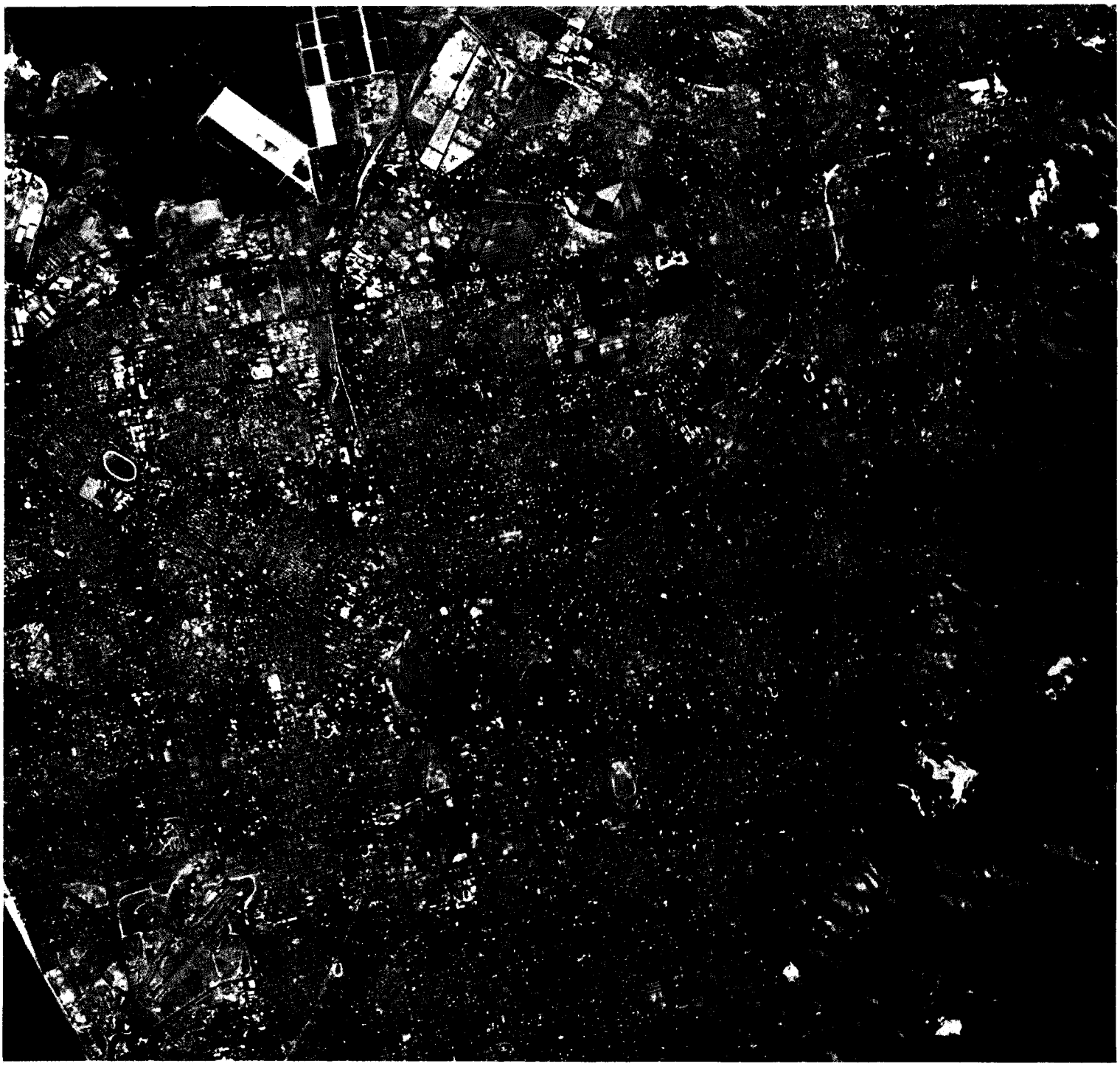
ACRES NEWS



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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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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.

