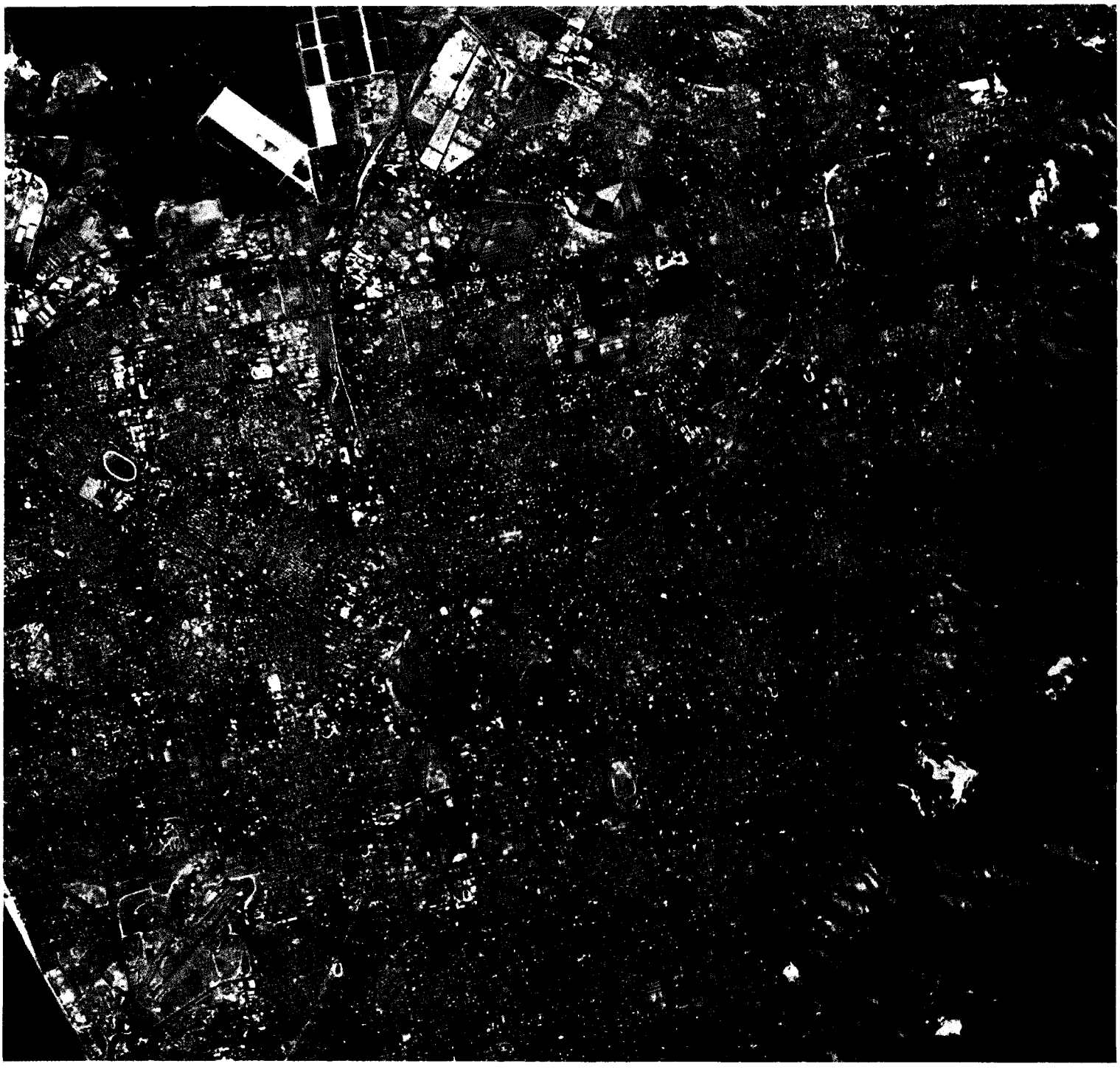
ACRES NEWS



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COVER

The cover of this first issue of ACRES NEWS shows a SPOT multispectral image of Adelaide and the location of the venue for the 4TH AUSTRALIAN REMOTE SENSING CONFERENCE, which is to be held from 14-18 September, 1987.

The image was acquired looking east and is part of a set of 2 stereo pairs of Adelaide (XS & PAN). The two pairs were acquired in the bi-viewing configuration for simultaneous acquisition of a panchromatic and a multispectral image at the same viewing angle. The images looking west were acquired on 21 April 1987 with a viewing angle of 23°; the east looking images were acquired on 24 April 1987 at an angle of 15°.

Digital and photographic products of these data are available from ACRES.

ACRES NEWS is published by the Australian Centre for Remote Sensing to provide information about ACRES' products and services, and on remote sensing activities in general. This publication is distributed free of charge to interested persons and organisations.

Contributions in the form of news items, general and review articles, correspondence, professional and tutorial papers concerning Remote Sensing are welcome, and will be included at the discretion of ACRES.

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(Please copy – do not cut)

FLOPPY DISK PRODUCTION AT ACRES

The need for small media

Recent improvements in the performance/price ratio of micro-computers has brought these systems into the class of remote sensing workstations. A number of IBM-PC/AT based systems (and compatibles) with third party video systems suitable for display of imagery are currently available in Australia and dominate this sector of the image processing market. Commonly, these systems use the MS-DOS operating systems and the industry-standard 5 1/4 inch floppy disks. In recognition of the need to support the micro-based remote sensing workstations ACRES' specialists have developed the software to routinely supply image data on floppy disks from Landsat's Multispectral Scanner, Landsat's Thematic Mapper and SPOT.

With over forty micro-based systems already operational in Australia and many more scheduled for delivery this year, it is anticipated that demand for remotely sensed data on floppy disks will rise dramatically over the next few years. The smaller organisations of both government and private enterprise are expected to reap the benefits of investigation and routine monitoring with this form of low cost remotely sensed data from space. The major users will be marine science, agriculture, geology, conservation, forestry as well as in the education of these and other disciplines. It is anticipated that over the next few years both the range and particularly the number of users of remotely sensed data will expand significantly as a consequence of this new product.

Floppy disk formats

The image processing systems currently receiving wide acceptance are MicroBRIAN and ERDAS. Both systems use the MS-DOS operating software and 5 1/4 inch floppy disks. Both require the band-interleaved-by-line (BIL) format. Table 1 gives the file descriptions for MicroBRIAN and ERDAS as well as the names of the loading program supplied with each ACRES floppy disk. Loading programs are supplied in source code and in executable code.

Table 1

	MicroBRIAN	ERDAS
Header	512 bytes	128 bytes
No of bands	4	user specified
No of Pixels/band	512	user specified
No of Lines/band	user specified	user specified
Loading program	BRIANLOAD	ERDASLOAD

ACRES supplies image data on floppy disks as sequential files of 512 pixels by 512 lines and any number of spectral bands. These floppy disks may contain up to 360 K bytes or 1.2 M bytes of data depending on the packing density of the user's disk drive.

Processing Levels

Two levels of processing are available for floppy disk image data. The first level, "A" is essentially raw data with sensor balance and calibration corrections based on statistics applied from the full scene.

Level B processing includes the Level "A" processing but in addition corrections are made for spatial distortions due to the Earth's rotation and curvature as well as the spacecraft's orbital model and ephemeris data.

Image Selection

Ordering small subscenes of image data involves the need for greater image location accuracy than is required for other image data. Because of the much smaller area, location accuracies need to be at the pixel level. Floppy disk scenes are therefore identified by the starting pixel and line of the north-west corner of the image area in addition to the usual WRS identification.

Landsat-MSS

For selection of floppy disk subscenes of Landsat images the standard sub-scene selection grid can be used to identify approximate line/pixel starting positions. The grid divides each image into (8x8) 64 subscenes of 300 lines by 405 pixels. For unrectified data such as the ACRES Colour Micro Image Catalogue the grid is rectangular and may be used for floppy disk selection at the A level of processing.

The coordinates of the grid lines are as follows:

W-E : 0, 405, 810, 1215, 1620, 2025, 2430, 2835, 3240 (pixels).

N-S : 0, 300, 600, 900, 1200, 1500, 1800, 2100, 2400 (lines).

Rectified data such as that of a standard bulk processed 1:1 000 000 Landsat image is skewed due to the geometric corrections made during processing and a skewed grid should be used for this type of data. At the B level of processing in floppy disk generation, offsets are introduced as a consequence of geometric corrections and the grid coordinates need to be adjusted accordingly.

A simple rule of thumb formula can be applied to estimate the apparent eastwards shift of pixels due to geometric corrections.

$$\text{Landsat 4,5 } P_o = \frac{(2400\text{-}L)\ \text{COS}\ (\text{Lat}\text{-}0.72^\circ) \times 220}{2400}$$

$$\text{Landsat 2 } P_o = \frac{(2400\text{-}L)\ \text{COS}\ (\text{Lat}\text{-}0.72^\circ) \times 228}{2400}$$

where P_o = the starting pixel including the offset,

L = the line number of the starting pixel,

and Lat = the latitude in degrees of the full scene centre as indicated on the Micro Image Catalogue. (latitude in absolute values, the 0.72° need to be added for northern hemisphere latitudes)

For the selection of floppy disk sub-scenes requiring the "B" level of processing, the result of the appropriate formula above should be added to the starting pixel number as obtained using either grid.

Please note however that the grids only serve to estimate the starting pixel coordinates and that framing of floppy disk sub-scenes is not limited to grid intersections.

For more precise framing, pixel coordinates may be interpolated between grid lines. Pixel coordinates may also be obtained through converting simple linear measurements on a full Landsat scene to pixel coordinates bearing in mind that each full Landsat scene has 2400 lines from north to south and approximately 3240 pixels per line from west to east.

The above formulae should still be used to estimate the offset due to geometric corrections if level "B" processing is required.

Customers who do not have ready access to either a photographic print of the image area or to the Micro Image Catalogue may request a printed copy of an image from our micro fiche viewer and mark the area of interest or just its centre. The prints are in black and white (negative) and are of very much degraded quality, only showing major features.

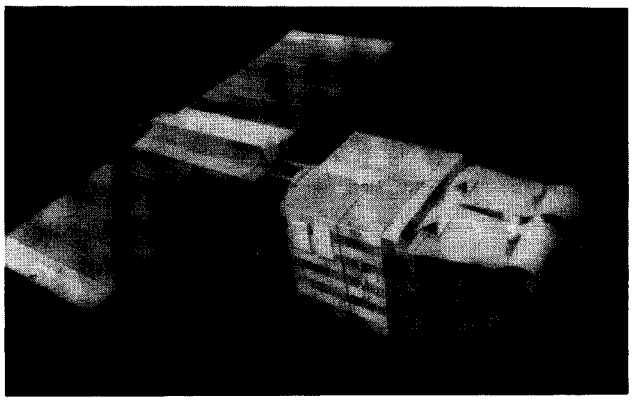
ACRES RECEIVES 4-STAR AWARD

On Friday, 13 February, the Executive Director of the National Safety Council of Australia (NSW/ACT Division), Mr. Cliff Reece (right), presented ACRES with a 4-Star Safety Award. The award was accepted on behalf of ACRES by Mr. Con Veenstra (left), the Director of the Department of Resources and Energy's Division of National Mapping.

The NSCA's 5-Star Health and Safety Management System was introduced into Australia three years ago following its proven success overseas in contributing to the reduction of accidents. The NCSA system is now in place in 132 organisations throughout Australia.

Mr. Reece said that the average grading for Australian organisations in terms of health and safety management is 1-Star and that the ACRES 4-Star award, being the first in the ACT and one of only nine throughout Australia, recognises the achievement and the commitment by the ACRES management and staff to an occupational health and safety program that works. Mr. Reece further said that it was very rare for an organisation to achieve a 4-Star grading on its first audit. The ACRES Safety Officer, Mr. Bob Jones said that the Centre would be aiming for a 5-Star grading on the second audit.

SPOT DATA DISTRIBUTION AND NEWS



Prior to the completion of the upgrade of the ACRES facility in Alice Springs and Canberra, remotely sensed data of Australia by the French satellite SPOT is being routinely recorded onboard the spacecraft and downlinked to the Kiruna ground facilities in Sweden or to Toulouse in France for processing. National Mapping has signed an Agreement with the French for ACRES to distribute SPOT data and products (including derived works) recorded over Australia and its Territories.

An extensive listing of SPOT products and prices (Aus.$) has been compiled and is available on request. Although the prices are subject to change without notice, a decision by SPOT IMAGE not to increase prices in 1987, suggests that the prices from ACRES are not likely to change unless major currency fluctuations occur.

Australian Archive

In order to be able to provide repeat orders for the same data at fast turn-around-times, all SPOT data distributed by ACRES is archived in Canberra as

digital or photographic masters. This archive is gradually expanding and for these historical data a delivery time of a few weeks can be anticipated. For data already recorded but not yet archived at ACRES, the delay is approximately 6-8 weeks. A SPOT data catalogue on micro-fiche is available from ACRES on request.

Programming Requests

For scenes not yet acquired by the spacecraft, a programming request may be made. The fee for this service ($500) is payable in addition to the products ordered, but only if the required acquisition is successful. Customers are therefore encouraged to select imagery from either the archive at ACRES or from the extensive archive at SPOT IMAGE. Presently, the French archive covers almost all of Australia in both the multispectral and the panchromatic modes as well as a large number of stereo pairs.

In order to determine what does and what does not constitute a single programming request, a number of parameters are used:

a. **Location**

In principle, but with some exceptions, each separate scene location (K,J) constitutes a separate programming request. An exception is made however for consecutive or adjacent scenes, ie. any polygon for which the images are ordered simultaneously, independent of the number of images that are required. For these data only a single programming fee will be charged.

b. **Survey Method**

Different viewing angles over the same area e.g. a vertical multispectral image and a panchromatic image at 21° viewing angle, constitute separate programming requests as these cannot be acquired simultaneously. The exception here is the stereo pair, which is regarded as a single request. A request for a stereo pair with either a multispectral or panchromatic image of different viewing angle is regarded as 2 requests.

c. **Spectral Mode**

A panchromatic image and a multispectral image of the same location can be acquired simultaneously and is regarded as a single request; if different acquisition dates are required, this is regarded as two requests.

d. **Multitemporal Requests**

The simultaneous ordering of images of the same location with identical viewing parameters to be acquired less than one year apart is regarded as a multitemporal sequence and constitutes a single programming request.

Promotional Data

For the purposes of promotion, demonstration, education, etc., SPOT IMAGE has made the following special products available:

1. A computer compatible tape (CCT) holding 22 SPOT sub-scenes (512x512 and 1024x1024) selected from data from all over the world and illustrating the main themes of applications in which SPOT data may be used:

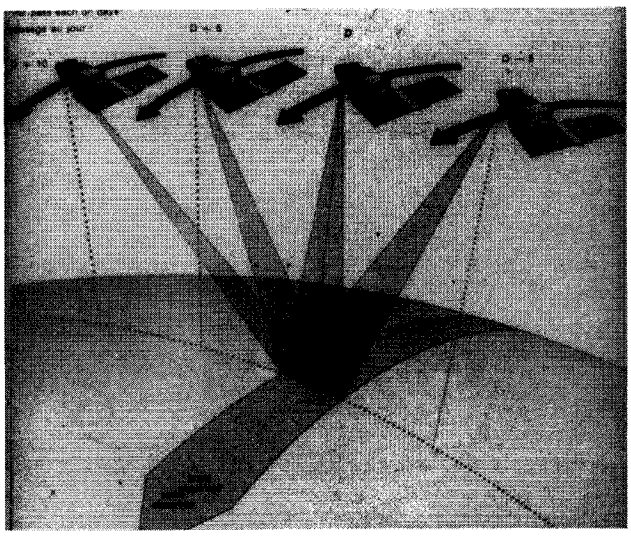
- **Agriculture:** Thailand (XS), Morocco (3 dates XS), The Netherlands (XS) and the U.S.A. (XS);
- **Geology:** Algeria (XS), Morocco (XS), Australia (P stereo, Kalgoorlie, W.A.), Turkey (XS);
- **Environment:** Japan (XS), Kenya (XS), France (XS), U.S.S.R. (XS), Colombia (XS);
- **Forestry:** Australia (XS, Perth, W.A.), France (XS);
- **Coastal Studies:** Australia (XS, Great Barrier Reef, Flinders Group), India (XS), Cook Island (XS), Guinea Bissau (XS);
- **Hydrology:** Hungary (XS), Paraguay (XS), China (P);
- **Urban Planning:** Paris (P), Dakar (P), Ryadh (P);
- **Civil Engineering:** Toulouse (XS, P), Argentina (P);
- **Cartography:** France (P stereo).

(XS) = Multispectral, P = Panchromatic)
Price $930 first CCT, $480 additional CCTs.

2. A set of 45 slides derived from the same image data as on the CCT, with explanatory text in English (French, Spanish).

Price $215 first set, 10%-20% off for additional sets.

NEW SPOT PRODUCTS – "IMAGES A LA CARTE"



SPOT IMAGE has made available a new range of digital and photographic products specifically matched to user requirements. After a highly successful first year of operation, this expanded range of products is likely to receive wide acceptance by remote sensing data users.

Level 1P processing

This new processing level, specifically designed for photogrammetric applications, will be available soon on positive film. The image data for this new product will be resampled to 9000 pixels by 9000 lines with a pixel size of 6.67 m. The image size will be 225 x 225mm at a scale of 1 : 266 667. Ancillary information will be available on Computer Compatible Tape (CCT).

Level 2A processing

A new precision processing level, without the use of Ground Control Points (GCPs), in which the image data are rectified to a specific cartographic projection. The internal scene accuracy will be that of Level 2 products (30m); the absolute location accuracy will be of Level 1B products, about 800m. Simple translation of X and Y directions however, allows for co-registration with a map of the same projection to within 30m accuracy. Level 2A products are very useful in areas for which GCPs are not available and accurate survey control is required. An obvious use for this product is geophysical and geochemical surveys in remote areas or where access is difficult.

