast amount of satellite imagery used in this project, and also store other DPI spatial information such as meteorological data, soils and land information.

Satellite monitoring program

The Framework Convention on Climate Change (FCCC) requires member countries to report on policies for reducing greenhouse gas emissions, with the aim of returning emissions to their 1990 levels by the year 2000. A 1990 baseline emission rate will enable a calculation to be made at any stage in the future to determine our progress towards the FCCC goals.

Landsat TM digital imagery has been acquired for three time periods, 1987/88, 1991, 1994/95. The 1987/88 to 1991 period will be used to calculate the baseline clearing rate and the 1991 to 1994/95 period will determine the most recent rate of clearing. The 1987/88 date marks the start of routine acquisition of Landsat TM by the Australian Centre for Remote Sensing (ACRES). The 1991 data was chosen in preference to 1990 as it was a much drier year, which should enable better discrimination of woody vegetation for baseline vegetation mapping. The 1994/95 imagery is the most recent cloud free imagery available. It is also planned to continue this monitoring on an annual basis for a further two years by acquiring Landsat TM imagery for 1996 and 1997. If Landsat data is no longer available we may substitute data from alternative satellites, e.g. SPOT.

Where possible, we chose winter dates (June-October) for the imagery purchased to maximise the difference between woody vegetation and pastures. The Landsat scene positions were all adjusted from the standard centres which enabled Queensland's land area to be covered with 84 full scenes and four quarter scenes.

ACRES annual distributors' meeting

Early December 1995 saw the gathering of ACRES Distributors in Canberra for the annual Distributors' Meeting. The meeting always provides a good opportunity for the cross-flow of ideas in relation to sales, marketing, production and distribution issues, with this year being no exception.

AUSLIG GENERAL MANAGER, JOHN KENT, CONGRATULATES BOB WALKER OF GEOIMAGE FOR RECEIVING THE GOLD AWARD FOR DISTRIBUTOR SALES.

One of the first items on the agenda was the presentation of awards to distributors for the top three sales achievers for 1994/95. The three award winners were:

Gold:	Geoimage Pty Ltd
Silver:	SPOT Imaging Services
Bronze:	Remote Sensing Applications Centre (DOLA, WA.)

AUSLIG General Manager, John Kent, congratulated all distributors on a job well done for their contribution towards a year of record sales. (Please refer to ACRES Update November 1995 edition for the summary of sales results.)

ACRES Manager, Paul Trezise, presented an enlightening session on some key issues including the ACRES Satellite Acquisition Strategy, in addition to feedback on the ACRES Customer Service Guarantee. The majority of distributors indicated there had been a significant improvement in the level of customer service since the introduction of the guarantee.

AUSLIG's Remote Sensing Product Manager, Jim Mollison, provided some details on sales results, while ACRES Production Manager, Mike Pasfield, outlined the latest on the ACRES production system and satellite health.

The meeting ended with an open discussion session followed by a dinner, complete with Christmas party hats!

AUSLIG RETAIL SALES MANAGER, JOHN PAYNE, PRESENTS THE SILVER AWARD TO CARL MCMASTER FROM SIS.

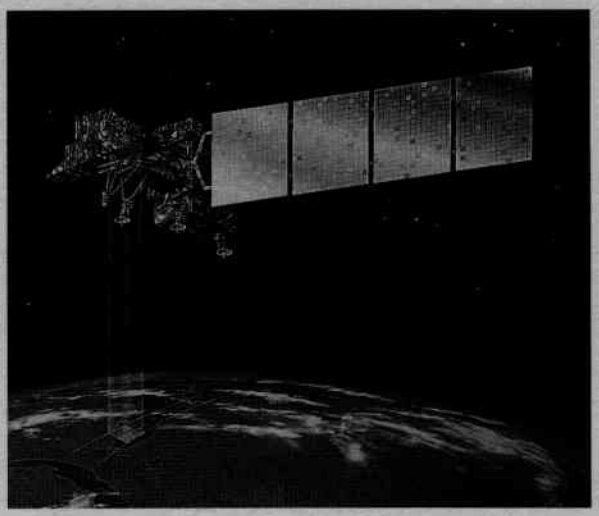
JOHN KENT, CONGRATULATES KEN DAWBIN OF RSAC, DOLA FOR RECEIVING THE BRONZE AWARD.

ACRES ADMINISTRATION OFFICER, BOB JONES, WITH KATIE BRIAN OF SIS.