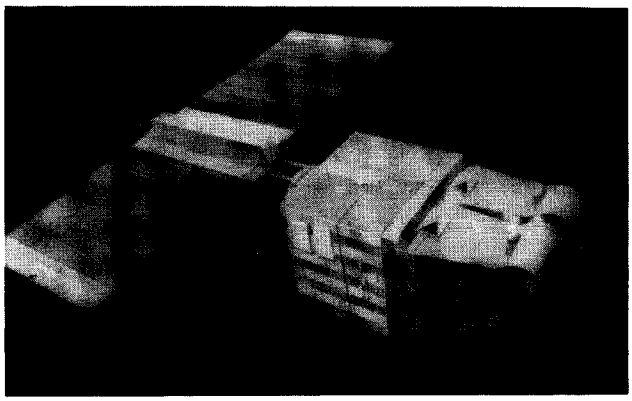
ACRES RECEIVES 4-STAR AWARD

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:

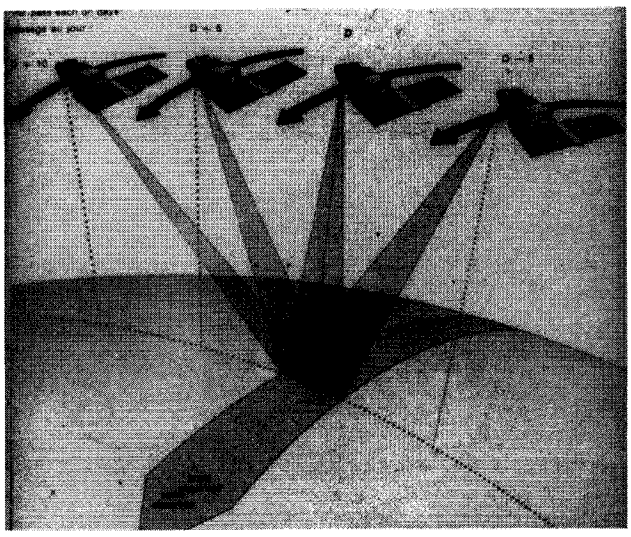
- **Agriculture:** Thailand (XS), Morocco (3 dates XS), The Netherlands (XS) and the U.S.A. (XS);
- **Geology:** Algeria (XS), Morocco (XS), Australia (P stereo, Kalgoorlie, W.A.), Turkey (XS);
- **Environment:** Japan (XS), Kenya (XS), France (XS), U.S.S.R. (XS), Colombia (XS);
- **Forestry:** Australia (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.

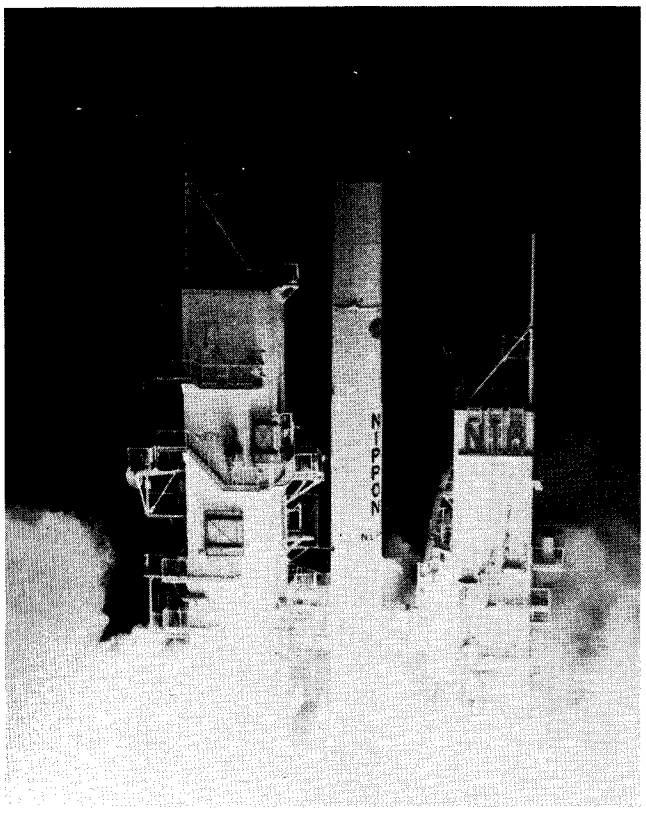
MAJOR JAPAN-AUSTRALIAN SPACE AGREEMENT

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-