Quarter scenes

SPOT quarter scenes (30 x 30km) have been available for some time, but were restricted in location to the four quadrants. Now, special quarter scenes may be located anywhere in a scene.

Non-standard framing

Non-standard scenes, framed anywhere along the satellite's ground track, are now available as CCTs (price $3750) and as photographic products.

Two and four scene mosaics

Mosaics of two successive scenes along the satellite's ground track have become available as continuous 120km (N.S.) x 60km (E.W.) scenes on CCTs (price $5480) and as photographic products* from the CCT data.

Mosaics of two successive bi-scenes (2 adjacent scenes acquired with both HRV instruments side by side) have also become available as 4 scene mosaics covering an area of 120 x 120km. These are available on CCTs (price $10955) and as photographic products* from the CCT data.

Multispectral images with 10m resolution

Image data acquired in the multispectral mode with 20m ground resolution can now be supplied as images that are merged with data simultaneously acquired in the 10m resolution panchromatic mode. The result is a multispectral image showing the detail of the 10m resolution. These data are available on CCTs (price $4290) and as photographic products*.

* Due to the limited size of negatives, photographic products are supplied as separate geometrically and radiometrically matched scenes. Because of the wide range of photographic products that can be derived from these new data, a supplementary price list for special products will be made available soon. In the meantime, enquires regarding these products may be addressed to the User Services section of ACRES in Belconnen. Phone (062) 52 4411 or write to PO Box 28, Belconnen, ACT 2616.

IN MEMORIAM – TONY CHILES

Tony Chiles

Anthony B. Chiles died aged 48 on 5 November 1986, whilst on duty for ACRES in Thailand.

Tony's profound knowledge and understanding of photography enabled the Australian Centre for Remote Sensing to produce photographic images from satellite data at a quality that is recognised as being amongst the best in the world. His contribution to the development of the often poorly understood processing techniques of transferring digital data to high quality photographic images was invaluable.

Tony and his family migrated to Australia from England in 1950 and eventually settled in Nambour, Queensland, where he worked as assistant to a local

photographer. In March 1956 Tony enlisted in the Royal Australian Air Force, where he received his formal training before serving in most of the Royal Australian Air Force establishments throughout the country and in Vietnam, Malaysia and the United States.

His ability and dedication to his profession were duly recognised and in September 1969, Tony became a commissioned officer, quickly rising to the rank of Squadron Leader. Tony retired from his Air Force career in 1979 as Commanding Officer of the Royal Australian Air Force School of Photography in Sale, Victoria, and his talents were quickly put to use at the newly established Australian Landsat Station, as it was then called.

His passing is a loss to his family and friends, to ACRES and to the remote sensing industry.

ACRES OPERATIONAL CONTRACT CHANGED TO A.W.A.

The operations and maintenance of the ACRES facilities in Canberra and Alice Springs, like many other space tracking facilities, are handled by private enterprise under government contract. Since the establishment of the Australian Landsat Station (now ACRES) in 1979, this contract has been with Fairey Australasia Pty Ltd of Adelaide.

The tender for this contract was recently awarded to the Marine-Aviation Division of Amalgamated Wireless (Australasia) Ltd (A.W.A.) in Leichhardt, N.S.W., and all Fairey staff at ACRES are now employed by A.W.A. as from 1 April 1987.

SIXTH BIRTHDAY FOR LANDSAT-4

On Friday 17 July '87 (Australian Time) Landsat-4 will commence its seventh year of operation. This is quite remarkable considering that its original design life was just three years and that due to the failure of cables connecting some of the solar panels, Landsat-4 lost part of its power supply in 1984.

EOSAT (Earth Observation Satellite Company) the commercial operator of the Landsat system, has recently spent several weeks testing the Landsat-4 Thematic Mapper (TM) to determine its condition and that of the spacecraft's power system, to find out to what extent TM and Multispectral Scanner (MSS) operation can be supported. The test data showed that the TM instrument is still in an operational condition and capable of providing satisfactory products to the user community. However, the power system tests indicated that limited TM operation can be supported only with a reduction of MSS operation.

The routine acquisition of MSS data of Australia is achieved with Landsat-5 and the Landsat-4 MSS will continue to be switched on over Australia only when there is a specific requirement. EOSAT states that "it will continue to devote every effort to the careful stewardship of the remaining Landsat-4 and 5 resources and do everything it can to minimize the potential gap between the current program and Landsat-6."

CLOUD FREE TASSIE

In many parts of the world and particularly near the equator, cloud cover limits the frequency at which useful remote sensing data is collected in the Visible and Near-Infrared (VNIR) part of the electromagnetic spectrum. Although in this regard Australia is generally blessed with frequently cloud free skies, in some areas cloud cover is quite persistent.

Tasmania, a large island at the southern tip of Australia, is rich in mineral and other natural resources but is one of those areas where cloud cover persists. Six full 185 x 185km Landsat scenes are needed to cover the entire island and the chances that a once every sixteen days Landsat overpass coincides with a cloud free sky are quite small, making it difficult to obtain cloud-free images.

During early February 1987 something quite unusual happened. Landsat 5's Multi-Spectral Scanner (MSS) recorded a cloud free overpass over Tasmania and nearby Flinders Island while covering path 90 of the World-wide Reference System (WRS) on 7 February and seven days later the adjacent path (path 91) was acquired almost free of cloud. Now, for the first time, ACRES is able to supply cloud-free Landsat MSS data covering almost the entire island with virtually no seasonal variation.

We must stress however, that since 1979 we have acquired a large number of very useful overpasses over Tasmania with limited cloud cover; information about these and about the cloud-free overpasses is available through any of the ACRES Data Distribution Centres, where an accurate cloud assessment can be made using our Colour Micro Image Catalogue.

TROPICAL ENVIRONMENTS REMOTE SENSING

The tropical environments of Northeastern Australia are of great significance from both a national and international point of view. In the past, the often unique marine and terrestrial environments of this vast region have been the site of relatively sparse investigations.

The resources required for adequate monitoring, in order to understand and preserve the very sensitive habitats, have been prohibitive in the past in terms of manpower and financial considerations.

Since the introduction of remote sensing techniques much progress is being made towards developing new monitoring programs based on strategically chosen reference sites. The selection of these sites may be based on any of the following criteria:

- specific ecological interest;
- subject to human impact;
- threatened by human impact;
- strategic conservation value;
- natural resource value;
- site of an existing management and/or research program;
- site of current or emerging problems;
- site on which extensive ground data is already available.
- suitability for extrapolation of research results to other areas;
- diversity of environments;
- availability of various types of remote sensing data;
- significance to research generally.

In order to co-ordinate these activities and make the best use of available resources, a Tropical Environments Remote Sensing (TERS) Working Group was established in January 1986, following initial discussions held between officers of the Great Barrier Reef Marine Park Authority (GBRMPA), Mr. Richard Kenchinton and Mr. Dan van Claasen, Commonwealth Scientific and Industrial Research Organisation (CSIRO) scientist, Dr. Deborah Kuchler, and scientists of the Australian Institute of Marine Science (AIMS), Dr. Peter Moran and Dr. Russell Reichelt. The group's membership has expanded since, and now also includes staff of the James Cook University (JCU), the Queensland National Parks and Wildlife Service (QNPWS) and a private surveyor.

Apart from the co-ordinating role, the TERS-WG aims to develop a proposal for the archiving of remote sensing data from the recently ordered NOAA receiving facility at JCU. The group further aims to publish a bi-annual newsletter, as well as publishing articles on its activities in other publications, particularly in relation to the reference sites as these are proposed and/or selected.

The following sites are being considered:

Great Barrier Reef Reference Sites:
- Capricorn-Bunker Group;
- John Brewer Reef;
- Wheeler Cay and Reef;
- Green Island, Arlington and Michaelmas Reefs.

Island Reference Sites:
- Raine Island.

Water Mass Reference Sites:
- Whitsunday Islands Region;
- Torres Strait Region;
- Continental Shelf break in the central Great Barrier Reef Region.

Coastal Reference Sites:
- The lowland rainforest area between Cardwell and the Murray River.

Terrestrial Reference Sites:
- To be decided.

Whilst the concept of reference sites is receiving enthusiastic responses, and development of the above sites is in progress, a detailed record on existing data bases needs to be compiled in addition to records on the data from current remote sensing and other research projects.

A listing of these research projects as well as more detailed information about the TERS-WG may be obtained through contacting Dr. Deborah Kuchler, CSIRO, PMB PO Aitkenvale, Townsville, Qld., 4814, Australia. Ph. (077) 719540.

CSIRO BEGINS TRANSFER OF GEOLOGICAL REMOTE SENSING TECHNOLOGY

The CSIRO Division of Mineral Physics and Mineralogy at North Ryde, NSW has recently commenced a major programme of transferring technology and information developed by its Remote Sensing Group to the mining industry and to tertiary educational institutions. The group has been carrying out research into the theory and technology of remote sensing, and its specific applications to various mining activities in Australian conditions, for the past 9 years. The group now plans to bring the results of all the work together into a comprehensive information and education package which, it is hoped will allow the major advances made in remote sensing by the group to be utilised to a wider commercial and educational advantage.

The package is planned to be in modular form, each module comprising a self contained topic of remote sensing theory or technological application, and designed

to be used either as a self education resource for geoscientists working in industry, or for university teaching staff who normally do not have the facilities or resources to teach remote sensing courses.

It is also anticipated that the package will form the basis of future AMF courses in advanced remote sensing for geoscientists.

The guiding principle in the planning of the package will be the practical applications of remote sensing to the development of Australia's mineral resources through the contribution it can make to mineral exploration, mining and extraction, monitoring of the environment and to conservation. The importance given to various facets of the topic will be influenced by the views of the mining industry, the universities and other educational institutions who are being consulted during the planning phase.

Much of the research by the Remote Sensing Group has been jointly funded by the Australian Mining Industry through AMIRA and the CSIRO's Division of Mineral Physics and Mineralogy. This joint venture approach to R and D between government and industry has proved to be very effective and will greatly facilitate CSIRO's efforts to disseminate the results of its remote sensing work more widely.

The technology transfer and production of the information package will be coordinated by Dr Eric Swarbrick who has recently joined CSIRO. Dr. Swarbrick was formerly on the staff of the Mineral Department of Esso Australia and more recently has been offering consulting services in remote sensing to the mining industry.

It is expected that the transfer of existing technology will take approximately two years. In the meantime the Remote Sensing Group will continue its research programme particularly in the development of new image processing techniques and their application to mineral exploration, and in advanced instrumentation research.

For further information call Erick Swarbrick at CSIRO Division of Mineral Physics and Mineralogy, North Ryde NSW (02) 8878667.

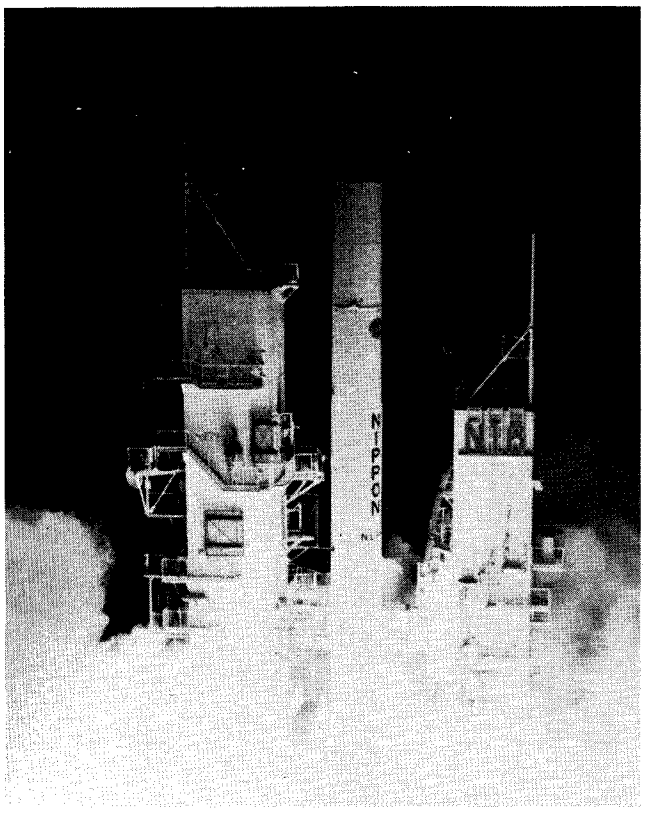
MAJOR JAPAN-AUSTRALIAN SPACE AGREEMENT

An important space research and development agreement on the direct reception of MOS-1 data in Australia was signed in Canberra on 4 June 1987 by Dr Boardman, Chief Executive of CSIRO, and by Mr Osawa, President of the National Space Development Agency of Japan (NASDA).

The Federal Minister for Science, Mr Barry Jones announced the agreement, which is designed to boost Australia's expertise in remote sensing applications, research and other space technologies. Mr Jones said "The agreement gives Australia the opportunity to enhance further its reputation and skills in the field of remote sensing. The project will benefit fisheries, marine and oceanographic research, geological exploration, atmospheric science, mapping and surveying."

"The agreement will strengthen ties between our two countries in the area of space science and technology" Mr Jones said. "Japan has implemented an ambitious and far-sighted space program which includes the manufacture of satellites for scientific research and Earth observation as well as achieving a launch capability. The experience of Australian researchers in applications, processing and interpretation of satellite data will complement this program," he said.

Under the agreement, Australian and Japanese scientists will use data from Japan's Marine Observation Satellite (MOS-1), which carries instruments to observe the Earth's surface, particularly the oceans. The instruments onboard MOS-1 will measure the reflectance and emission of the Earth's surface in the visible, infrared and microwave regions of the spectrum (ref. ALS Newsletter Vol 3, No 5, September 1986, pp 13-14). MOS-1 also carries a data collection system which can relay information gathered from remote automatic sensors on the ground and at sea.



MOS-1 Launch 19 February, 1987 (Courtesy NASDA)

Outside Australia, the only direct access to information from the satellite will be through stations operated in Japan, Thailand, Antarctica and by the European Space Agency. The data acquisition programme (anticipated to cover about 1/5th of the MOS-1 daytime swaths over Australia from April to October 1988) will be coordinated by a MOS-1 Project Team.

The Project Team will also be responsible for pro-

ducing an assessment of the utility of MOS-1 data for Australian scientific and technological applications. It will act as the focal point for presentation of results of investigations undertaken during the MOS-1 experiment at, for example, national or international conferences.

Intending investigators who have not already sent COSSA (CSIRO Office of Space Science Applications) an expression of interest and a brief project description, should do so as soon as possible. These project descriptions will provide a starting point for planning by the Project Team.

The Australian Space Board has approved a substantial contract to COSSA for management of industrial participation in the development of MOS-1 reception and processing capacity. The separate tasks involved will be sub-contracted to local industry. Detailed technical preparations will be co-ordinated by the MOS-1 Technical Team, chaired by Dr Andy Green of CSIRO Division of Mineral Physics and Mineralogy, PO Box 136, North Ryde, NSW 2113, ph (02) 887 8881.

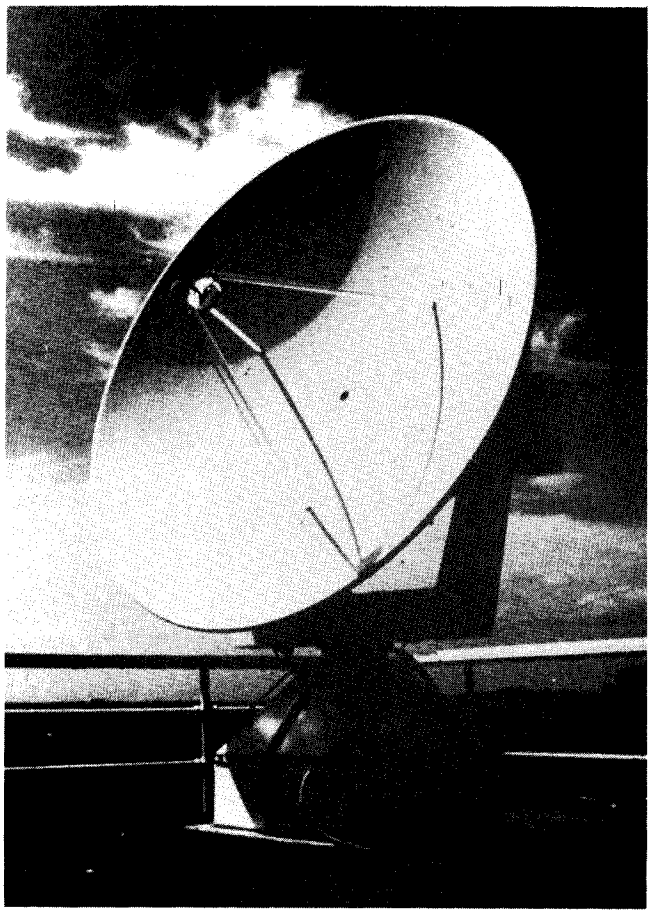
For further information, contact:
Dr K.G. McCracken (Director, COSSA) ph (062) 701800
or
Mr Jeff Kingwell (Head, Science & Aplications, COSSA) ph (062) 701810

AVHRR RECEIVING FACILITIES FOR PERTH AND TOWNSVILLE

The AVHRR (Advanced Very High Resolution Radiometer) is one of several remote sensing instruments aboard the NOAA (National Oceanic & Atmospheric Administration) satellites of the U.S.A. The instrument (AVHRR-2) provides image data in five channels, ranging from 0.63 μm (visible red) to 12.0 μm (thermal infrared), with an IFOV (instantaneous field of view) of approximately 1.4 milliradians over a swath width of around 2500km. At the nominal altitude of 833km the IFOV equates to a pixel size of 1.1km directly below the satellite. Usually there are two operational NOAA satellites providing global coverage twice daily, once at night and once during the day.

Like the other instruments aboard the spacecraft, the AVHRR was primarily intended for use in weather monitoring. Over the years however, a much broader range of applications has been found for the data, including disaster monitoring (bushfires, droughts, floods), vegetation indexing, disaster prevention programs (vegetation moisture and fuel load assessment to prevent bushfires, atmospheric volcanic debris detection to prevent aviation disasters), sea surface temperatures for monitoring ocean currents and eddies (of great significance to our fishing industry and shipping), geological applications etc.