Report on the Landsat-7 Technical Working Group Meeting

Karl Nissen, ACRES Projects Engineer

At the end of November 1995, I was fortunate in being able to attend the Landsat-7 Technical Working Group Meeting (LTWG) in Sioux Falls, South Dakota. The Landsat Technical Working Group meetings are concerned with the technical aspects of the Landsat satellites and are typically held about once per year. This LTWG meeting was the first since the unsuccessful launch of Landsat-6 and was the first technical working group meeting for the next Landsat satellite, Landsat-7.



ARTIST'S IMPRESSION OF LANDSAT 7

The construction and launch of Landsat-7 will see a new era in the operation of remote sensing satellites, particularly in the US market. Currently, the operation of Landsat-5 (and Landsat-6 if the launch had been successful) is by EOSAT as a commercial company and commercial operation. With Landsat-7 the operation of the satellite is fully controlled by the US federal government through NASA, NOAA and the United States Geological Survey (USGS). NASA will be responsible for the management of the satellite design and integration, NOAA will be responsible for the operation of the satellite once launched, and the USGS will be responsible for data acquisition, processing and archiving through the EROS Data Center (EDC) in Sioux Falls.

At the time of my visit the EROS Data Center was undergoing significant construction work for new offices and a computer room for the Landsat-7 processing system. A single antenna will eventually be installed at the EROS Data Center site for the reception of direct and recorded downlink data from the Landsat-7 satellite.

The Landsat-7 satellite extends the capability of the TM instrument on Landsat-5 and the Enhanced Thematic Mapper (ETM) instrument that was installed on Landsat-6. Consequently the sensor is called an Enhanced Thematic Mapper plus (ETM+) instrument. In the overall structure the instrument uses the same technology as that of the TM instrument with the scanning mirror forming a data swath of 8 detectors (60 metre thermal band), 16 detectors (30 metre spectral bands) or 32 detectors (15 metre panchromatic band), with an identical swath coverage and orbit pattern. Data from the ETM+ sensor will provide continuity with TM data from Landsat-4 and Landsat-5.

Of particular interest is a tighter absolute radiometric specification at +/-5% compared with the current TM specification of +/-10% and the 15 metre panchromatic band which will be co-registered with the 30 metre spectral bands. In addition two gain settings are programmable to allow for areas that currently saturate on the TM instrument.

Alex Wyllie joins NGIS (Australia) Pty Ltd

National Geographic Information Systems, an independent GIS and remote sensing consultancy and services firm, and ACRES Specialist consultant, announce that Alex Wyllie has joined the team as the Manager Remote Sensing. Alex was formally with the Remote Sensing Applications Centre of the Department of Land Administration of Western Australia and has fifteen years of image processing and remote sensing experience.

He will be responsible for ER Mapper sales, support and training and the development of image processing and remote sensing consultancy services. He brings with him a reputation for high quality image production and service to his customers.

NGIS is continuing to expand its range of services to an ever growing client base.

"I am looking forward to the challenge of working in the Private sector, but still plan to keep in contact with my former public sector colleagues", he said. "I am sure there are opportunities for us to work together on significant projects that will require input from both the public and private sector".

Alex will continue in his role as a Director/Treasurer of the Remote Sensing and Photogrammetry Association of Australasia Ltd and can now be contacted for enquiries on membership and other matters on:

Tel: (09) 310 5247 (home)
(09) 316 4455 (work)
Fax: (09) 364 9200 (fax)
e-mail: ngis_aus@interworld. com.au

The ARIES project

Dennis Puniard, ARIES Project Officer

ARIES is the Australian Resource Information and Environment Satellite. The ARIES project aims to develop and launch from Australia a Low Earth Orbit (LEO) satellite which will carry into space a hyperspectral sensor capable of identifying materials on the earth's surface not able to be seen by any current satellites. The hyperspectral sensor will image the earth in at least 64 spectral bands using reflected visible and infrared light. ARIES, being a LEO satellite, will be able to cover the whole globe and will provide its data commercially to an international remote sensing market place.

The ARIES-1 project not only involves the development of a satellite carrying a hyperspectral imaging spectrometer, but will be a commercially oriented end-to-end information system designed to acquire, process and deliver data and value-added products to a worldwide market. The project is firmly based on applications solutions rather than technological pathfinding, with the development of specialised value-added products as part of the business strategy. By developing processing software for the satellite data in Australia, we will be able to take up a leading position in international markets to export not only the data but also the analysis tools and value-added services.