Australian scientists have received AVHRR data



SAT-TRAC 2.4m steerable dish.

locally for many years for weather forecasting and on an experimental basis for research purposes. Because of the characteristics of many applications that have been developed, near-real time availability and regular acquisition and archiving of AVHRR data is essential. The growing demand for supply of these data on an operational basis has lead to the design and construction of the SAT-TRAC AVHRR receiving facility by PCM Electronics Pty Ltd of Melbourne in conjunction with CSIRO's Division of Atmospheric Research in Aspendale, Victoria.

The SAT-TRAC system began as a research project at the Division of Atmospheric Research and couples state-of-the-art hardware and modular computer equipment with powerful software for the integrated reception and storage of AVHRR and TOVS (TIROS Operational Vertical Sounder) data from the NOAA series of satellites. Extension of the system to cover additional satellites such as GMS (Geostationary Meteorological Satellite), SARSAT (Search and Rescue Satellite) and ERS-1 (**E**uropean Space Agency **R**emote Sensing **S**atellite) is under development or investigation.

The establishment of the first operational NOAA-AVHRR facility in Australia in June 1987 is due to the efforts of a consortium called WASTAC (West Australian Satellite Technology and Applications Consortium) consisting of the Curtin University of Technology in Perth (formerly WAIT), CSIRO, Western Australia Department of Land Administration (DOLA) and the Bureau of Meteorology. WASTAC was specifically

established to acquire and operate the automated SAT-TRAC system for the reception, processing, archiving, distribution and analysis of remotely sensed data from the NOAA series of satellites.

The WASTAC facility comprises a 2.4m steerable dish antenna and controller, located at Curtin University; a control computer at the Bureau of Meteorology premises in Perth; a microwave link between the two sites; and an archive located at the WA Remote Sensing Applications Centre of the Department of Land Administration.

In Townsville, a consortium called NASIS (Northeast Australian Satellite Imagery System) placed an order for the SAT-TRAC system earlier this year, in the hope of having the facility operational in time for the ANZAAS Conference to be held in Townsville from 24-28 August 1987. The foundation members of the consortium are the James Cook University of North Queensland (JCU), the Australian Institute of Marine Science (AIMS), the Great Barrier Reef Marine Park Authority, CSIRO and the (Queensland) Department of Mapping and Surveying.

The NOAA receiver will be sited in the JCU Department of Electrical & Electronic Engineering, with the initial workstation located at AIMS. A Management committee under Chairman, Professor Peter Arlett (JCU) and Deputy Chairman, Dr John Andrews (AIMS) will manage the station's affairs.

In addition to the SAT-TRAC facilities already located at the Bureau of Meteorology in Melbourne, a number of other operational NOAA-AVHRR receiving faciltiies, using the PCM SAT-TRAC system, are planned for other Australian and overseas locations.

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NASIS
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TOWNSVILLE, Qld 4811
Telephone: (077) 814279 or 814299

SAT-TRAC
PCM Electronics Pty Ltd
20-22 Hardener Road
Mt Waverly, Vic 3149
Telephone: (03) 5436000

AUSTRALIAN SPACE BOARD LETS ERS-1 CONTRACT

Canberra – on 7 June 1987, the Chairman of the Australian Space Board, Mr Robert Somervaille, announced that the Board has let a contract to enable Australia to receive and process data from the European remote sensing satellite ERS-1.

The contract is for the development and manufacture of an ERS-1 ground system and was awarded to a consortium led by British Aerospace Australia. "Of particular value to Australia is the development of a new and internationally marketable technology for the processing of the huge quantities of data from the latest series of Earth observation satellites", Mr Somervaille said.

The ERS-1 satellite is the first of a new generation of Earth observation satellites that will carry a large synthetic aperture radar (SAR) for high resolution all weather imaging during the day and at night. The ERS-1 mission is primarily oriented towards land and ocean monitoring with, in addition, an all weather high resolution micro-wave imaging capability over land and coastal zones.

The SAR of the satellite will be able to image over a minimum swath width of 80km at resolutions of 30m and 100m, whilst the Along Track Scanning Radiometer (ATSR) of ERS-1, of which Dr Ian Barton of CSIRO's Division of Atmospheric Research is co-designer, will be able to monitor sea surface temperatures to within 0.5K. (see article "ERS-1 Proposal for Australia and New Zealand" in this issue).

ERS-1 is being constructed by the European Space Agency (ESA) for launch on an Ariane rocket in 1990 and is expected to function for 3 years, orbiting in a sun synchronous orbit at an altitude of 777km.

CSIRO RELEASES VERSION 4 OF DISIMP IMAGE PROCESSING AND GRAPHICS PACKAGE

The CSIRO Division of Information Technology has developed an extensive suite of image processing software, called "DISIMP" (Device-Independent Software for Image Processing), as part of its research and development activities.

DISIMP has been installed at 18 sites in Australia and overseas, primarily for processing of remotely sensed data. User sites include other CSIRO Divisions, mineral exploration companies, federal and state government departments, universities and, at the Technical Research Centre and the National Board of Survey in Finland.

The continued development of the software by the Division's Centre for Spatial Information Systems, under Dr John O'Callaghan, has lead to the release of Version 4 of DISIMP on the Dindima ARLUNYA IW-1000 workstation and the Quentron Optics QDS-1000 display under collaborative agreements with these companies.

The software provides a comprehensive range of

facilities for processing of digital image data from many different sources, whilst being able to support a variety of computer systems and a wide range of peripherals. Facilities include image restoration and enhancement, geometric and intensity transformations, statistical analysis and interactive colour image displays. Its common device interface allows DISIMP to be installed on a range of interactive display systems. DISIMP's modular and flexible design allows system builders to extend its capabilities and to develop additional utilities as required for specific applications.

Special facilities are provided in the software for analysing multi-spectral images from the Landsat, SPOT and NOAA satellites and for their integration with related data involving topographic, geophysical and cultural properties. The main applications of DISIMP have been in the analysis and processing of remotely sensed data and image based geographic data. Projects include landcover classification, vegetation condition assessment, geophysical data interpretation and atmospheric data analysis.

For the marketing and distribution of DISIMP, the Division has established agreements with two Australian companies,

- Quentron Optics Pty Ltd, which supports the software on COMTAL and LEXIDATA display systems and on its own low-cost QDS-1000 terminal.
- The DINDIMA Group Pty Ltd, which supports the software on its UNIX-based image workstation, the ARLUNYA IW-1000, which has been developed in conjunction with CSIRO's Division of Atmospheric Research.

Distribution of the DISIMP software for other image processing systems is currently handled by:

CSIRO Division of Information Technology
GPO Box 664 Ph (062) 433307
Canberra ACT 2601 Telex AA 62145

SOUTH AUSTRALIA WINS $6 MILLION ETHIOPIAN CONTRACT

The South Australian Centre for Remote Sensing (SACRS) and FORTECH Forest Management Ltd have been selected for a 4 year resources monitoring program for Ethiopia, underwritten by the World Bank. The $6 Million contract involves the assessment and monitoring of Ethiopia's forest and agricultural resources using satellite remote sensing and image processing techniques.

The contract was won against very strong international opposition, particularly from Sweden, because of the S.A. Centre's innovative approach to solving problems related to the drought and food shortages in Ethiopia.

Announcing the contract, the Premier of South Australia, Mr John Bannon said "The project will involve reafforestation of parts of Ethiopia to lessen the effects of drought, whilst high-tech resources in the country will be used to formulate a plan to help manage existing energy resources."

Mr Bannon went on to say that Ethiopia has recognised that the loss of its forests has contributed to declining agricultural activity and that this loss has been a very important factor in prolonging and aggravating drought.

SACRS Director, Mr John Douglas said that over the years Ethiopia's forested areas had declined to about 10% of the country. The need to use wood as a source of energy further compounded the problem. The Ethiopian Government realises the need to plan and develop reafforestation, but that it has to start with establishing an inventory of existing resources.

Mr Douglas continued: "Drawing on existing Australian expertise in the application of remote sensing and other techniques to the management of arid land resources, SACRS will help develop a resources management plan, looking at soil conservation and management, agriculture and forestry".

"The 4 year project, which involves the supply of sophisticated equipment, computer hardware and software, expertise, training and technology transfer, will be part of a long term program which will enable the Ethiopian people to overcome the droughts and food shortages suffered in the past".

ADELAIDE UNIVERSITY SETS UP REMOTE SENSING STEERING COMMITTEE

Staff members of the Geography and the Geology and Geophysics Departments at Adelaide University have established a Remote Sensing Steering Committee to promote the use of remote sensing and image analysis techniques in education and research.

For its remote sensing activities the University primarily uses AUDIA micro-computer based image analysis hardware and software for educational purposes, whilst more sophisticated processing is carried out on the central VAX facility. The AUDIA (Adelaide University Digital Image Analyser) equipment was developed "in house" and constructed by the department of Geology and Geophysics. Current uses of the system include studies in petroleum exploration, geological mapping, land use and vegetation assessment.

With the support from several other departments and study centres within the University, the Committee coordinates remote sensing related activities within the University and with other organisations outside the University. Together with its supporters, the committee is seeking to establish a fully equipped Image Analysis Centre at Adelaide University and consequently it also oversees the acquisition and expenditure of funds for further development of the AUDIA systems as well as the acquisition, storage and use of various types of digital data.

INTERNATIONAL NEWS

NEW AVHRR CHANNEL FOR NOAA K-M

The NOAA (National Oceanic & Atmospheric Administration) series of low Earth orbiting meteorological satellites of the U.S.A., began with the launch of the NOAA-1 in 1970. The spacecraft followed the TIROS-(I-X) and ESSA-(1-9) missions of the 1960s. The precursor to the AVHRR (Advanced Very High Resolution Radiometer), the VHRR was first carried on NOAA-2. The present AVHRR instrument commenced operations with the launch of TIROS-N (Television and Infrared Observation Satellite) in 1978.

The AVHRR-1 aboard TIROS-N had a very broad VNIR (Visible and near infrared) band from 0.55 μm - 0.90 μm which partially overlapped the NIR band (0.72 μm - 1.08 μm) of the second channel. A modified AVHRR-2 instrument (NOAA-(E-J)) was built with a much narrower first band (0.58 μm - 0.68 μm) covering visible red, and also having a fifth spectral band (11.5 μm - 12.5 μm) in the thermal infrared (TIR) region. The other three spectral bands, channels 2 (0.72-1.08), 3 (3.55-3.93) and 4 (10.5-11.5) remained unaltered.

Further modifications are now being planned for the next generation AVHRR-3 series for NOAA-(K-M). AVHRR-3 will have a sixth channel, 1.58 μm - 1.64 μm, specifically designed to discriminate between snow and ice, as well as being able to monitor the leaf-moisture content of plants. In order to maintain the same data rate, this 1.6 μm channel is time shared with the 3.7 μm thermal channel. The 3.7 μm (channel 3) data will be transmitted during night passes and the 1.6 μm, data (channel 3A) will be transmitted during the daytime part of an orbit.

Other modifications for AVHRR-3 include improvements in the response characteristics of channels 1 and 2 (VNIR) and their electronic gain function to improve data with low albedo. Both channels will be modified to get a more symmetrical response. Channel 2 will be narrower (0.84 μm - 0.87 μm) than before, and the signal to noise ratio is expected to improve from 3:1 to at least 9:1 at 50% albedo.

In addition, a stability monitor is expected to be added, to provide quantitative information on albedo responses of the channels due to instrument changes over time, and to improve the comparison of data acquired at different dates.

CHINA APPOINTS EOSAT AS WORLD WIDE DISTRIBUTOR

The Chinese Academy of Science of the People's Republic of China (PRC) has appointed EOSAT (Earth Observation Satellite Company), the commercial operator of the Landsat system, as the official representative for Landsat data acquired by the Beijing Landsat Station.

EOSAT will market the Landsat data (MSS & TM) of China on behalf of the PRC to a world wide customer base. Initially the data will be available on CCTs only. Photographic products in colour and black & white will be available in the near future. Orders for archived image data will be delivered approximately 3-6 weeks after receipt and will have copy and distribution protection similar to all EOSAT products.

For information contact:

Mr Richard Mroczynski
Director of Public Affairs, EOSAT
4300 Forbes Boulevard ph 1-301-550545
Lanham, MD 20706, USA telex (RCA): LSAT UR

NASA ISSUES SPACE STATION RFPs

The US National Aeronautics and Space Administration, NASA, has issued requests for proposals (RFPs) to US industry for detailed design and construction of a permanently manned Space Station to be operational in the mid 1990s.

The Space Station will be in low Earth orbit at about 400km altitude with an orbital inclination to the equator of around 28.5 degrees. It will include a man tended free flying polar orbiting platform as well as instruments and payloads to be attached to the main module. It is anticipated that a range of Earth remote sensing instruments, to be provided by the US and international partners will be attached to these platforms to provide the primary source of Earth remote sensing data for several decades.

Contact: Mark Hess, Public Affairs, NASA Headquarters, Washington DC 20546.

REMOTE SENSING IN THE PACIFIC ISLANDS

The above title refers to a report on the Pacific Island Regional Remote Sensing Workshop and Training Course on Resource Mapping held at the Institute of Natural Resources of the University of the South Pacific in Suva, Fiji, from 27 January to 23 February 1986.

The course and workshop were organized by the UNDP/ESCAP Regional Remote Sensing Programme (RAS/81/034), the Australian Development Assistance Bureau and the Institute of Natural Resources of the University of the South Pacific.

Apart from providing some detail on the remote sensing workshop and training course on resource mapping, the report also contains addresses by:

- Hon. J.B. Navsara, Minister for Lands, Energy and Mineral Resources (Fiji);
- S.A.M.S. Kibira, Executive Secretary, ESCAP;

and technical presentations by:

- Dr. David Jupp, CSIRO, Australia: *Remote Sensing Applications from Satellites with Special Emphasis on Shallow Water Mapping;*
- *Microcomputer-based Image Processing in the South Pacific Environment;*
- Dr. Kenneth Turgeon, NOAA, USA: *Satellite Remote Sensing: Applications for Marine Fisheries;*
- Dr. Randolph Thaman, USP, Fiji: *Coming Down to Earth: Strengthening Remote Sensing Applications in Island Countries;*
- *Mapping and Field Inventory with a Case Study of Tonga.*

Readers wishing to obtain a copy of this report should contact:

H.L. Thung
Project Manager
(Co-ordinator Regional Remote Sensing Program)
United Nations Building
Rajadamnern Avenue
Bangkok 10200
THAILAND

Other documents recently released under the UNDP/ESCAP Regional Remote Sensing Programme include:

- Development and Applications of Remote Sensing for Planning, Management and Decision-making, Seminar Proceedings, Beijing, 15-24 April 1985;
- Remote Sensing Applications to Highland Development, Proccedings of the Regional Seminar, Kathmandu, Nepal, 7-11 December 1985;
- Remote Sensing Centres/Programmes in the ESCAP Region, Proceedings of the Meeting of Directors, Colombo, Sri Lanka, 15-19 May 1986.

LATE NEWS

CANADIAN $725 MILLION RADARSAT PROGRAM RECEIVES GO-AHEAD

On 25 June 1987, a restructured Radarsat program received conditional Canadian Government approval for the development of a synthetic aperture radar (SAR) satellite costing an estimated $725 million. Of this amount, over $300 million is expected to come from Canada's proposed partners in the Radarsat program – the United States and Britain. The Canadian Government approval is conditional on reaffirmation of U.S. and British commitment to the program by the end of 1987.

The satellite will carry an advanced SAR as the primary instrument, capable of day and night monitoring at resolutions of 100 - 10 metres even if the Earth's surface is covered by cloud. The Radarsat bus and 2 additional science instruments are expected to be provided by Britain, whilst the U.S. is expected to provide the launch vehicle. West-German participation in the program is also likely, as U.S. officials want the German Modular Optoelectronic Multispectral Scanner to fly on Radarsat.

The Radarsat SAR will be able to image the Earth at differing look angles anywhere within a 700km wide strip at swath widths variable from 500km at 100m resolution to 55km at 10m resolution. The single frequency SAR allows for imaging of the surface independent of cloud cover with daily repeat coverage at the 100m resolution and every 3 days at the 10m resolution.

The applications of the SAR data will range from monitoring ice movements in the arctic and antarctic regions of the world to crop forecasting in agricultural areas. The Radarsat launch into a polar orbit is expected to take place in 1994.

ACRES UPGRADE

A contract, valued at approximately $11 million over three years, for upgrading of the Australian Centre for Remote Sensing has been successfully negotiated by the Major Purchasing Division of the Department of Local Government and Administrative Services with MacDonald Dettwiler Technologies Ltd., of Vancouver, Canada.

The Centre is operated by the Division of National Mapping and its function is to receive, record and archive data from earth resources remote sensing satellites. ACRES processes these data into photographic imagery and digital magnetic tapes for subsequent analysis and interpretation by users and researchers in a wide range of natural resource based applications and industries.

The upgrade will provide the Centre with a flexible and versatile system which will cater for the new generation high resolution instruments carried by the United States Landsat and French SPOT satellites. It will be easily upgradeable for future satellites by relatively minor modular additions, principally in software.

MacDonald Dettwiler is a leading world supplier of ground stations and was the supplier of the original Australian Landsat Station in 1979. For the upgrade this Canadian organization will work in close association with two Australian based companies, British Aerospace Australia and Computer Sciences Australia, which will ensure a high degree of Australian industry participation.

ERS-1 PROPOSAL FOR AUSTRALIA AND NEW ZEALAND

Lyndal Thorburn & Jeff Kingwell

COSSA Scientific Services
Canberra, A.C.T.

Introduction

Australia has been an active and innovative user of Earth remote sensing satellites for over twenty years. Political, scientific and industrial communities have examined the role of space technologies in Australia, and the way in which they can act as a stimulus to the country's industries and user groups. Our neighbour, New Zealand, has been involved in several of these studies.