The Consortium

The CSIRO Division of Exploration and Mining is coordinating the activities of a consortium with expertise in all the disciplines required to deliver the end-to-end ARIES concept. The partners in the consortium are:

- CSIRO, lead by the Division of Exploration and Mining;
- AUSPACE Pty Ltd;
- The Australian Centre for Remote Sensing (ACRES);
- Earth Resource Mapping Pty Ltd;
- Geoimage Pty Ltd; and
- Technical and Field Surveys Pty Ltd.

The Australian Minerals Industry Research Association (AMIRA) is an associate member of the consortium involved in broking the project for the mining industry.

Project Background

The concept for the satellite has evolved through 20 years of research and development by CSIRO scientists and the mining industry, who have developed ground spectrometers to detect minerals and airborne instruments with similar characteristics.

Australia has an enviable reputation in the use of remotely sensed data from space for renewable and non-renewable resources management, including mineral exploration. Australian mining companies are fast becoming international or trans-national explorers, and are now poised to take up new tools to increase the efficiency and environmental sensitivity of future exploration.

Fast effective screening of broad areas in remote parts of the world is becoming a critical issue for mining companies that are rapidly expanding their international exploration programs in response to new opportunities in many countries previously closed to foreign investment. One of the key exploration problems thus created is how to rapidly and effectively examine the prospectivity of previously poorly mapped and unexplored lands in remote locations ahead of the competition. The ARIES-1 project is designed to deliver a new generation of geological and mineral alteration mapping maps to the Australian Mining Industry, anywhere in the world and on demand.

Because of its new spectroscopic approach, ARIES-1 will also be capable of providing improved environmental and agricultural resource information that is both better than and complimentary to current information from existing satellites, such as LANDSAT and SPOT. The hyperspectral sensor will allow improved sensing of green and dry vegetation types and crops, thus bringing opportunities for improved and more informed management of natural resources such as forests, rangelands and agriculture. Agricultural enterprises and environmental agencies will be able to remotely map and monitor crops, soil conditions and vegetation status in detail not previously possible.

In addition, the project will deliver a competitive edge to Australian industry through the development of industry capability in space technology.

The initial phase of the project is a full-scale commercial and technical feasibility study. This study will help define end-user product requirements and their product delivery needs. Comprehensive market research will be conducted to identify the requirements of major international markets for data, value-added products and data reception and distribution franchises.

If you would like more information about the project, please contact:

Dennis Puniard
ARIES Project Officer
CSIRO Headquarters
PO Box 225
Dickson ACT 2602

Tel: (06) 276 6158

Fax: (06) 276 6437

email: dennis.puniard@corpcent.csiro.au

It's a RAID!

The second phase of the most recent upgrade to ACRES processing systems was completed on 20th February 1996.

PRODUCTION MANAGER, MIKE PASFIELD, AND COMPUTER OPERATOR, QUYNH PHAM TAKING ADVANTAGE OF THE NEW HARDWARE UPGRADES.

It consisted of an additional 8Mb of RAM, a disk controller with 16Mb cache and a 24Gb RAID array.

The big boost of an additional 24Gb of disk storage via the RAID array (Random Access Independent Disks) is made up of 6 physical disks organised into 3 virtual disks each of 8Gb. The array is configured as RAID 0 (disk striping) which will provide the best performance for the large image file throughput required by GICS (ACRES production system).

In full production mode these hardware additions, along with an earlier software upgrade, will significantly improve production efficiency. They will allow for more work orders to be ingested and then queued for digital processing, which can be completed unattended during the 'graveyard shift'. The upgrade will also facilitate the addition of new product, such as imagery on CD-ROM.

Products may also be held on disk pending Quality Assessment. Previously, products failing QA would have to be re-ingested and reprocessed from scratch, even for minor fixable aberrations.

Improved turn around time and increased product range are some of the benefits for ACRES and its customers from this project.

Image Writing on 5 Gigabyte 8mm (Exabyte) tape

ACRES is investigating the appropriate hardware/software to enable our Image Writing system to cope with 5.1 Gb (high density) 8mm tape. In the mean time please check that your Image Writing data is written to 2.3 Gb 8mm tape or low density DAT. CCTs at 1600 or 6250 bpi are also acceptable.

SPOT over New Zealand

Roger Goodwill, Spot Imaging Services

SPOT data over New Zealand is being routinely received at the TERRS ground station in Hobart during February and March under arrangements negotiated by Spot Imaging Services (SIS). Products made by ACRES will be supplied by SIS to the New Zealand Department of Survey and Land Information (DOSLI) primarily for use by agencies involved in the national Land Cover Data Base project.

Spot Image in France schedules Spot 2 passes which are recorded at TERSS. Browse images are generate at TERSS for viewing by SIS and DOSLI on the Internet. Useful imagery will be cloud assessed, catalogued and archived at ACRES and products may be ordered from SIS and its Distributors.

This innovative project gives New Zealand (the land of the "long white cloud") access to SPOT data via a ground station as an alternative to the SPOT 3 tape recorders

First portable ground station in North America: Alaska

For the first time ever a civilian portable satellite remote sensing ground station has been placed in North America, specifically, in Alaska.

EOSAT and the Alaska Aerospace Development Corporation (AADC) have completed the initial phase of a remote sensing and Geographic Information System (GIS) development program that will broaden Alaska's business and educational opportunities and increase the industrial growth of geo-technologies. The AADC, a public corporation created by the State of Alaska in 1991, promotes and facilitates aerospace space-related economic development, educational programs and scientific research.

In July, EOSAT installed a portable ground station on the campus of the University of Alaska at Fairbanks, to collect multispectral remote sensing data from the US Landsat satellite and the Indian Remote Sensing Satellites IRS 1-B and P-2. The area covered includes almost the entire state and portions of Canada and Russia. The Alaska location lends itself to more frequent Landsat and IRS satellite passes globally because of its proximity to the North Pole.

Catchment management using satellite imagery

Environmental Research and Information Consortium Pty Ltd (ERIC) uses advanced technology and techniques involving satellite data, airborne radiometric, radar, magnetic and electromagnetic data. These data are used to value add to the clients' existing information system to support sound and innovative solutions with particular attention to the implementation of resource management plans.

ERIC uses leading edge technology as part of a social process to communicate to the community information about the environment in which they live. This approach is particularly relevant for large regional communities to participate in the use of the information for economic and social development, and environmental management.

ERIC has used this process with the Jerrawa Creek Landcare group (upper Lachlan River catchment) in the preparation of a catchment management plan. The approach involved an initial stakeholders forum to agree on community values for the catchment and the management outcomes for the project. LANDSAT TM data were processed using the fully integrated software of TNTmips™ and classified to produce a first iteration land cover and land condition map. The landcare group, in conjunction with ERIC, used this map for ground-truthing and field verification of land cover, land condition, land capability and suitability.

This process identified the pressures and issues for catchment management, and a second iteration map was then produced and ground-truthed by the landcare group. This map was used as a communication and decision aid among the landcare group, including a display at the Gunning show to communicate to other members of the catchment the views and ideas about the place in which they live.

The use of satellite data has been a valuable tool for developing a community based action plan through a process of learning, increasing their knowledge about the catchment and developing new skills to achieve the desired outcomes from the stakeholders forum. This process will continue through group workshops leading to the development of a catchment management plan.

JERRAWA CREEK LANDCARE GROUP MEMBERS PERFORMING GROUND-TRUTHING IN THE GUNNING DISTRICT, NSW.

Land Condition Monitoring – remote sensing information sheets

A series of information sheets on Land Condition Monitoring has been produced by the CSIRO Division of Mathematics and Statistics in Perth. The sheets are one of the results of a collaborative project between CSIRO, LWRRDC (Land and Water Research and Development Corporation), ACRES, DOLA and Agriculture WA.

Each double-sided, A4 colour information sheets refers to a specific topic. The topics are:

- Mapping and monitoring salinity
- Monitoring remnant vegetation
- Monitoring the extent of waterlogging
- Mapping variation in cereal crop yield
- Modelling the Earth's surface
- Evaluating the effects of drains

Each information sheet contains a brief background, description of the relevance of satellite imagery, example images, and the benefits which can be achieved.

A series of posters is also available in digital form for printing on A4, A3 and A0 size paper. The topics are:

- Mapping salt-affected land using satellite images
- Mapping salt-affected land using satellite images and landform data
- Mapping changes in salt-affected land using satellite images
- Mapping land condition using satellite images
- Long-term changes in land condition
- Clearing history from satellite images

The information sheets and postscript files are available from either ACRES or from:

Norm Campbell
CSIRO Division of Mathematics and Statistics
The Leeuwin Centre
Floreat WA 6014

Tel: 09 387 0100

Fax: 09 387 0121

Developing the remote sensing industry through co-location at the Leeuwin Centre for Earth Sensing Technologies

Richard Smith, Chairman Leeuwin Centre Coordinating Committee and Manager Remote Sensing Services, Department of Land Administration, W.A.