The European Space Agency (ESA) plans to launch its Remote Sensing Satellite ERS-1 in 1990. In May, 1986, ESA published an Announcement of Opportunity (AO) calling for proposals to participate in scientific, applications and validation projects utilising ERS-1 data.

In order to ensure proper co-ordination and management of our response to the ERS-1 AO, the CSIRO Office of Space Science and Applications (COSSA) arranged for a number of chairmen to co-ordinate four separate discipline proposals. The grouping was based on an initial survey of over 70 scientific and industrial research and development groups in Australia and New Zealand, and on subsequent technical discussions.

Instrumentation

The satellite will be launched by an Ariane 2 rocket from Kourou (French Guiana) in 1990 and is expected to function for three years, orbiting at an altitude of 777km in a sun-synchronous orbit with a southbound equatorial crossing time of around 1030 hours.

ERS-1 (for **E**uropean Space Agency **R**emote Sensing Satellite **S**ystem) will carry a number of instruments which will have particular applications for examination of the oceans, the cryosphere, and air-sea interaction. Onshore applications are also intended.

The satellite will carry:

1. Active Microwave Instrument (AMI). The AMI functions in C band (5.6cm wavelength, 5.3 GHz frequency) in three modes:

- wind scatterometer 'wind mode' giving surface wind velocity to about $\pm$ 2 m/s and $\pm$ 20° accuracy over a 400km swath
- SAR (Synthetic Aperture Radar) 'wave mode' giving the wavelength spectrum and direction of ocean waves
- SAR 'image mode' giving 30 x 30m resolution two dimensional images of the radar reflectivity of ice, ocean or land surfaces.

The swath width for full performance is 80km, offset by about 290km from the sub-satellite track.

Particular areas of application of AMI data will be for topographic mapping of the cryosphere, land use studies, and coastal zone examination.

Small discrete targets (ships, icebergs etc) should also be revealed by the radar imagery.

Because of the high power drain, AMI can only operate in the 'image' mode for a total of ten minutes per orbit.

2. Radar Altimeter. This is a Ku (- 13.8 GHz) band nadir-pointing pulsed radar similar to that used on SEASAT in 1978. It operates in two modes:

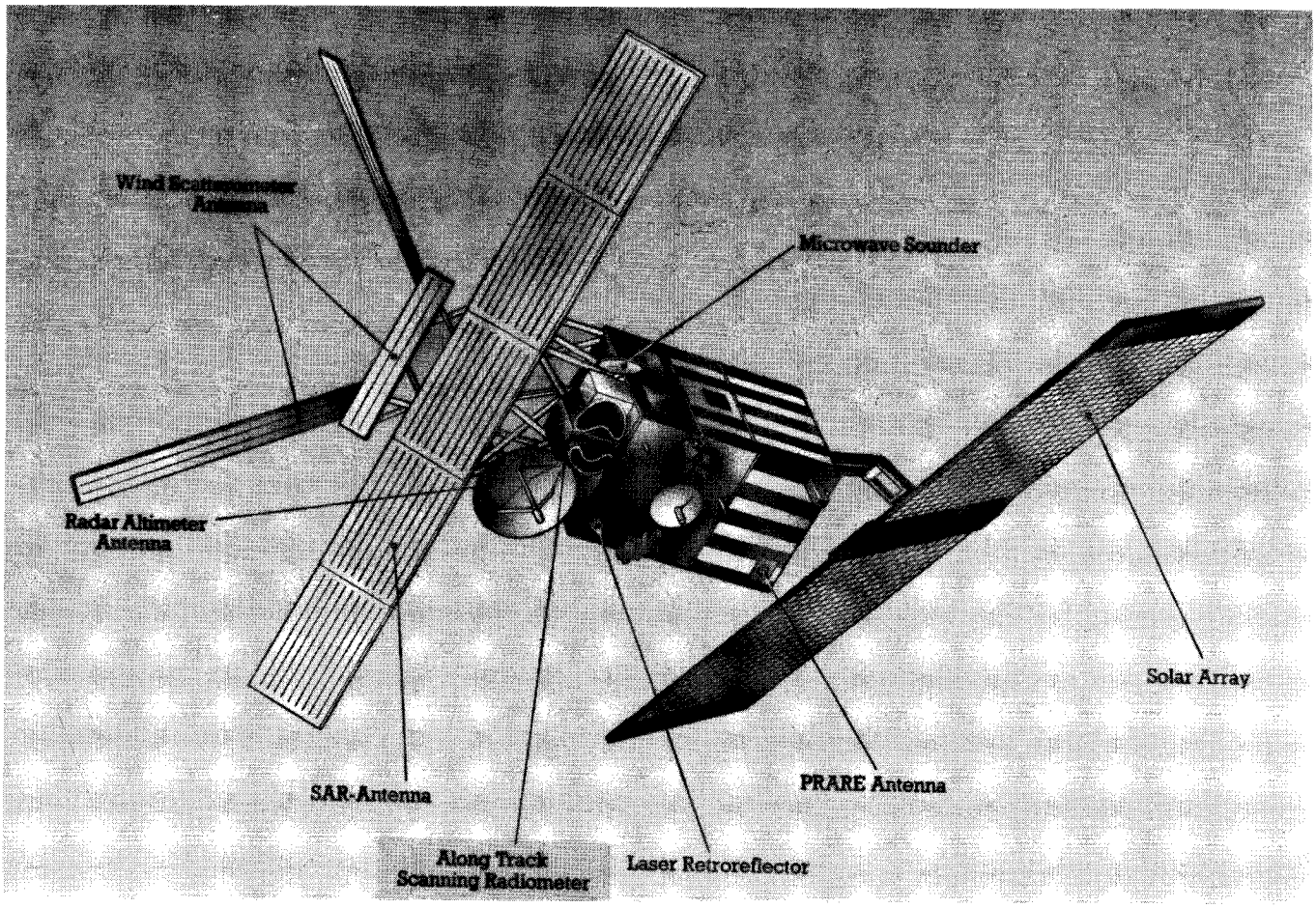
- 'ocean' mode, giving altitude, surface windspeed and wave height spectrum
- 'ice' mode, operating at a lower precision than the ocean mode because of the greater shape variance of surface features and yielding topographic data in the cryosphere.

The design objectives are for significant wave height measurement to 0.5m or 10% accuracy, and altimetric precision of 0.1m over the ocean and 0.4m over ice.

3. The Along Track Scanning Radiometer (ATSR), for which Dr Ian Barton of CSIRO's Division of Atmospheric Research is co-designer, consists of a 3-channel infrared instrument operating at 3.7, 11 and 12 microns. It is expected to be capable of measuring average sea surface temperatures over 50km x 50km squares to within 0.5K, in up to 80% cloud cover. The swath width is 500km, and instantaneous field of view 1 x 1km at nadir.

The ATSR, which is being developed by a consortium of UK and Australian groups, will be complemented by a French/Danish microwave sounder operating at 23.8 and 36.5 GHz. The microwave data will provide an important input to the radar altimeter calibration (the so called 'wet atmosphere correction') and will give information on haze and total water vapour content in the atmosphere. The sounder will have a 22 x 22km Instantaneous Field of View (IFOV).

4. The S/X Band Precise Range and Range Rate Experiment (PRARE). This is a German project which will be used for orbit determination and geodetics. It will operate at X and S bands (8.5 GHz and 2.2 GHz) on the downlink and X band (7.2 GHz) on the uplink.



Artist's impression of ERS-1 spacecraft

The ranging accuracy of PRARE is predicted to be of the order of 5-10cm. Ground stations will operate at X or S band. The S band transmissions will provide information on the total ionospheric electron content. The PRARE system also functions as a Data Collection System for meteorological data measured at small modest-cost ground stations.

5. Laser retroreflector. These are passive corner cubes (similar to those proposed for Aussat II) which reflect laser signals to ground stations. The time delay of the signal gives precise orbital determination (to within 1 or 2cm in radial component) and the data is also used to calibrate the satellite's radar altimeter.

Structure of Proposals

On-land Applications

The on-land applications of ERS-1 were dealt with in three separate proposals.

Geology

The geology proposal involves evaluation of the C-band SAR (Synthetic Aperture Radar) for geological field research in areas of low topographical relief and superficial weathering, with assessment of its ability to differentiate rock types, weathered materials, soils and vegetation and other onshore surface covers. A comparison with previously studied areas where X-band SAR has been used will form part of the experimental program.

Chairman: Mr C. Simpson, Bureau of Mineral Resources, Geology and Geophysics

Land Use and Vegetation

The land use proposal will form part of a long term forestry experiment, also utilising Shuttle Imaging Radar (SIR-A, SIR-B, SIR-C) and Earth Observation System (EOS) data to develop an understanding of the microwave energy of Australian forests with a view to backscatter modelling and an evaluation of its use in monitoring change in forest biomass.

Chairman: Professor J. Richards, Department of Electrical and Electronic Engineering, University of NSW, University College, Australian Defence Force Academy

Mapping and Tropical Environments

The mapping and tropical environments proposal complements geological applications through proposing an assessment of SAR data as part of the Regional Geographic Information Systems (REGIS) project. REGIS will be operational by 1988 and incorporation of SAR data in this system will enhance evaluation of the spatial and spectral properties for mapping and monitoring land resources. The experiment will also evaluate SAR data over tropical environments, in particular during the extended rainy seasons.

Chairman: Mr N. Divett, Department of Mapping and Surveying, Queensland

Physical Oceanography

Physical oceanography comprises the major response to the ERS-1 AO and includes proposals from seven research institutions. ERS-1 is seen as opening up a new era in which polar orbiting satellites will play the major role in obtaining synoptic and time-series data and will enable Australia and New Zealand to increase their contributions to the World Climate Research Program (WCRP), including the Tropical Oceans/ Global Atmosphere Experiment (TOGA) and the World Ocean Circulation Experiment (WOCE). Experiments are proposed for all major oceans around Australia and New Zealand and will measure heat fluxes, assess dynamics and circulation features, undertake wind wave modelling, and contribute to the existing program of ocean monitoring and forecasting and air-sea interaction studies including cyclone detection. Altimetric data will also permit investigation of bathymetric features including charted and uncharted seamounts.

Chairman: Dr C. Nilsson, CSIRO Division of Oceanography

Antarctic Studies

Antarctic Studies form another major segment of the package of experiments, and bring together proposals from five research institutions. All proposals use the SAR mode as the primary data source and depend on availability of suitable data, from either a permanent or a transportable receiving station in the Antarctic. The proposals will result in a successful comprehensive topographic and geological study of the region and also form part of the long term plan of field activities in glaciological research.

Chairman: Mr N. Young, Department of Science, Antarctic Division

Along Track Scanning Radiometer

Australia is collaborating with the UK in the provision of the Along Track Scanning Radiometer (ATSR) which is to be part of the ERS-1 payload. CSIRO scientist Dr Ian Barton was involved in the original design of this Radiometer, while working in the UK, and is the Project Scientist for the ATSR. He is also playing a major role in the calibration and validation of ATSR data, particularly in the Australasian region. An Australian aerospace company has built a major part of the digital electronics for this instrument, and is providing signal channel electronics expertise. This work is funded by the Australian Government, demonstrating its commitment to furthering scientific and industrial participation in ERS-1.

The ATSR proposal in the response to the AO involves further validation and ground truthing of the ATSR instrument. This ground truthing will form part of Australia's participation in the Satellite Validation Experiment (SAVE) which will be held in Australian waters in 1990. SAVE aims to provide a better understanding of how the physical processes that underlie the reflection and emission of infrared radiation at the sea surface and its transmission through the atmosphere. SAVE will also include comparison of the products from and performance of different satellites, including ERS-1.

Chairman: Dr Ian Barton, CSIRO Division of Atmospheric Research

Discussion

Involvement in ERS-1 studies by Australia and New Zealand will be of great national benefit, and will have important international implications as well. The Australian continent's climate, geology and vegetation pose some unique technical and scientific challenges; the location of both countries in the data-poor southern oceans offers new and valuable inputs for global and regional scientific investigations; and it provides the opportunity for Southern Hemisphere validation, instrument calibration, and data reception.

The wide scientific and technical competence in both countries is supported by some excellent facilities, including the Australian Centre for Remote Sensing Data Acquisition and Data Processing Facilities at Alice Springs and Canberra respectively; AVHRR receiving stations in Perth, Melbourne and Hobart (with several others planned); a number of fully equipped oceanographic research vessels; a research aircraft with its own design engineering team; specialised oceanographic laboratories at Townsville, Perth and Hobart; an SAR-processing facility at the University of New South Wales; and a range of satellite data processing facilities covering the various Earth remote sensing wavelengths.

There are numerous mutual scientific benefits to Australian and New Zealand participation in ERS-1 scientific research studies and applications-oriented projects. It is certain that both countries will increase their use of Earth remote sensing technologies. The Australian government's commitment to space science and technology will ensure maximum benefit to both the scientific and industrial community as a result of this increase involvement.

SATELLITE STUDIES OF THE LEEUWIN CURRENT

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A.J. Prata, J. Wells and J. Carter
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Introduction

The Leeuwin Current is a stream of relatively warm tropical water that appears seasonally off Western Australia, carrying with it the larvae of a variety of tropical marine organisms (Legeckis and Cresswell 1981; Maxwell and Cresswell 1981). The existence of such a current was postulated almost a century ago by biologists studying the unusual distribution of tropical and temperate marine life on the continental shelf. They suggested that a warm southerly flow in autumn and winter was the only possible explanation for the water at

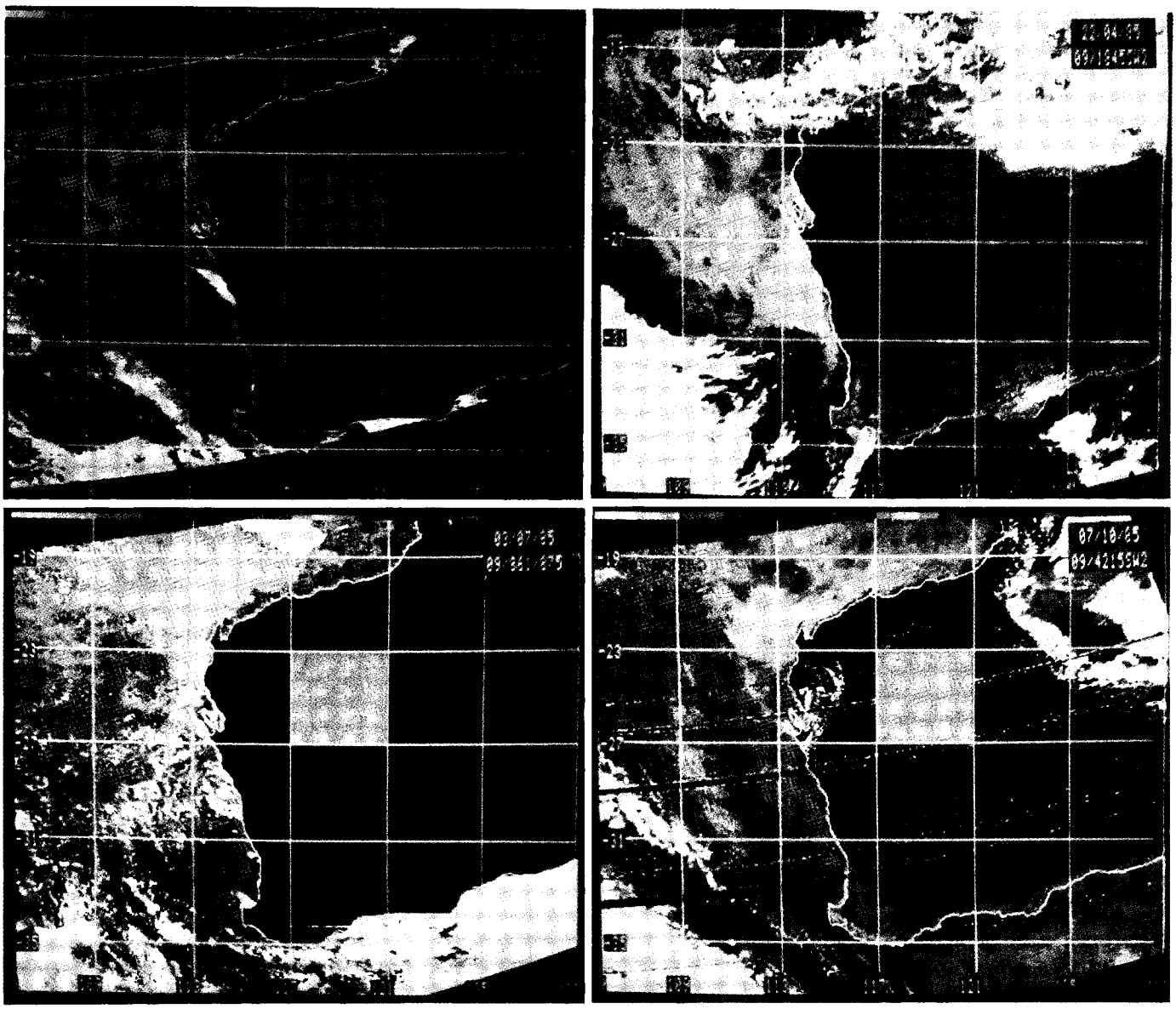


Figure 1: Seasonal temperature images of the ocean circulation off Western Australia in 1985, using AVHRR data from NOAA7 and 9. The colour scale at the top of each image shows the 1° C temperature intervals; white areas are clouds. The latitude and longitude lines are at 4° intervals. (The grey block is for colour-matching).
(a) NOAA7 orbit 18255, 6 January 1985, representing summer;
(b) NOAA9 orbit 1845, 22 April 1985, autumn;
(c) Composite image derived from two NOAA9 orbits, 3 July 1985, winter;
(d) NOAA9 orbit 4215, 7 October 1985, spring. (The black bands across this image are due to data drop out during transmission.)

the Abrolhos Islands (some 60 km off Geraldton) being warmer than that closer inshore.