To capture the economic and environmental benefits of earth sensing technology, the Leeuwin Centre for Earth Sensing Technologies was built in 1993 by the State Government of Western Australia for CSIRO. The objective is to create synergy between complementary skills by co-locating companies and organisations in the remote sensing and earth observations industries.

The current participants, with over 200 staff in the Leeuwin Centre, are the World Geoscience Corporation (airborne geophysics and exploration geology), Digicon (seismic exploration), Curtin University of Technology (research training in remote sensing and GIS), TAFE (training in GIS and analysis of remotely sensed data), CSIRO (research into remote sensing, GIS and visualisation) and Department of Land Administration (ACRES/SPOT distributor, value added remote sensing and NOAA satellite archive).

Thus the Centre brings together under one roof organisations with capabilities in data acquisition (satellite and airborne), instrumentation, Geographic Information Systems, data processing and image analysis, image interpretation, image production, research and skills training. The staff routinely apply these capabilities to mineral and petroleum exploration, geologic mapping, hydrogeology, salinity mapping, environmental monitoring, drought and crop yield forecasting, bush fire detection, sea surface temperature, and ocean current measurement. In addition, a dedicated laboratory with 10 work stations is run by TAFE for general and customised training in GIS and remote sensing.

As a result of these complimentary skills, the Centre provides:

- a comprehensive 'one-stop' service of data acquisition, analysis and interpretation to commercial and government users of earth sensing technology;
- support for industry development through collaborative programmes for research and development, technology transfer and training;
- a focus for earth sensing activities at State, National and Regional levels.

Earth sensing is the name given to environmentally benign methods for acquiring spatial information about the Earth's systems; of land, oceans and atmosphere. Sensors are usually mounted on a satellite or airborne platform and specific techniques include the measurement of related solar radiation; thermal infrared emissions; the Earth's magnetic and gravity fields; gamma radiation from naturally occurring and man-made radionuclides; soil conductivity from induced electromagnetic fields; radar reflections and laser induced fluorescence from active radar and fluorescent sources respectively. Such earth sensing data has a wide range of applications, including mineral mapping and resource exploration; environmental monitoring; topographic and land use mapping; agricultural land use and land degradation studies; ocean current, ocean chlorophyll and sea-surface studies; climate modelling and land form engineering.

Earth sensing is a cost-effective means of acquiring the large amounts of geographic data required to support these applications. It provides a unique spatial and temporal view of the land, ocean or atmospheric system that would be difficult to achieve any other way. This synoptic and temporal view is vital for successful exploration and management of complex environmental and resource issues. It is also important for updating GIS databases of landcover and landuse by private and Government agencies.

Contact: The Chairman
The Leeuwin Centre for Earth Sensing Technologies
65 Brockway Road
Floreat WA 6014

Mail Address:
PO Box 452
Wembley WA 6014

Tel: +619 9 387 0101

Fax: +619 9 387 0121

Behind ACRES new SAR processor

Peter Radonyi and Paul Wise

By August this year ACRES should be well positioned to start providing a more complete range of products from ERS SAR and possibly JERS SAR data.

The BAeA SAR processor (Aethers) which was commissioned at ACRES in October, 1992 was only designed to generate the ESA fast delivery and raw products. This meant that the products contained the majority of the geometric distortions associated with SAR data acquisition. SAR data could not be integrated easily with optical data and in areas of fluctuating relief even basic interpretation was a problem.

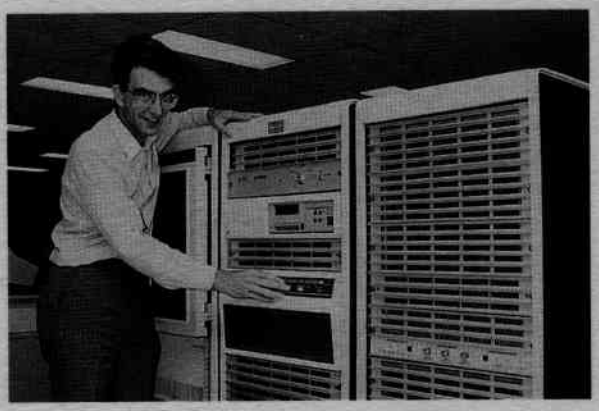
ACRES adopted a staged approach to learning more about SAR processors and SAR processing. The Atlantis Scientific PCSAR showed the value of modular software design and menu based selection and input in a SAR processing package, but the PC engine proved unsuitable for a production system (87 hours for a full ERS scene). In addition, the Atlantis system did not have Direct Data Ingest (DDI), that is the data had to be passed through the Aethers or similar processor to produce RAW SAR data in CEOS format suitable for computer ingest. This process then entailed four more hours transcribing the data from Aethers CCT to Exabyte and then loading that data onto the PC hard disk.