Although the seasonal interchange of water properties (sea temperature and salinity) off Western Australia was measured by CSIRO over 30 years ago, it was only from the trajectories of satellite-tracked drifting buoys in the late 1970s that the existence of a southwards current was positively identified (Cresswell and Golding, 1980; Pearce and Cresswell, 1985). It was subsequently named the Leeuwin Current, after the "Leeuwin", a Dutch vessel which explored the southern coast of Australia in 1622. In the last decade, with the advent of satellite imagery, the complex structure and behaviour of the flow have become clear (Pearce 1985).

Satellite imagery

A NOAA satellite facility was set up jointly by CSIRO and the Western Australian Institute of Technology, now Curtin University, at the end of 1981 (Carroll et al. 1981, Myers 1984). Because the Leeuwin current is much warmer than the adjacent water, the flow can be traced in thermal imagery from the NOAA satellites. The NOAA7 and NOAA9 satellites both carry the 5-channel AVHRR, which contains two thermal bands in the 10.5-12.5 μm window and enables absolute sea-surface temperatures to be derived. Each satellite passes over twice per day, although NOAA7 is no longer operational.

Images have been recorded since early 1982, generally daily on weekdays and sometimes over weekends, except when the area was covered by heavy cloud or the receiving facility was out of action. By early 1987, almost 1000 NOAA passes had been archived on magnetic tape.

Using this archive, a two-year study of the seasonality and structure of the ocean circulation off Western Australia is being undertaken under a Marine Sciences and Technologies grant, using a locally-developed software package PESST (Procedure for Estimating Sea-Surface Temperature; Prata et al. 1986). Weekly images recorded over the 5-year period 1982-86 have been geometrically re-mapped to a standard Mercator projection; the area covered is about 18° to 36° S, and 106° to 128° E. The thermal radiances have been converted to temperature and a correction algorithm applied to account for the absorption by atmospheric water vapour. Studies comparing the resultant sea-surface temperatures with conventional measurements from a boat in the coastal waters off Perth have indicated that the error in absolute temperature is generally less than 0.5° C (Pearce et al. 1987); temperature gradients, on the other hand, are resolved at about 0.1° C, which is more than adequate to reveal the temperature structure in the Leeuwin Current.

Results and Discussion

To date, some 190 weekly images have been processed. These clearly show the seasonal waxing and waning of the Leeuwin Current, as for example in Figure 1. The contrast between the warm water of the Northwest Shelf and the cool Southern Ocean water in the south is evident in all seasons. In the north, summer temperatures are about 29°, dropping to 24° C in winter, while south of Albany the corresponding temperatures are 20° C and 15° C. The Leeuwin Current can be seen as the transport of warm water southwards in autumn and winter, rounding Cape Leeuwin (the southwestern corner of the continent) and moving eastwards towards the Great Australian Bight. On occasion, the tropical water reaches as far eastwards as Tasmania (Nilsson et al. 1987).

Although there is usually some indication of southwards flow throughout the year, even in the summer months, the current certainly appears to be strongest between May and October (when, unfortunately, cloud cover off Western Australia is heaviest!). When an image is enlarged and the temperature resolution increased (Figure 2), meanders and eddies on a variety of length-scales are seen to be major features of the flow.

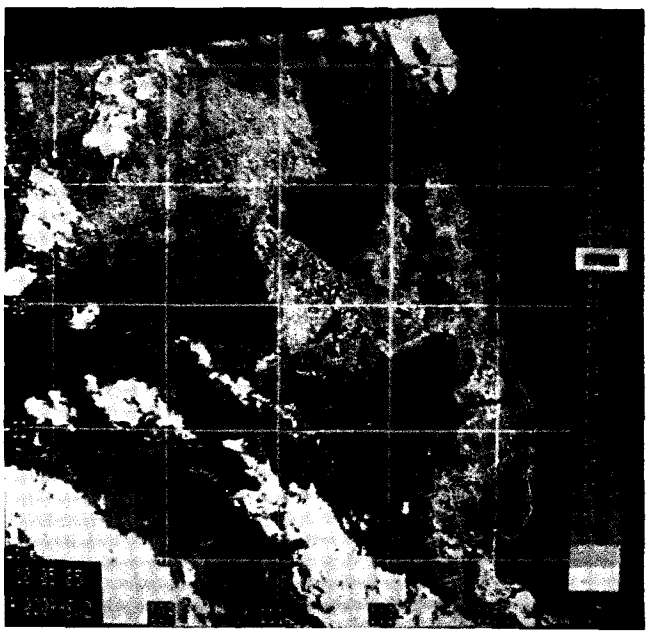


Figure 2: Finer-resolution image, with temperature bands at 0.5° C intervals, for the latitude range 25° to 35° S; NOAA9 orbit 2099 on 10 May 1985.

In addition to producing coloured temperature images as visual representations of the circulation, the original digital data can be used to study daily, weekly, monthly or annual temperature variations in any particular area. Further, surface-temperature profiles across the current can be analysed in terms of the thermal gradients associated with the flow. Figure 3(a) is an example of the cross-stream temperature structure in summer, while in autumn (b) when the Leeuwin Current is relatively strong, there is a warm "core" of tropical water.

Further work

Having established the "climatology" of the current in the form of weekly sea-surface temperature images,

4TH AUSTRALASIAN REMO

The Remote Sensing Association of Australia (RSAA), the International Society for Photogrammetry & Remote Sensing (ISPRS) and the South Australian Centre for Remote Sensing (SACRS) will be hosting the 4th Australasian Remote Sensing Conference in Adelaide, 14 - 18 September 1987.

The Conference is co-sponsored by the United Nations Environment Program (UNEP), the Australian Space Board (ASB) and the Commonwealth Scientific & Industrial Research Organization's Office of Space Science and Applications (COSSA) and is supported by the Australian Centre for Remote Sensing (ACRES).

Special Emphasis

Like the previous highly successful Australasian Remote Sensing Conferences (Landsat '79, '81, '84), this fourth conference in the series will see papers presented from around the world on a wide range of aspects and applications of remote sensing. In addition, there will be a special emphasis on new developments in operational air- & space-borne remote sensing systems and regional developments in operational remote sensing applications, associated industries, research and services.

Industry Exhibition

One of the major highlights of the Conference will be the Remote Sensing Industry Exhibition which has attracted many companies and organizations from around the world. Exhibitors will include leading manufacturers of data acquisition systems, ground receiving stations, image processing systems, as well as suppliers and users of remote sensing products and services.

PROGRAM

Monday 14 September

Welcome and Opening

Following a welcome by the Chairman of the Organising Committee, Mr John S. Douglas and by the President of the Remote Sensing Association of Australia, Assoc. Prof. Bruce Forster, the Conference will be officially opened by the Premier of South Australia, The Hon. John Bannon, M.P.

Keynote Speakers

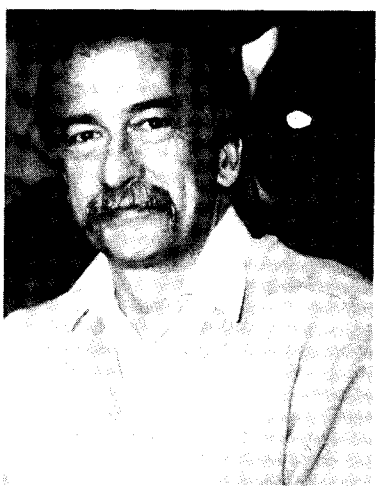
Keynote Speakers will be emphasising the characteristics of remote sensing in South East Asia, The Pacific Rim Countries (including Australia) during the 1990s. The speakers are:

Prof. Shunji Murai – Institute of Industrial Science, University of Tokyo.

Prof. David Landgrebe – Purdue University, U.S.A.

Madam Maimun Din – Deputy Secretary General, Malaysian Ministry of Science, Technology and the Environment, Malaysia.

CHAIRMAN'S MESSAGE



The 4th Australasian Conference on Remote Sensing has as its twin theme Operational Remote Sensing and its Associated Aerospace Industry.

The Conference is setting a regional theme emphasising developments and applications in Australia, South East Asia and the Pacific rim countries.

With this in mind the Conference papers cover a wide area of practical applications in Research and Development, Education and Training, and Technology Transfer. Keynote Speakers of international renown in the field of Remote Sensing will further consolidate the regional theme.

Of particular interest is the workshop on the US/Australia Joint Scanner Project. Presentation of papers from Australia and USA will report on this program in which the NASA C–130 aircraft with its unique suite of advanced sensors was flown over Australia during October 1985.

Other workshops include High Resolution Spectra and Spectro-radiometry, the future of Low cost Image Processing, Space Platforms and Programs, Geographic Information Systems (GIS), Radar, Lidar and Data Transmissions.

Such workshops will concentrate on answering practical questions and will also allow the participants to work in small groups led by specialists in these fields.

In addition the COSSA F-27 research aircraft will be visiting Adelaide and visits will be arranged to view the onboard scanner and other sensors. The Flinders University Meteorological Research aircraft will also be on display.

A major component of the Conference is the Industry Trade Expo. This Expo provides an ideal opportunity to view the latest hardware and software in remote sensing products and services available worldwide.

We have the pleasure of inviting you to this 4th Australasian Remote Sensing Conference.

JOHN S. DOUGLAS
Chairman of the Organising Committee

Dr. Nay Htun – Director & Regional Representative for Asia and the Pacific, UNEP, Thailand.

Dr. Ken McCracken – Director of CSIRO Office of Space Science and Applications, Australia.

Dr. Heng Thung – Project Manager and Co-ordinator, Regional Remote Sensing Program, ESCAP, Thailand.

Dr. John MacDonald – Chairman MacDonald Dettwiler, Canada.

Mr. Ray Arnold – Deputy Director Earth Science and Applications Division, NASA Headquarters, U.S.A.

A representative from the Indonesian Space Agency, LAPAN, Indonesia.

Tuesday 15 September

Presented papers on:

. SPOT
. DATA COLLECTION AND RECEPTION
. POLICY
. LAND-USE
. IMAGE PROCESSING
. GEOLOGY & ENERGY
. US/AUSTRALIA JOINT SCANNER PROJECT

Wednesday 16 September

Presented papers on:

. US/AUSTRALIA JOINT SCANNER PROJECT
. METEOROLOGY AND OCEANOGRAPHY
. GEOLOGY & ENERGY
. LAND-USE
. CARTOGRAPHY AND G.I.S.

Thursday 17 September

Presented papers on:

. IMAGE PROCESSING
. CARTOGRAPHY AND G.I.S.
. GEOLOGY AND ENERGY
. LAND-USE
. IMAGE PROCESSING
. WATER RESOURCES
. POLICY

Friday 18 September

Reviews of previous sessions and summaries by the chairpersons.

Closing addresses by:
RSAA President – Assoc. Prof. Bruce Forster
Organising Committee Chairman – Mr John S. Douglas

Saturday 19 September

Technical Tours

A number of Technical Tours have been arranged to give delegates the opportunity to visit some of Adelaide's High-Tech industries at Technology Park and other locations. Final details will be provided at the Conference.

WORKSHOPS

In conjunction and concurrent with the Conference a series of workshops will be held on the following topics:

Radar & Lidar
Chairman: Mr. M. Morgan
Dept. of Science & Technology, Adelaide, S.A.

Sensors & Platforms
Chairman: Dr. T. D. Cocks
CSIRO, Div. of Mineral Physics and Mineralogy, North Ryde, N.S.W.

Data Formatting
Chairman: Dr. J. O'Callaghan
CSIRO, Div. of Information Technology, Canberra, A.C.T.

High Resolution Spectra and Spectroscopy (C-130)
Chairmen: Dr. A.A. Green, Dr. J.F. Huntington, CSIRO, Div. of Mineral Physics and Mineralogy, North Ryde, N.S.W.

Interaction Between Radiation and the Land Surface
Chairman: Dr. D.L.B. Jupp, CSIRO, Div. of Water Resources Research, Canberra, A.C.T.

An Introduction to Radar Remote Sensing
Chairman: Dr. P. Morgan
Canberra College of Advanced Education, Canberra, A.C.T.

Social Program

Invitations to attend the official Opening Cocktail Party on Monday evening and the Conference Dinner on Thursday evening will be issued during registration for the Conference. In addition, an extensive accompanying persons program has been arranged. Activities include the viewing of Australian native fauna and flora, sight seeing, visits to historic towns, tasting of some of Australia's best wines (no Adelaide conference would be complete without it) and a range of other activities.

For further details about the Conference and associated activities, please contact the Conference Co-ordinator,

Ms Lia Michael
South Australian Centre for Remote Sensing (SACRS)
Innovation House, 1st Ave., Technology Park
The Levels, S.A. 5059.
Telephone (08) 2600134
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Facsimile (08) 3497003

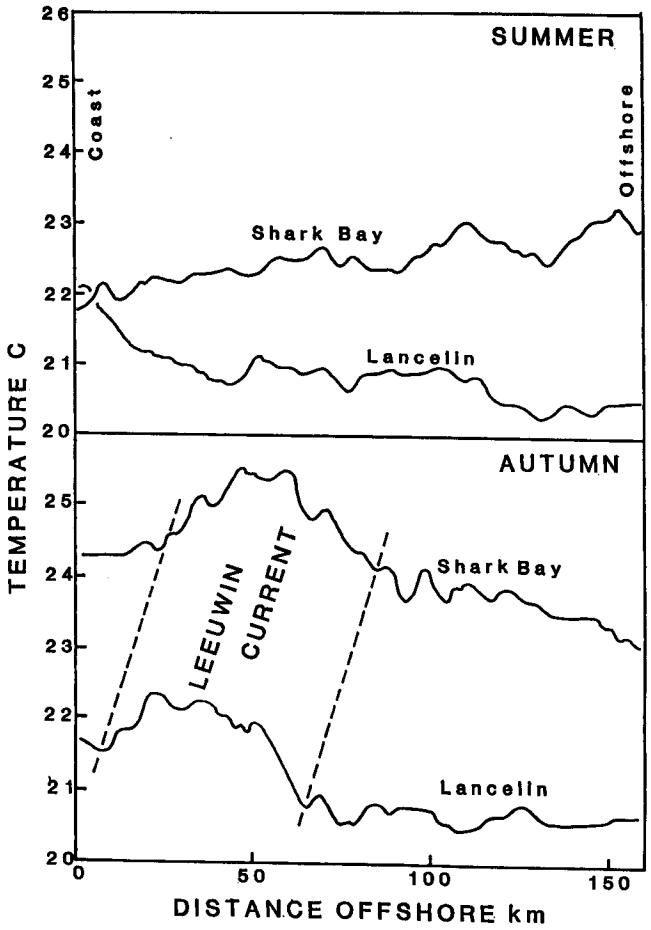

Figure 3: Sea-surface temperature profiles from the coast westwards across the flow, derived from the digital data for (a) NOAA7 orbit 18255 (6 January 1985), and (b) NOAA9 orbit 1789 (18 April 1985). The two sections are off Shark Bay (26°S) and Lancelin (30°S).

the project is attempting to quantify the "strength" of the southwards transport as a monthly index, expressed perhaps in terms of the temperature gradients across or along the stream axis. It is anticipated that the results will be of value in studies of the climate of Western Australia (for example, sea-surface temperatures may be related to drought/rainfall episodes), and to the fishing industry, as the larval migrations of commercially important species may be linked to the strength and behaviour of the Leeuwin Current (Phillips 1981).

Acknowledgments

We acknowledge the provision of NOAA imagery by the joint Curtin University/CSIRO satellite facility over the past 5 years.

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REMOTE SENSING ACTIVITIES IN CSIRO DIVISION OF MINERAL PHYSICS AND MINERALOGY

R.W.N. Cook

CSIRO, Division of Mineral Physics and Mineralogy
North Ryde, N.S.W. 2113

The Remote Sensing Group in CSIRO's Division of Mineral Physics and Mineralogy comprises a multi-disciplinary team involved in pure and applied contract research. The principal elements of the group's research incorporate:

- Image processing
- Spectral Data Processing
- Hardware Development
- Geological/Exploration Applications

The role of *Image Processing* and *Spectral Data Processing* software development is centred on techniques for geoscientific display and analysis of data recorded by satellite and airborne scanners, airborne spectrometers, and field and laboratory spectrometers. Recent successful developments have concentrated on new algorithms for extracting the weaker "mixed" signals from the new generation of high resolution scanners (Landsat TM and Geoscan) and spectrometers. Included in the framework of image processing is *Data Integration* of remotely sensed data, geophysical (magnetics, gravity, etc.) data and geochemical data (figure 1) with geological data. The software has been developed for use on VAX 11-780 and HP-1000 series computers together with Unix-based workstations, and ith IBM AT series personal computers.

Fig. 1 Data Integration. This density sliced image depicts lithological, topographical and stream geochemical data integrated with Landsat imagery. Shown are relative concentrations by colour density of tin, niobium and tungsten. Forsayth, QLD, 1:100 000 map sheet.

Hardware Development of sensors and data acquisition systems have been undertaken both in-house, jointly with other CSIRO divisions and with numerous public and private sector organisations.

Projects completed and underway include modifications to, and upgrading of, existing instruments such as the Daedalus Thermal IR Scanner and IRIS Field Spectrometer, as well as the design, construction and development of new instruments for use in satellites, aircraft, in the laboratory and in the field.