The PCSAR experience nevertheless provided us with a number of valuable criteria which we would use in determining the specifications for a production system.

In March 1995 a preliminary investigation into acquisition of a new SAR processing system was carried out. A posting was placed on various news groups on the Internet and companies which were likely contenders were canvassed. A preliminary report was prepared in June, 1995, which short listed the handful of companies who could deliver the end-to-end system we required.

Following a full evaluation based on replies to a formal Request for Quotation a contract was signed with VEXCEL Corporation of Boulder, Colorado, USA.

VEXCEL's President and CEO, Dr. John C. Curlander will be well known to anyone reading about the development of synthetic aperture radar. The VEXCEL system is based on original developments at the Jet Propulsion Laboratories in the USA. VEXCEL itself has expertise in the disciplines of photogrammetry, radar, signal/image processing, remote sensing and mapping which helped in their understanding of a number of the specific parameters required by ACRES.



ACRES SENIOR ENGINEER, PETER RADONYI, AT THE CURRENT AETHERS SAR PROCESSING SYSTEM.

Over the next few months ACRES and VEXCEL will work together to ensure that the operational interfaces are well designed and efficient. VEXCEL will help ACRES to become familiar with generating the more sophisticated geocoded and orthocorrected SAR products.

When delivered, the system will be hosted on a top model DEC Alpha workstation, and will be able to ingest data directly from ACRES HDDTs or Optical Tapes using VEXCEL's own programmable data ingest module. As well as SAR processing, the system will have a fully integrated interferometric and DEM generation capability allowing ACRES to explore the exciting new world of higher resolution DEMs from SAR. The data from the ERS tandem mission will be very valuable in this regard.

Although not part of the initial delivery, ACRES does have the option of purchasing the RADARSAT processing capability including ScanSAR.

The system is modular and easily expandable by adding more processing platforms.

While the trail seems long and complex ACRES believes it will have a value-for-money, world class system and be well equipped to process satellite SAR data from existing and future sensors.

Value adding to paper maps with satellite imagery

David Pratt, Encom Technology, Sydney

Organisations involved in resource assessment often invest many man months in the preparation of complex base maps that reflect the acquisition and interpretation of many disparate sources of information. As organisations start to move across to digital storage of mapping information, what do they do with their valuable legacy of printed and manually prepared maps?

Scan them! Large format maps can now be scanned in monochrome or colour at reasonable costs that makes it practical to preserve the data for reuse. Resolutions ranging from 100 dpi to 800 dpi can be very cost effective and the data can be stored economically on Exabyte cartridge or similar medium.

Archiving and reproduction is not the only benefit from this process. Scanned images can be warped to the Australian Map Grid and manipulated in the same manner as a satellite image. From this located image new maps can be prepared at different scales, segments can be extracted as backdrops for other projects and new features can be added to the existing base as vector overlays. Conventional image enhancement techniques can be applied to clean up dirty and faded maps.

Significant value can be added to scanned paper maps by merging the images with satellite data. If your paper maps are monochrome, then you might consider blending this with an RGB satellite image display. Using image processing techniques, the original line work is lifted from the scanned map and superimposed on the satellite image channels. The line work can be blended with the satellite data as a half tone backdrop or superimposed as a high contrast vector overlay.

If the original paper map is in colour then image processing techniques allow selective layers to be extracted and superimposed on the satellite image. In this manner you can blend selective layers from multiple paper originals into one composite map using the satellite image as the primary base map. If your original paper map is in colour, satellite imagery can be used to provide a grey tone texture base to the original map.