Notable among the many and varied hardware development projects are: the ACRES/CSIRO (Landsat Thematic Mapper) Signal-Processing Experiment; UNSW/CSIRO silicide detector development; airborne

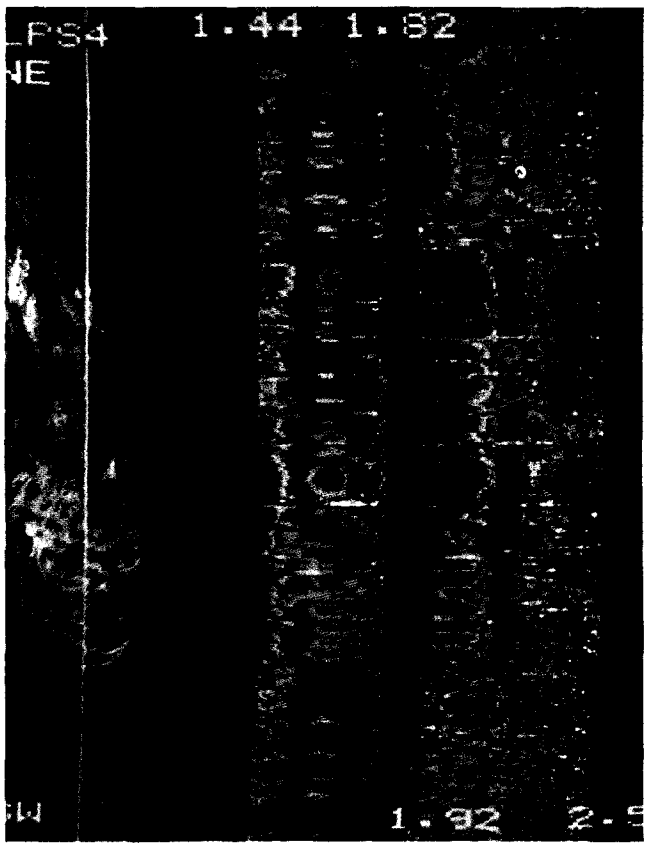

Fig. 2 Spectral Analysis. Density sliced airborne spectroradiometer data (right) co-registered to simultaneously acquired airborne scanner data (left). Two windows of spectroradiometer data have been processed to logarithmic residuals from 1.44 to 1.82 m and 1.92 to 2.5 m leaving out the atmospheric water absorption feature that occurred at 1.9 m. Absorbtion features can be correlated to various mineralogical species known to occur on the ground. The approx. 3 km flight line is situated at Mount Leyshon, QLD.

profiling spectrometer, imaging spectrometer, laser spectrometer, and pushbroom scanner design and development; field portable spectrometer design; micro-computer based image-processing systems; and general-purpose high-speed data-acquisition systems.

Geological/Exploration Applications research is being undertaken at several prospects across the country and internationally in conjunction with numerous mining companies, through AMIRA and various national and international public and private sector organisations. The goal of the work is the development of better techniques to determine the presence and distribution of geological minerals, in particular those minerals and structures relevant to mineral and hydrocarbon exploration.

These projects include investigations into the spectral properties of Australian terrain (figure 2); spectral discrimination of "clay" alteration minerals; the US/Australia Joint Scanner Project; chlorite and kandite studies; spectral discrimination of iron oxide species and vegetation (figure 3); fracture pattern analysis; hydrocarbons exploration; and a collaborative project with the New Zealand DSIR. Data sets used for this work include those from Landsat MSS and TM, aircraft Daedalus TM, Meis-II, and Geoscan scanners, various airborne spectrometers and field spectrometers.

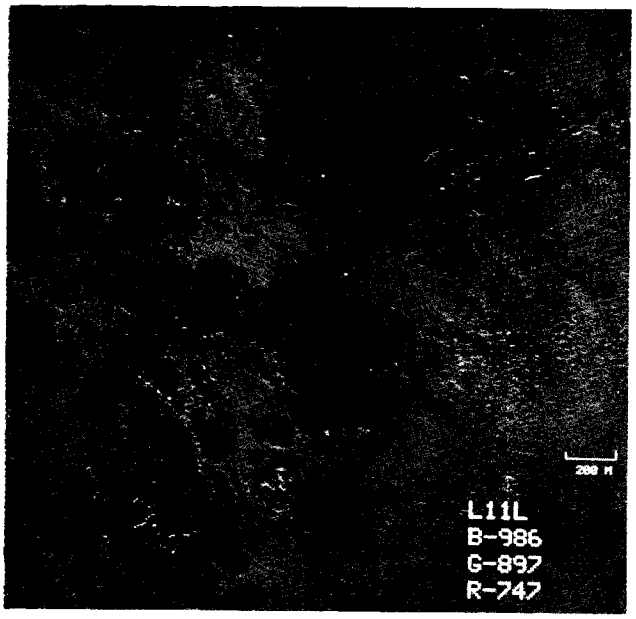

Fig. 3 Iron Oxide Species Mapping. MEIS-II logarithmic residual colour composite over lateritized mesas on the northern end of the Lady Annie/Lady Loretta (nr. Mt Isa, QLD) flight line. The mesa tapes have a strong hematitic response (dark blue/magenta), whereas the weathering aprons around the mesas are goethitic (red/orange).

The Remote Sensing Group is also evaluating the application potential of various instruments and expert systems for spectral identification, and compiling a spectral library of characteristic minerals, rocks and soils.

Various non-geoscience projects have been and are being undertaken. They include dry grassland, wheat and frost monitoring, sink-hole location mapping and, notably, involvement in the Aquarius Bushfire Project. Members of the team are also involved in various remote sensing education facilities.

All three images shown are the product of inhouse software and hardware development.

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Dr. J.F. HUNTINGTON – Geological/Exploration Applications.
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PROFESSIONAL PAPERS

AN ENVIRONMENTAL IMPACT STUDY USING LANDSAT

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Canberra

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Environment Science & Services P/L
Spring Hill, Brisbane.

Abstract

A major environmental impact study carried out in the sand dunes of eastern Cape York used image analysis of remotely sensed data to both select sites for ground investigation and categorise the different ecological units present. The approach adopted was particularly suited to the type of environment in question and allowed a high degree of quantification, at a high level of confidence, at costs several orders of magnitude less than conventional methods.

Introduction

The Shelburne Silica Joint Venture proposed to establish an extractive industry in the Olive River Dunefield, to the south of Shelburne Bay, Cape York (figure 1). Before this project could proceed an environmental impact study (EIS) was required and Macdonald Wagner P/L was commissioned to produce this (Macdonald Wagner, 1986) in addition to their engineering feasability study. Macdonald Wagner P/L sub-contracted much of the study of the existing environment to Environment, Science & Services P/L who assembled a team of specialist consultants to carry out the study and provide a report on the Olive River Dunefield. The authors formed part of that team. As part of the EIS the vegetation, soils and topography of the surrounding region were required to be studied and mapped at a regional scale, and in the area surrounding the proposed development a more detailed study was required. The EIS involved studying a remote and inaccessible area of some 700 to 800 square kilometres. From the beginning it was clear that the EIS was likely to become the centre of some controversy and a study methodology was sought which would give results at a high level of confidence and yet remain both time and cost-effective.

The Olive River Dunefield, like many of the sand bodies of the east and north coasts of Australia, shows a very close association between soils, vegetation, topography, and age of the deposit. Coaldrake (1961) showed this in the coastal sands of south-eastern Queensland and more recent work by Thompson and others at Cooloola (Thompson, 1981; Walker et al, 1981) shows that with increasing age the depth to the B horizons of the dune podsol increases and the amounts of total phosphorus and potassium in the surface layers of the soil decreases. An up to date review of work in this area is contained in Myerscough and Carolin (1986).

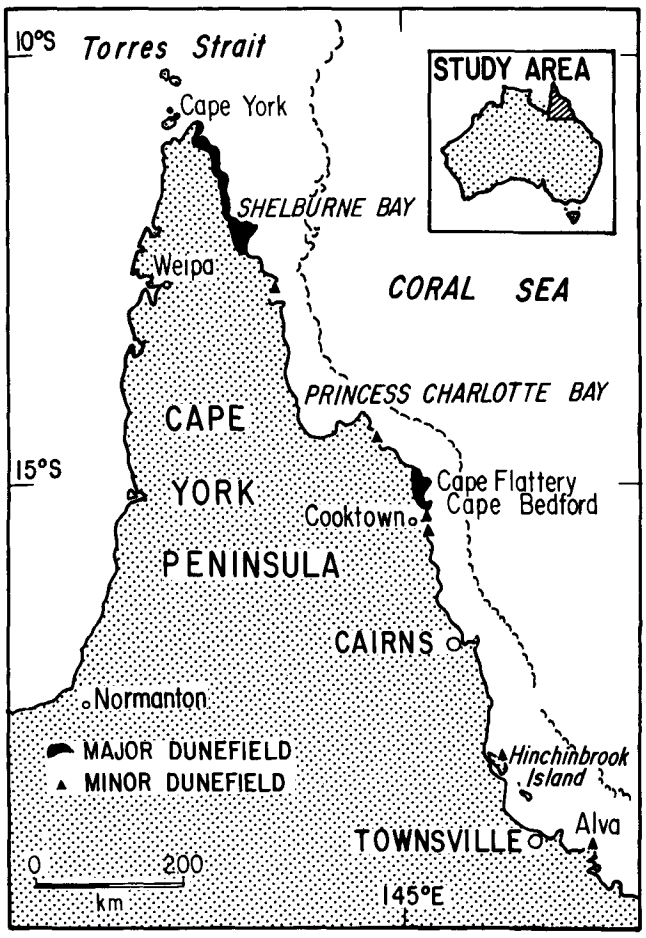

Figure 1: Distribution of dunefields along the east coast of Cape York.

Podsolization

Podsolization is a progressive process in which the original character of the sand body changes through

time. As acid ground waters percolate down through the sediment, soluble minerals are leached from the upper layers of the deposit. This zone of depletion is called the A horizon. The minerals are deposited in lower parts of the sediment called the B horizon. The depth of the leached horizon increases with time. Sesquioxides and clay minerals in the upper part of the B horizon are continually being remobilised by organic acids and redeposited lower in the profile. Over time, deep white A horizons develop from which much of the clay, iron, manganese and aluminium has been removed. The underlying B horizon initially undergoes a period of marked reddening, but after continued weathering a dark brown colour develops. As the process of podsolization proceeds, the upper A horizon becomes increasingly loose with the removal of clay material and any disturbance to the overlying vegetation may lead to the remobilisation of this A horizon.

Soils

In the Olive River Dunefield the white A horizon sands are typically very well drained and have a composition of greater than 99.7% quartz sand. They tend to be deficient in most nutrients. The B horizons tend to consist of red-brown loamy sand which is richer in minerals and often incorporates a gravelly lateritic horizon.

The Olive River Dunefield is less complex than many of the dunefields to the south where a considerable amount of reworking has occurred. The formation of the older dunes in the Olive River Dunefield has been dated by Thermoluminescence to between 15000 and 18000 years ago. Deep podsols formed within these dunes and subsequent periods of remobilisation of A horizon sands during the last 1000 years have led to the exposure of the underlying red to red-brown, comparatively nutrient-rich B horizon. These two dunesand units form the most extensive geomorphic units in the dunefield. Some transgression by very recent marine sands, and some areas of exposed bedrock, make up much of the balance.

Topography

The area of older dunes is characterised by a 'hummocky' topography with gentle slopes and comparatively low relief. The soils are derived from the B horizons and consist of red and yellow loamy sands. The older dunes form a very large proportion of the north-eastern part of the study area (figure 2).

In contrast, the younger dunes form a more dramatic topographic unit with marked breaks of slope, wide areas of low lying interdune sand plain and numerous shallow lakes (figure 3). The soils of these dunes tend to be undifferentiated, almost chemically pure, silica sands derived from the remobilised A horizons of older deposits. The large areas of inter-dune sand plain typically have groundwater humicretes forming in the white sand areas outside the lakes and aquatic humicretes forming within the lakes. This unit forms the bulk of the western part of the dunefield. The small areas of exposed bedrock, the Recent beach-ridge plain and its overlying transgressive dune sheet are all associated with distinct soils and vegetation units.

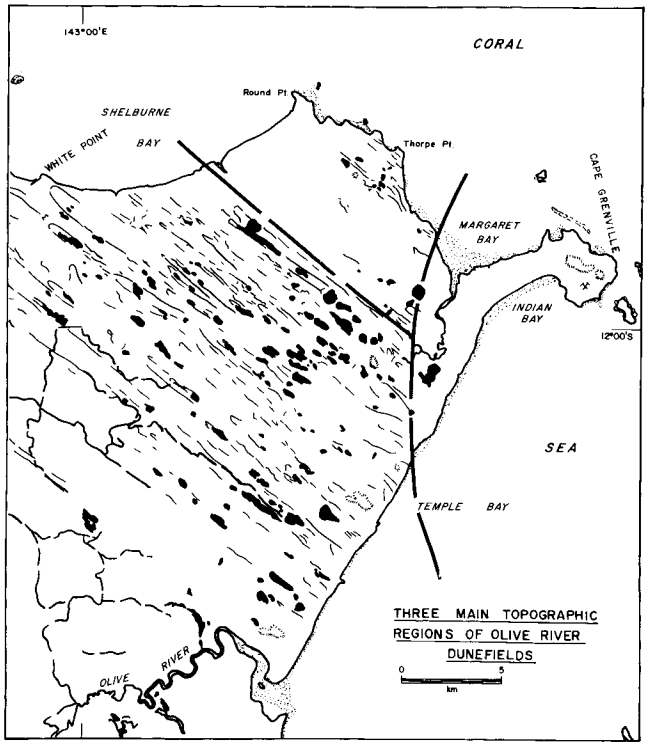

Figure 2: The three main zones of the Olive River dunefield consist of the remnants of older, stable dunes to the north-east, a Recent beach-ridge plain linking the dunefield proper to Cape Grenville in the east, and the modern, active dunefield to the south-west.

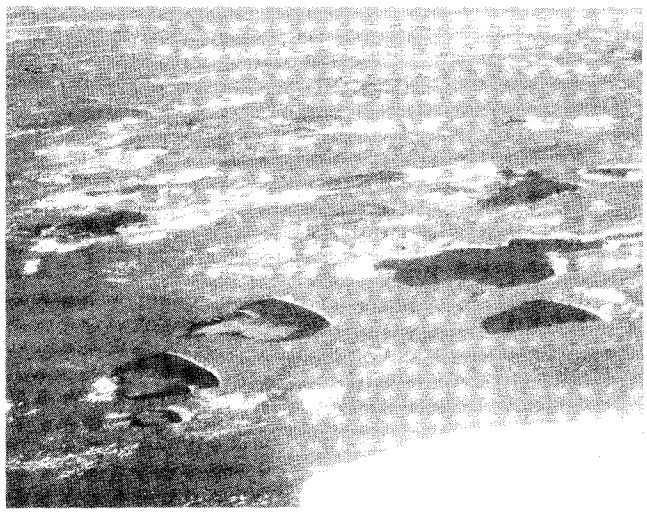

Figure 3: An oblique view of a section of the modern, active dunefield.

Vegetation

The deep, red sandy B horizons of the older dunes support areas of closed broad leafed forest and open eucalypt forest with a closed, broad leafed understorey. The white sands of the Recent, mobile dunes and the

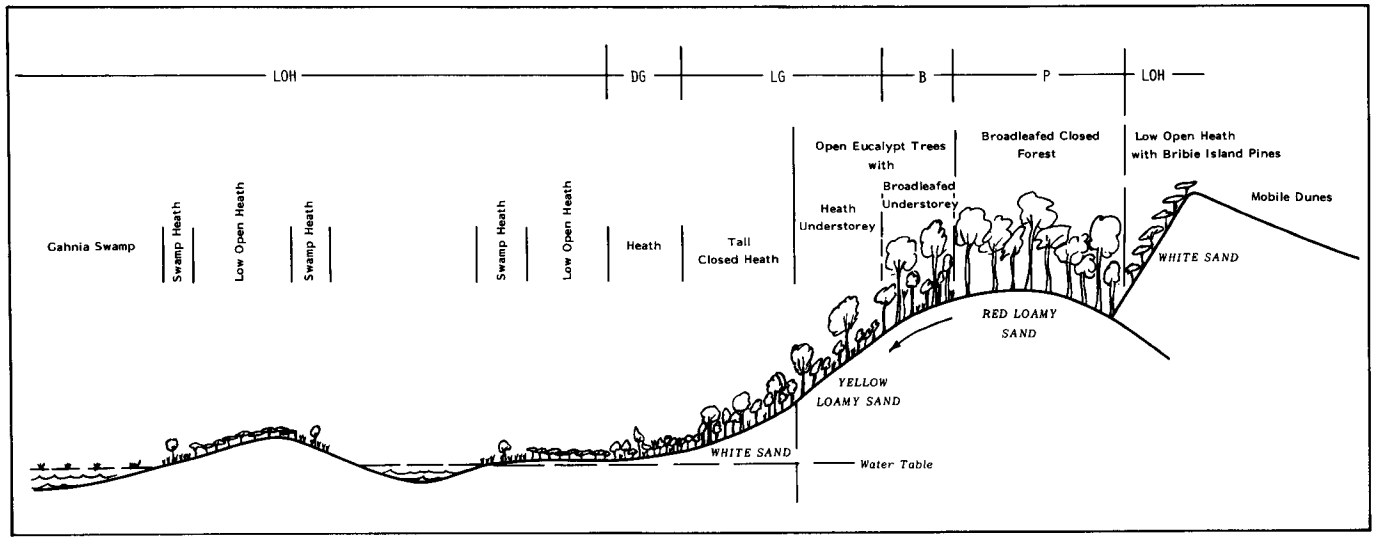

Figure 4: An idealised cross-section of the dunefield showing the relationship between topography, soils and vegetation. The codes across the top correspond to the classes in figure 7. 'P' is pink, 'B' is blue, 'LG' is light green and 'DG' is dark green.

inter-dune sand plain support heath vegetation whilst the yellow loamy sands, which grade between areas of white sands and red sandy loams in many places, support an open eucalypt forest with a heath understorey (figure 4).

Some small areas of anomalous vegetation which did not fit this general pattern were noted. The areas of exposed sandstone on the coast support a prostrate community containing a significant number of heath species. The outcropping granidiorite near the mouth of the Olive River carries a low closed forest dominated by hoop pine. A littoral scrub containing several broad leafed species characterises the strandlines of modern marine sand in the bays on the east coast of the study area and grades into a more extensive area of closed forest on the modern (late Holocene), comparatively unweathered, marine sands of the beach-ridge plain. Mangroves fringe much of the coastline and tidal inlets of the area. The marked differences in ecological units noted in the study area, and the close association between vegetation, soil and geomorphology, suggested that digital analysis of remotely sensed data was likely to be a useful basis for the field investigation.

Image analysis

Initial work in the area was based on hard copy produced from a digital image enhancement of LANDSAT 2 data acquired on 31/10/80, the most recent cloud free scene at that time. Processing included contrast enhancements (equalisation, exponential stretch, and logarithmic stretch of the image histogram), principal components analysis (PCA) and pseudo-colour density slices. Whilst PCA had proved useful in the Cape Flattery - Cape Bedford Dunefield to the north of Cooktown, it was of little use in the Olive River Dunefield. The enhancement with the greatest correlation to the ground patterns of interest were the pseudo-colour density slices of bands 4, 5, and 7 combined, a crude classification in effect (figure 5). This work was reported in Lees and Tassell (1984).

Figure 5: Pseudo-colour density slice of bands 4, 5 and 7, LANDSAT 2 MSS.

For the current exercise this experience was built on and a sequence of supervised, maximum likelihood classifications were produced on a Dipix Systems Ltd. (Canada) LCT-11 Image Analysis System by Technical and Field Surveys P/L. The information classes selected for the classification omitted the communities of broad leafed species because of the reflectance characteristics of these plant communities. Areas of monsoon vine forest and other areas of broad leafed species tend to have a high variance around their mean reflectance values. Experience has shown that classes based on such communities 'swallow up' closely related, tightly clustered classes to the detriment of the final utility of the analysis. Instead the information classes selected corresponded to the following plant communities: open eucalypt forest with closed broad leafed understorey, open eucalypt forest with heath understorey and tall heath (these were indistinguishable), and heath. A further information class which was believed to represent swamp communities was later found to represent humic stained water. The classification was superimposed on a standard false colour composite (figure 6)

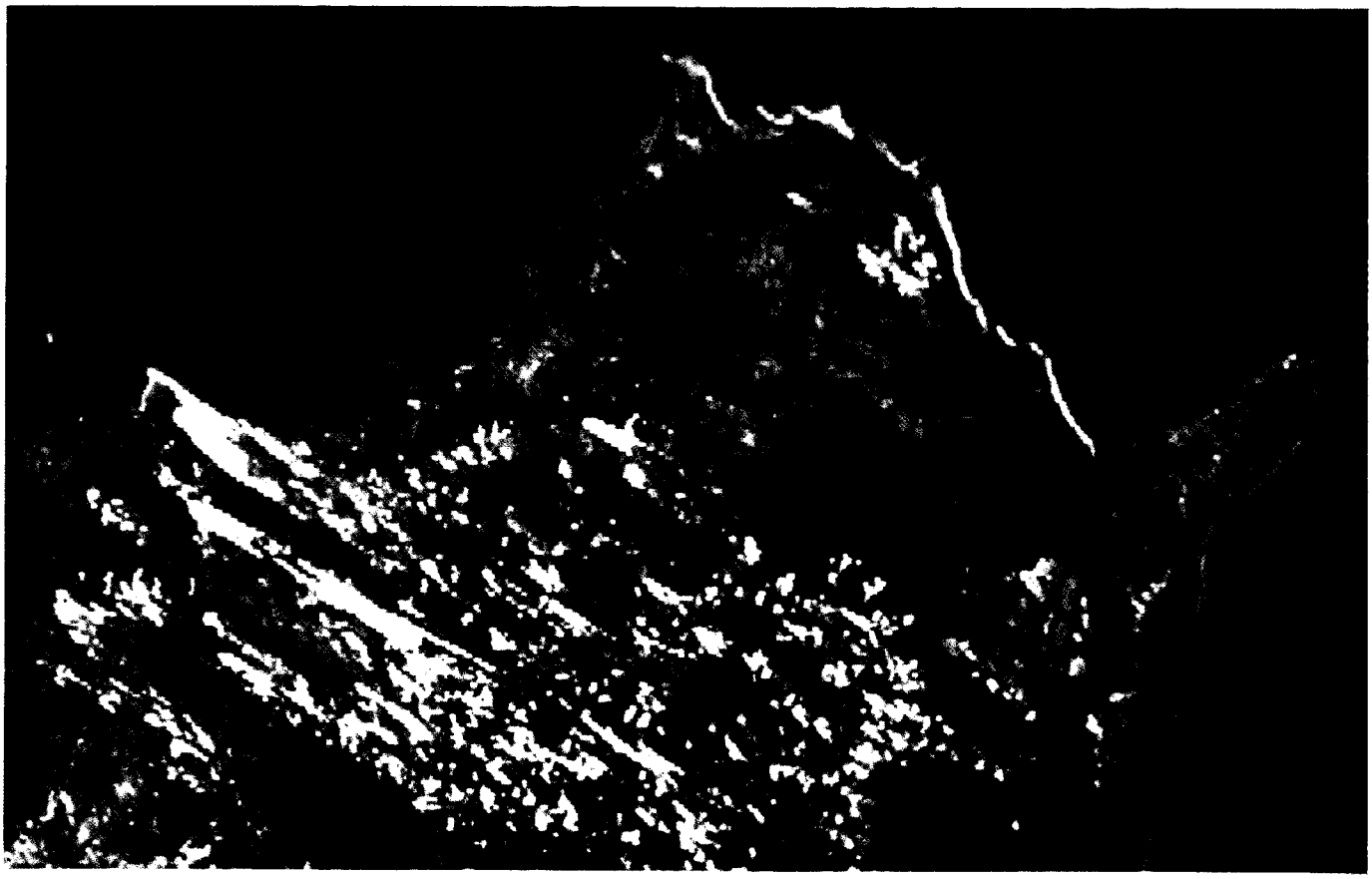

Figure 6: Standard false colour composite, LANDSAT 2 MSS

Figure 7: Final classification superimposed upon the standard false colour composite. The yellow class is humate stained water. Figure 4 contains the key to the information classes.

which resulted in the areas of monsoon vine forest and other areas of broad leafed species being displayed in red/pink (figure 7). This was appropriate as these are areas of high conservation value and needed highlighting.

The confusion over the information class which was initially ascribed to swamp vegetation communities resulted from the presence of suspended or dissolved humate due to bacterial breakdown of organic matter and subsequent leaching of humus by rainwater. Surface streams and lakes in the study area are frequently black or brown and were part of a fresh water class representing lakes and streams in the dunefield and fresh water effluent in the nearshore zone.

Field checking of the classification was carried out by a number of extensive transects on foot. The locations of these transects was selected both by examination of hard copy of the classifications and by aerial examination from a helicopter. An extensive collection of plant material was made during these transects and the soil associations checked by augering. Once a high degree of confidence in the relationship between information classes and plant communities was gained the classification was used as a predictive tool, and the predictions field checked.

Final transects were made by helicopter to visit areas not previously covered on foot.

The classification was finally used to give areal estimates of the various communities identified in the study area. The LCT-11 calculated the areas of each information class in hectares, both for the project area and for the whole dunefield. This was important in assessing the extent of threatened communities outside the project area and provided a quantitative basis for assessing the impact of the project on the environment, the aim of the exercise.

Comment

The use of image analysis of LANDSAT data in this study meant that a very large section of the EIS could be carried out very accurately, efficiently and cost-effectively. Given suitable environments, it is clear that digital analysis of remotely sensed data can be an extremely effective adjunct to field investigation. In terrain such as this, where movement on foot is difficult, and in remote areas where extensive use of helicopters is very costly, expensive field time can be minimised using this study methodology. The coastal sand bodies of Australia appear particularly suited to this approach.

Acknowledgements

The figures presented are from Macdonald Wagner (1986). The paper summarises much more extensive discussions contained in the EIS.

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REMOTE SENSING OF CORAL REEFS: AUSTRALIAN INSTITUTE OF MARINE SCIENCE

Russell Reichelt

Australian Institute of Marine Science

Abstract

A project underway at the Australian Institute of Marine Science aims to evaluate remotely sensed data in order to monitor the changes that occur in shallow coral reef communities from one year to the next. Special emphasis is placed on assessing the use of satellite imagery to monitor the impact of ***Acanthaster planci*** *(the "crown of thorns" starfish) on the Great Barrier Reef.*

Introduction

The Australian Institute of Marine Science (AIMS) is a statutory authority with headquarters in Townsville, North Queensland, and is actively carrying out research into tropical marine phenomena. Until recently remote sensing work at AIMS has involved mainly oceanographic applications. A number of scientists (Drs Eric Wolanski, Derek Burrage, John Andrews and Masamichi Inoue) are working on the mapping of water masses using both ocean colour measured by Coastal Zone Color Scanner, Landsat and aerial photography, and also sea surface temperature estimated from NOAA Advanced Very High Resolution Radiometer data. The recent outbreaks of predatory starfish on the Great Barrier Reef have focussed attention on the applications of remote sensing to monitor ecological changes that occur on coral reefs over periods of months to years.

The crown-of-thorns starfish.

In response to concerns about the large scale impact of outbreaks of the starfish, *Acanthaster planci* (photo 1), on the coral communities of reefs in the central Great Barrier Reef region it was suggested that the effects may be visible in remotely sensed data such as that from the Landsat MultiSpectral Scanner, the Landsat Thematic Mapper or the French satellite SPOT. This suggestion has formed the basis of one project at the Institute aimed at detecting the changes that occur after large starfish outbreaks have occurred on a reef.

Photo 1: ***Acanthaster planci*** *is a large predatory starfish that eats live coral tissue. Specimen shown here is about 50cm in diameter.*

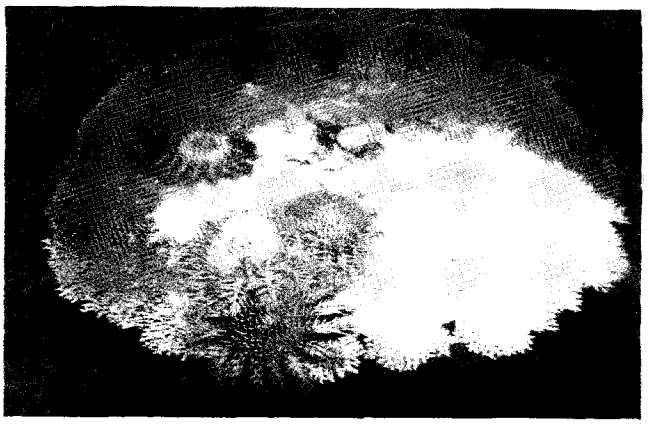

Photo 2: Feeding starfish leave white dead patches on a large plate coral.

The crown-of-thorns starfish digest the thin layer of living coral tissue (photo 2). This leaves the coral's white skeleton exposed as a fresh unprotected surface for the relatively rapidly growing algae that begin to colonize this surface within a few weeks after the coral's death. When starfish populations reach tens of thousands on a reef, the coral mortality may be very widespread (occuring over kilometres of reef) and the reef system changes from one dominated by living corals to one dominated by dead coral covered with algae. This change in the biological community is assumed to change the 'colour' of the reef. Severely disturbed coral reefs may take 10 to 15 years to regain their cover of live coral (Moran et al 1985, Moran 1986).

Because the starfish outbreaks have had a significant impact on reefs over a very large area (about one third of the Great Barrier Reef), a cheap survey method that would highlight areas of starfish activity would be of great benefit to both researchers and managers of the GBR. The only survey technique available at present involves large numbers of divers and months of expensive ship charter to cover any substantial area of the GBR. Turning to remote sensing methods, the first efforts will involve the Landsat Multispectral Scanner (MSS) data because it is relatively cheap and there is a large historical database. Other sources of remotely sensed data may be used in the near future.

MicroBRIAN

In order to study the applications of remote-sensing to research problems on the Great Barrier Reef, AIMS has installed a MicroBRIAN imagery analysis work station. This commercially available, microcomputer-based system is an important product of CSIRO's Division of Water and Land Resources research (Jupp et al 1985a, 1985b). The early development work was done in collaboration with the Great Barrier Reef Marine Park Authority (GBRMPA) and the Australian Survey Office (ASO). This system permits the manipulation of imagery data in a way that allows the user to explore a variety of enhancement procedures which may include the incorporation of local expert knowledge into the interpretation of the images. GBRMPA and ASO are already using the CSIRO system for mapping the Great Barrier Reef Marine Park with tremendous cost savings accruing from the use of satellite imagery rather than extensive ground survey. The level of detail provided by the ASO's standard coral reef imagery products (see ALS Newsletter, November 1985) is excellent for the purpose of developing management plans for the Marine Park.

Ground truth data

For the starfish project a set of 3 images of John Brewer reef (near Townsville) was purchased from the Australian Centre for Remote Sensing. The images were recorded at times that spanned the duration of a very large starfish outbreak on that same reef between 1983 and 1985 (Moran et al, 1985). These data have been analysed both on the MicroBRIAN system and on the larger facilities of the Australian Survey Office. Although there is variation among the 3 images, the question then arises as to whether this variation is caused by the effects of the starfish or by some of the other possible sources of variation such as water depth and quality at the time of the samples.

Verifying the interpretation of the imagery is complicated by the lack of detailed ground data taken at the time of sampling. Although the starfish distributions were plotted by divers during the outbreak, the detailed distribution of corals and other organisms is not well known for this period. The survey of starfish effects, before and after the outbreak, would demand a distinction to be drawn between sand, coral and algae at the least. The CSIRO Division of Water and Land Resources' results have demonstrated the efficacy of Landsat MSS as a tool for mapping geomorphological zones (Jupp et al 1985b) but did not extend the work into the problem of mapping biological patterns in the reef's benthic cover within the broader reef zones.

In the crown of thorns starfish project the first aim is to test a range of field procedures for collecting ground truth data at a level of detail that would permit the distinction of starfish effects from other sources of variation. Of course, the feasibility of making this distinction ultimately depends on the level of variation in the image data caused by the starfish 'signal' compared with the variation caused by all the other factors. A by-product of this work is expected to be an assessment of a number of field survey techniques that can be used to measure the amount of sand, live coral, dead coral and algae on the shallow areas of the reef. This assessment will include a "cost-benefit" exercise, comparing the sampling efforts required for a range of field techniques with the degree of detail necessary to interpret the imagery.

The problems of shallow water mapping.

At this stage of the starfish project the field work has been completed and data analysis is underway. The sample sites at John Brewer Reef were fixed relative to the Australian Map Grid and then surveyed underwater by visual census and by line transect methods. Unfortunately, the likelihood of tracking changes in algal cover in Landsat MSS imagery to the level of detail required for the starfish project is not particularly high. The 80m x 60m pixel size of Landsat MSS is a little too coarse when compared with the size of some of the high coral cover zones of coral reefs (see photo 3). A further problem is that the spectral channels being recorded may be too far from the blue end of the visible spectrum. Most of the information on benthic cover is concentrated in only two of the four bands.

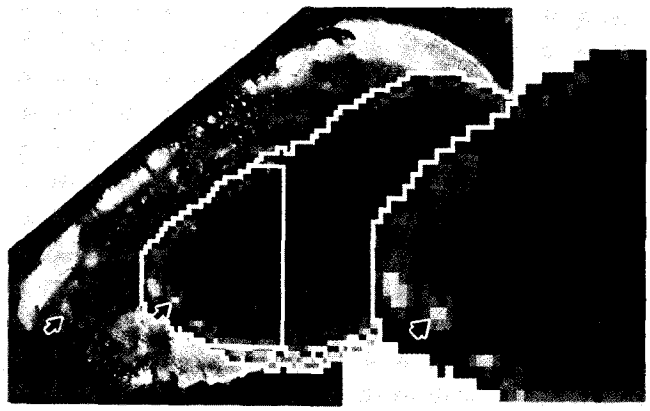

Photo 3: Overlay of a Landsat MSS image of John Brewer Reef onto an aerial photo shows the relative coarseness of the satellite imagery. The western end of the reef is enlarged on the right and the same set of patch reefs are marked in each case.

Better prospects for fine scale studies of benthic cover may lie in the use of SPOT and Landsat Thematic Mapper data because of their higher spatial resolutions. Data from both sources are presently under investigation. The potential is also good for both airborne scanner data and aerial photography for the same reason.

Another area of special interest is the quantitative comparison of images recorded at a number of different times. Such multi-date images require careful rectification to permit the mapping of one image to another. It is hoped that the transient features in the images can be distinguished from the more persistent features. This is essential if the ground-truth study described earlier is

to be extended into an assessment of remotely sensed data as a monitoring tool rather than a once-only mapping tool.

Acknowledgements

The surveying work at John Brewer Reef was done by Mr Grant Kelly (of Kelly and Karavas, Townsville) with assistance from the Australian Survey Office.

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REMOTE SENSING DIRECTORY

The following brief descriptions provided to the editor, give details of bodies that have an involvement or interest in remote sensing at either a state or federal level.

ALCORSS – CUCRS

An important function of the Australian Centre for Remote Sensing is to provide secretariat support for two advisory committees. The committees provide advice on satellite remote sensing to the Department responsible for the operation of the Centre. These committees are:

. the Australian Liaison Committee on Remote Sensing by Satellite (ALCORSS); and

. The Commonwealth Users' Committee on Remote Sensing (CUCRS).

The Australian Liaison Committee on Remote Sensing by Satellite

ALCORSS representation is drawn from the Commonwealth, the six States, the Northern Territory and from private industry, universities, colleges of advanced education and the CSIRO. Each member represents a constituency of users of remote sensing data/technology, to provide input and advice that will benefit the remote sensing industry.

State/Territory

New South Wales
Mr. D. Grant
Surveyor General, NSW
Dept of Lands

Victoria
Dr. P. Rudman
Dept of Conservation
Forests & Lands, Vic

Queensland
Mr. K. J. Davies
Surveyor General, Qld
Dept of Mapping & Surveying

Western Australia
Mr. H. J. Houghton
Manager
WA Remote Sensing
Applications Centre

South Australia
Mr. J. S. Douglas
Director
South Australian Centre for
Remote Sensing

State/Territory (Contd.)

Tasmania
Mr. R. G. Roberts
Director of Land Information
Dept of Lands, Tasmania

Northern Territory
Mr. T. Menzies
Assistant Director
Dept of Lands, NT

Organisations/Institutions

Universities
Professor J. A. Richards
Head, Dept of Electrical &
Electronic Engineering
Australian Defence Force Academy

Colleges of Advanced Education
Dr. W. Carroll
Head, Dept of Communications &
Electrical Engineering
Royal Melbourne Institute of
Technology

Organisations/Institutions (Contd.)