Landsat TM, MSS and SPOT imagery can all be used and the choice depends on the scale of mapping and end use requirements. The technique is viable at scales ranging from 1:10,000 to 1:1,000,000. Encom routinely uses this technique with the ER Mapper image processing software to blend satellite imagery with scanned geological and topographic maps. Recent projects have included the merging of government geological maps covering an area of 200,000 square kilometres with satellite images at 1:500,000 and 1:250,000 scale. Another project involved just 100 square kilometres and the use of part of a standard 1:25,000 scale topographic mapping enlarged to 1:10,000 scale.

For further information:

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Encom Technology Pty. Limited
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Milsons Point NSW 2061

Tel: 02 9957 4117

Fax: 02 9922 6141

e-mail: dave@encom.mpx.com.au

CRA Youth Science Forum visit ACRES

ACRES recently hosted visits from four groups of students attending the CRA National Youth Science Forum.

The forum is held each January in Canberra. It is organised by Rotary International to give Year 11 Science students from across Australia the opportunity to see science at work in a range of institutions in Canberra. The CRA sponsorship allows students from across Australia to attend the Forum at a greatly subsidised fee. The Forum consists of two groups, each visiting sites in Canberra over a period of two weeks. A total of about 300 students participate in the forum

During the visit to ACRES each group of 18 students spent about 3 hours learning something of the functions of ACRES and AUSLIG. The groups were given demonstrations regarding the generation of DEM's from SPOT Pan stereo imagery, the digital classification of multispectral imagery and an insight into the SAR image formation process.

The other organisations visited by the students included several CSIRO Divisions, the Australian National University including the Mt Stromlo Observatory and the Australian Geological Survey Organisation.

STUDENT PARTICIPANTS OF THE 1996 YOUTH SCIENCE FORUM IN THE ACRES PHOTOLAB

Image Writing of "Discovery 2000" geophysical data

Peter Gidley, Encom Technology, Sydney

Photographic products of satellite images produced by the ACRES image writing facility always excite earth scientists and invariably draws a crowd when a fresh new image arrives from Canberra. This has tended to put the image writing facility on a pedestal and many organisations have not attempted to use the facility thinking that it was probably too expensive for their needs.

When direct support for the ACRES ColourFire 240 was added to ER Mapper, Encom Technology decided to test the facility for preparation of gravity colour images for the NSW Department of Mineral Resources Discovery 2000 Initiative. These images consisted of colour renditions of the gravity data overlain by a very fine line contour of the same data. Legends, logos, graphics, commentary and title blocks were superimposed with high quality postscript text to produce a crisp, well saturated 24bit image display of the new gravity data.

Fine detail in the text rendering is the outstanding feature of the ACRES image writing facility. The quality results from a combination of the 10000 x 10000 resolution 8 inch negatives written by the ColourFire and the precision enlarger in the photographic lab.

Gravity data was collected across a 4 x 4 km grid by Surtec Geosurveys using a helicopter for rapid access to large tracts of land and differential GPS satellite positioning to provide both location and elevation. After reduction and processing, the point measurements were converted to an image by minimum curvature gridding techniques. A shadow enhanced pseudo-colour display is then used to render the grid on the photographic image. Contours from the grid are generated as vectors and superimposed on the output image.

Discovery 2000 is a major initiative by the NSW Department of Mineral Resources to encourage exploration for oil and minerals. A significant component of their budget is devoted to the collection of new high resolution airborne and ground geophysical data in prospective parts of the state. All of these contracts require the preparation of digital and photographic image products that include magnetic, gravity, gamma ray spectrometer and elevation measurements. As a result of these initial images, Encom has been awarded additional contracts by other Discovery 2000 contractors and the NSWDMR has expressed a preference for their photographic products to be produced to this standard.

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e-mail: peter@encom.mpx.com.au

Calendar

REMOTE SENSING AND ASSOCIATED EVENTS

18-21 March 1996 — **Vancouver, Canada**

Tenth Annual Conference on Geographic Information Systems.

Contact: Beverly Williams, Director of Conferences, GIS World, Inc. 155 E. Boardwalk, Suite 250, Fort Collins, CO 80525

Tel: 970-223-4848

Fax: 970-223-5700

e-mail: beverly@gisworld.com

25-29 March 1996 — **Vancouver, Canada**

26th International Symposium on remote Sensing of Environment and 18th Annual Symposium of the Canadian Remote Sensing Society. This joint conference will focus on applying remote sensing technologies to solve real world problems of the environment.

Contact: Symposium on Remote Sensing of Environment, 13800 Commerce Parkway, Richmond, B.C. Canada, V6V 2J3

Fax: +1 604 273 9830

e-mail: symposium@mda.ca

26-29 March 1996 — **Canberra, ACT**

Spaceworks '96 incorporating the *8th Australian Remote Sensing Conference.* The theme of the conference is "What's New and What Works". Other concurrent conferences are *the 10th Space Engineering Symposium; and the 4th Australian Space Development Conference.*

Contact: Australian Convention and Travel Services, GPO Box 2200, Canberra, ACT, 2601

Tel: 06 257 3299

Fax: 06 257 3256

15-18 April 1996 — **Paris, France**

SPOT International Data User's Conference – Spot: From a decade of accomplishment...to a decade of promise.

Contact: SOCFI/SPOT, 14, rue Mandar, F-75002 Paris-France

Tel: +33 1 44 88 25 25

Fax: +33 1 40 26 04 44

19-25 May 1996 — **Gifu, Japan**

20th International Symposium on Space Technology and Science.

Contact: Dr Michiro Kusanagi

Tel: +81 3 5473 7014

Fax: +81 3 5473 7814

30 May 1996 — **Chicago, USA**

Business Geographics for Educators and Researchers.

Contact: Sylvia Marshall
Tel: +1 970 223 4848
Fax: +1 970 223 5700
e-mail: sylvia@gisworld.com

27–31 May 1996 — **Seoul, Korea**

The 3rd Asia-Pacific Conference on Multilateral Cooperation in Space Technology and Applications.

Contact: Dr Jang-Soo Ryoo, Director, Space Division, Korea Aerospace Research Institute, PO Box 113, Yu-Sung Taejon, 305-600 Korea
Fax: +82 42 860 2004, 2005, 2007

10–14 June 1996 — **Budapest, Hungary**

GIS/LIS '96 – *"Market Driven Developments".*

Contact: European Secretariat, H-1026 Budapest, Szilagyi Erzsebet fasor 79. Hungary
Tel: +36 (1) 212 0056
Fax: +36 (1) 156 6581

24 – 27 June 1996 — **San Francisco, USA**

Second International Remote Sensing Conference and Exhibition: Technology, Measurement, and Analysis.

Contact: ERIM/Airborne Conference
Tel: +1 313 994 1200 ext. 3234
Fax: +1 313 994 5123
e-mail: wallman@erim.org

9 – 19 July 1996 — **Vienna, Austria**

XV111th International Society for Photogrammetry and Remote Sensing Congress.

Contact: Congress Secretariat, Mondial Congress, Faulmanngasse 4, A-1040 Wien
Tel: +43 1 588 04
Telefax: +43 1 58 69 185

4 – 9 August 1996 — **Denver, Colorado USA**

Multispectral Imaging for Terrestrial Applications – part of SPIE's 1996 International Symposium on Optical Science, Engineering and Instrumentation.

Contact: Denver 96, SPIE, PO Box 10, Bellingham, WA 98227-0010 USA
Shipping address: 1000 20th St., Bellingham, WA 98225 USA
Tel: 360/676 3290

7–12 October 1996 — **Beijing, China**

Space'96 47th Congress and Exhibition of the International Astronautical Federation.

Contact: Ms Chen Yang, Exhibition Co., CGWIC, 21 Huangsi Dajie, Xicheng Qu, Beijing, China 100011
Tel: 86 10 8372706, 8372707
Fax: 86 10 8372706, 8373155

4 – 7 November 1996 — **Lake Buena Vista, Florida USA**

Eco-Informa '96 Global Networks for Environmental Information – Bridging the Gap Between Knowledge and Application.

Contact: ERIM/Eco-Informa, PO Box 134001, Ann Arbor, MI USA 48113-4001
Tel: (1) 313 994 1200, ext. 3234
Fax: (1) 313 994 5123
e-mail: wallman@erim.org
WWW: http://www.erim.org/CONF/conf.html

4 – 7 November 1996 — **Berlin, Germany**

International Academy of Astronautics Symposium on Small Satellites for Earth Observation. This symposium will focus on the creation and usage of Small Satellites for solving most applied and scientific space exploration tasks.

Contact: Bernd Kirchner
Tel: +49 30 69545 545
Fax: +49 30 69545 532
e-mail: iaa.symp@dlr.de

1–9 July 1997 — **Melbourne, Australia**

Joint Assemblies of international Association for Meteorology & Atmospheric Sciences, and International Association for Physical Sciences of the Ocean

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