INDUSAT (Industry)
Dr. E. E. Swarbrick
President, INDUSAT

Commonwealth
Mr. C. J. Simpson
Remote Sensing Group
Bureau of Mineral Resources

Chairman
Mr. C. Veenstra
Director
Division of National Mapping

Secretary
Mr. D. J. Gray
Manager
Australian Centre for Remote
Sensing

CSIRO
Dr. K. G. McCracken
Director, CSIRO Office of Space
Science & Applications

Major Achievements

- A decentralised network of eleven remote sensing reference centres have been established in various universities and other centres of excellence.
- Providing advice and resources to the remote sensing working group of the Department of Science, Scientific Industries Steering Committee for the promotion of Australian expertise in the South East Asia and Pacific regions.
- Announcements of opportunity to participate in the evaluation phases of remote sensing satellite programs of other countries have been widely publicised and responses encouraged. The most notable success was the acceptance of seven Australian proposals by the French Space Agency, CNES, for evaluation of SPOT data.
- Provided evidence to the Australian Academy of Technological Sciences Inquiry on Space, Science and Technology for Australia.
- Published report "Earth Resources Satellites – Current Australian Activities and Future User Activities (1982)".

Overview

ALCORSS provides the most important source of advice available to the Commonwealth on remote sensing needs and activities; it assists in liaison and co-operation with the user community, and provides expert advice to other bodies, where remote sensing can be an adjunct to their central objectives.

The Commonwealth Users Committee on Remote Sensing (CUCRS)

This Committee was established to provide a forum for consultation, liaison and co-operation between Commonwealth Departments and Organisations which have operational research or co-ordinating responsibilities involving remote sensing activities.

It also provides a means whereby Commonwealth views on remote sensing matters can be formulated for presentation to ALCORSS and to provide Commonwealth user representation on ALCORSS.

Membership of CUCRS comprises the following representatives:

Chairman

Mr. C. Veenstra
Director, Division of National Mapping
(Department of Resources & Energy)

Secretary

Mr. D. J. Gray
Manager, Australian Centre for
Remote Sensing
(Department of Resources & Energy)

Members

Ms. C. Astley-Boden
CSIRO

Dr. J. O'Callaghan
CSIRO

Members (Contd.)

Mr. G.H.S. Hooper
Department of Primary Industry

Mr. R. Goleby
Department of Science

Dr. D. Gauntlett
Bureau of Meteorology
(Department of Science)

Detective Inspector S. D. Kendall
Australian Federal Police

Mr. R. M. Thackway
Australian National Parks &
Wildlife Service

Mr. C. McMaster
Australian Centre for Remote Sensing
(Department of Resources & Energy)

Members (Contd.)

Dr. D. McCrae
Department of Arts, Heritage &
Environment

Mr. D. Grabb
Department of Housing & Construction

Mr. C. J. Simpson
Bureau of Mineral Resources
(Department of Resources & Energy)
(CUCRS representative on ALCORSS)

Col. A. Laing
Royal Australian Survey Corps
(Department of Defence)

Mr. P. Holland
Australian Survey Office
(Department of Local Government &
Administrative Services)

Further information on ALCORSS and CUCRS can be obtained by writing to the Secretary, Mr. D. J. Gray, PO Box 28, Belconnen, ACT, 2616.

INDUSAT

INDUSAT is an Australian resource industry satellite group set up in 1977 with the aims of:

- Co-operating with the Australian Government to assist in providing optimum facilities for utilising earth satellite data in Australia,
- Educating people in the resource industries in the use of satellite and related remotely sensed data via sponsorship of courses and seminars, and

. Corresponding with similar groups overseas.

The group has a current membership of companies in the mineral exploration and agricultural industries.

Management of the group is by a committee of eight elected member companies from which a President, Vice-President, Secretary and Treasurer are selected.

Membership of the group is open to all companies or private organisations operating in Australia who are interested in the application of satellite and other remotely sensed data.

For further information concerning membership please contact:

INDUSAT GROUP
C/- M. C. Aubrey

GPO Box 722,
CROWS NEST NSW 2065

AUSTRALIAN SPACE BOARD

In September 1986 the Federal Government announced details of a national space policy which included the setting up of the Australian Space Board.

The role given to the Board by the Government is to co-ordinate and manage a national space program, provide a focal point for liaison activities both nationally and internationally, encourage the involvement of industry in space R&D activities and provide advice to the Government on space R&D priorities in accordance with the Government's broader general industry policy framework.

The Board comprises a Chairman and four other members appointed by the Minister for Industry, Technology and Commerce and an Executive Member from the Minister's Department. The Board is a non-statutory body and members serve on a part-time basis.

Members of the Board are:

Mr. R.D. Somervaille AM, Chairman of the Overseas Telecommunications Commission (Chairman)

Mr. I.J. Bettison, Consultant and Company Director

Professor J.H. Carver, Director and Professor of Physics, Research School of Physical Sciences, Australian National University

Dr. K.G. McCracken, Director, CSIRO Office of Space Science and Applications

Mr. R.A. Wheeldon, Joint Managing Director, BWD Industries Ltd

Dr. A.H. Hayman, Principal Adviser, Department of Industry Technology and Commerce

National Space Program

The major objective of the Government's space policy is to increase involvement by industry in space research and development activities and to promote development of commercially viable industries based on space technologies.

The National Space Program, which was set up in 1985, aims to promote industrial R&D through selected space-related project work. The Australian Space Board is responsible for the supervision of the program's activities.

Project proposals in properly documented form are welcomed from the community, particularly from industry, and should be directed to the Australian Space Board.

Criteria against which proposals will be judged are complex, particularly when there are more proposals than can be funded. In its policy statement on space, the Government provided the following broad criteria against which programs will be judged:

. development of technologies and skills needed to compete successfully in the international market in space and other high technology industries

. selection of projects likely to have significant spin-off benefits for other industries

. targeting of the programs at space technology markets in which Australia is at a similar point on the learning curve to other countries

. development/expansion of scientific research efforts to support industry participation in space activities

Funding of the program is through the Department of Industry, Technology and Commerce.

Enquiries should be directed to:

The Australian Space Board
Department of Industry, Technology and Commerce

Edmund Barton Building
Barton, A.C.T. 2600

AMIRA

The Australian Mineral Industries Research Association Limited – AMIRA, was set up in 1959 to act as a research and development broker and manager for the resource industries. Close to 100 companies, members, associate members and divisions of member companies, sponsor the research and development. From this membership, a council of 15 senior members is elected to be the policy making body of the Association.

The Association has no research facilities of its own. Instead, to achieve its aims it initiates and co-ordinates projects through a small permanent secretariat, giving all research contracts to outside groups.

Since its inception AMIRA has used this unique system for initiating, funding and managing jointly sponsored research for more than 200 projects. There are 50 current exploration, mining and processing contracts valued at over $11 million.

Over the past 10 years approximately $1.4 million has been directed towards the CSIRO Remote Sensing Group at North Ryde. This has involved AMIRA in co-ordinating five remote sensing projects sponsored by a total of 35 companies and government agencies. Early work was directed at developing reasonable products from the Landsat MSS data tapes supplied by NASA. Subsequent projects were directed at aircraft scanner and spectrometer systems for differentiating surface mineralisation and alteration applicable for mineral exploration. These studies were backed up by laboratory and ground spectrometer measurements.

A major achievement more recently has been the "Signal Processing Experiment" where AMIRA/ CSIRO/ACRES supported by 36 sponsors recorded Landsat Thematic Mapper data over Australia, PNG and part of Indonesia.

This has provided the community with access to some Thematic Mapper digital data in advance of upgrade of the ACRES facilities in Alice Springs and Canberra.

Enquiries:

Mr. Jeff D. Bailey
Research Co-ordinator – Exploration
AMIRA
11th Floor
63 Exhibition Street
Melbourne Vic 3000

Telephone: (03) 6548844
Telex: AA 38530
Facsimile: (03) 6548661

THE ASSOCIATION OF AERIAL SURVEYORS, AUSTRALIA

The AASA was formed in 1982 to represent the private enterprise sector of the aerial surveying profession in Australia.

The main aims and objectives of the Association are to:–

* advance and protect the interests and status of the science and practice of all facets of aerial surveying and to be the representative organisation dedicated to promoting the interests of members of the Association.
* define and maintain a code of practice for aerial surveyors and to promote and defend honourable practice by members.
* represent the role and voice of the private sector of the aerial surveying profession in the mapping of Australia and in so doing to demonstrate the technical and economic capabilities of the members in a reasonable way.

For many years, member firms have provided aerial photography, conventional photogrammetric services in graphical and digital format to the survey and mapping industry.

In addition, more recently, services to the remote sensing sector include the processing and interpretation of imagery, and integration of remotely sensed data with topographic, thematic and image mapping.

Further information on the AASA including current membership directory and guide for fees for professional services can be obtained from:

The Executive Officer,
Association of Aerial Surveyors, Australia,
P.O. Box 198,
VERMONT VIC 3133
Telephone (03) 878 1728

FORCORS

The Forestry Committee on Remote Sensing (FORCORS) is a subcommittee of Research Working Group 2 (Mensuration and Management) of the Australian Forestry Council. It was set up in 1984 to replace the Forestry Landsat User Group (FLUG) which had existed in a similar role for several years. Committee members are representatives of 10 state, federal, university and industrial organisations which have significant interest in forestry applications of remote sensing.

The role of FORCORS is to co-ordinate activities among the organisations where desirable, to advise the member organisations on matters related to remote sensing and to identify research needs. Meetings are held occasionally with the approval of the Standing Committee of the Australian Forestry Council. It is hoped to have a meeting in Adelaide in conjunction with the Australasian Remote Sensing Conference.

For further information contact the Convenor, Dr. Brian Turner, or the Secretary, Dr. Geoff Wood, at the Department of Forestry, Australian National University, PO Box 4, Canberra, ACT, 2600, telephone (062) 49 2579.

NEW SOUTH WALES REMOTE SENSING COMMITTEE

The New South Wales Remote Sensing Committee was established in 1979 under the chairmanship of the Surveyor General to advise the New South Wales Government on matters concerning remote sensing. The Committee is composed of members with managerial expertise within the public, academic and private sectors and is responsible for advice on policy and technical matters. For advice on specific matters the Committee relies on working parties that are formed as required.

In addition to advising the New South Wales Government the Committee has also provided a co-ordinating role and was instrumental in establishing the New South Wales Image Processing Centre within the Department of Lands in 1983 to serve the growing needs for processing and detailed analysis of digital imagery within New South Wales Government organisations. Progress on the application of remote sensing data was highlighted to the public during a week long display of Government remote sensing activities in 1985.

In 1986 the Surveyor General for New South Wales and the Remote Sensing Committee commissioned a private consultant to report on remote sensing activities and future planning requirements in New South Wales. The Committee and the Department of Lands are currently working towards implementing the recommendations made in the report.

Included in the report are recommendations to formulate a policy for "Image Processing Facilities in New South Wales" and to restructure the current Committee into a Remote Sensing Policy Committee and a Technical Working Group in order to further the application of remote sensing data in the management of the resources of New South Wales.

Contact:

Surveyor General for New South Wales
Department of Lands
23-33 Bridge Street, Sydney, NSW, 2000
Box 39, GPO, Sydney, NSW, 2001
Telephone: 228 6111, Ext. 6347

The following advertisements were received for inclusion in this directory :

COMING EVENTS

AUSTRALIAN DATES

24-27 August 1987
Australian Society of Agronomy
4th Australian Conference
Melbourne

24-28 August 1987
IASTED
International Symposium on Signal Processing & its Applications
Brisbane

24-28 August 1987
57th ANZAAS Congress
Science and Life in the Tropics
Townsville

24-30 August 1987
Image Enhancement & Classification (Course)
University of N.S.W.
Sydney

14-18 September 1987
4th Australasian Remote Sensing Conference
Adelaide

23-25, 28 September - 2 October 1987
AKCLIS – Courses
Introduction to Remote Sensing
Basic Digital Image Processing
Canberra

26-28 September 1987
International Conference on Landscapes of the Southern Hemisphere
Adelaide

16-18, 23-27 November 1987
AKCLIS – Courses
Introduction to Remote Sensing
Basic Digital Image Processing
Perth

30 November - 4 December 1987
Vegetation Mapping & Ground Truth Studies (Course)
University of N.S.W.
Sydney

1-4 December 1987
8th Australasian Conference on Coastal & Ocean Engineering
Launceston

2-4, 7-11 December 1987
AKCLIS – Courses
Introduction to Remote Sensing
Basic Digital Image Processing
Brisbane

27-29 January 1988
National Agricultural Outlook Conference
Canberra

31 January - 2 February 1988
9th Australian Geological Convention
Brisbane

1-3 February 1988
Hydrology & Water Resources Symposium 1988
Canberra

14-21 February 1988
ASEG/SEG International Geophysical Conference & Exhibition
Adelaide

16-24 February 1988
Remote Sensing of the Atmosphere & Oceans
Canberra

20-23 March 1988
Australian Petroleum Exploration Association (APEA) Conference
Brisbane

11-15 April 1988
Bicentennial Electrical Engineering Congress
Electro-Technology: A Springboard for the Future
Melbourne

26-29 April 1988
IMM – 2nd International Conference on Prospecting in Arid Terrain
Perth

9-12 May 1988
National Soils Conference
Canberra

16-20 May 1988
Bicentennial gold 88
Gold and the Explorationist
Melbourne

16-20 May 1988
58th ANZAAS Congress
Sydney

7-12 June 1988
International Technology Exhibition
Sydney

OVERSEAS DATES

31 August - 2 October 1987
26th International Workshop on Remote Sensing & Digital Image Analysis
Sioux Falls, South Dakota, USA

7-9 September 1987
Willi Nordberg Symposium 1987
Remote Sensing: Towards Operational Cartographic Application
Graz, Austria

7-11 September 1987
Remote Sensing Society Annual Conference
Advances in Digital Image Processing
Nottingham, UK

23-25 September, 1987
4th International Conference on Image Analysis & Processing
Cefalu, Sicily, Italy

4-9 October 1987
ASPRS-ACSM-WFPLS Fall Convention
Reno, NV, USA

10-17 October 1987
International Astronautical Federation Congress
Brighton, England

12-21 October 1987
International Cartographic Association
8th General Assembly
13th International Conference
Morelia, Mexico

14-16 October 1987
IEEE Eascon 87
Technology for Space Leadership
Washington, D.C. USA

20-23, 26-30 October 1987
AKCLIS – Courses
Introduction to Remote Sensing
Basic Digital Image Processing
Kuala Lumpur, Malaysia

22-27 October 1987
8th Asian Conference on Remote Sensing
Jakarta, Indonesia

26-30 October 1987
21st International Symposium on Remote Sensing of Environment
Ann Arbor, Michigan, USA

26-30 October 1987
ASPRS Conference
Geographic Information Systems – GIS '87
San Francisco, USA

15-18 November 1987
International Geographic Information Systems Symposium
The Research Agenda
Arlington, VA, USA

23-27 November 1987
SPOT 1 – Results of Image Utilization
Paris, France

24-27 November 1987
Space and Sea Colloquium
Marseilles, France

18-22 January 1988
Spectral Signatures of Objects in Remote Sensing
Aussois, France

4-8 April 1988
SPIE Technical Symposium
Optics, Electro-optics and Sensors
Orlando, Fl, USA

16-19 May 1988
ERIM
6th Thematic Conference on Remote Sensing for Exploration Geology
Applications, Technology, Economics
Houston, TX, USA

29 May - 3 June 1988
6th World Congress on Water Resources
Ottawa, Canada

1-10 July 1988
ISPRS
16th International Congress of Photogrammetry and Remote Sensing
Kyoto, Japan

5-7 September 1988
27th International Workshop on Remote Sensing
Sioux Falls, S.D., U.S.A.

ACRES REFERENCE CENTRES

A new concept in dissemination of ACRES data was announced with the introduction of designated Reference Centres. Each centre holds a full range of ACRES image samples and a complete set of the data and colour micro image catalogues. In addition, each reference centre holds a range of other reference material and relevant information, and will establish a comprehensive library of images covering the ACRES acquisition area.

At each centre, professionals with expertise in a range of disciplines are available for consultation, to demonstrate, give advice and provide guidance in analytical and interpretive techniques of remote sensing data. Most have on location, or have access to image analysis equipment and all have professionals who are familiar with ACRES data.

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PAPUA NEW GUINEA
Papua New Guinea University
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Centre for Remote Sensing
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Ph (02) 697 4964

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Technical & Field Surveys P/L.,
250 Pacific Highway
CROWS NEST NSW 2065
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TOWNSVILLE
The Economic Geology Research Unit
C/- Geology Department
James Cook University of North
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TOWNSVILLE QLD 4811
Ph (077) 814796

ARMIDALE
The Ellis Thorpe Library
Department of Geography and Planning
University of New England
ARMIDALE NSW 2351
Ph (067) 732 430

CANBERRA
Canberra College of Advanced Education
School of Applied Science
BRUCE ACT 2616
Ph (062) 52 2111

ACRES DISTRIBUTION CENTRES

Processed satellite images and related products are available from the Australian Centre for Remote Sensing, where these are made as colour and monochrome photographic prints at a range of scales and sizes, as well as photo transparencies of full scenes and sub-scenes. Pre-processed image data is also available on Computer Compatible Tape (CCT) in 800 and 1600 BPI format for user analysis and application. Precision rectified images are available as photographic products with some user selected image enhancements and radiometric/geometric corrections.

For selection of images and cloud assessment, data and colour image catalogues are available in microfiche form. These may be subscribed to annually for any number of fiche or the complete set for each Landsat cycle. Australian Centre for Remote Sensing products may be ordered from either of the ACRES facilities in Canberra and Alice Springs, or through a number of Distribution Centres located throughout Australia.

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HOBART
Tasmanian Government Publication
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134 Macquarie Street
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MELBOURNE
Dept of Property & Services
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2nd Floor, 318 Little Bourke Street
MELBOURNE VIC 3000
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MELBOURNE
Air Photographs Pty Ltd
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