ACRES

UPDATE • ISSUE NO 16 • MARCH 1998

RADARSAT Downlink Agreement Signed

THE AUSLIG, ACRES AND RSI CONTINGENT WITH RADARSAT SUB-DISTRIBUTORS, AGRECON AND GEOIMAGE, AT THE SIGNING CEREMONY. STANDING, LEFT TO RIGHT: PAUL TRESIZE, BRIAN BUTTON, JIM MOLLISON, SHAWN BURNS, IAN SHEPHERD, PETER HOLLAND, ROBERT TACK, MADELEINE CLARK, DAVID HISDAL, BOB WALKER. SITTING: JOHN LEE, JOHN PAYNE, TODD PEARSON, DANIEL JAKSA. INSET: AUSLIG GENERAL MANAGER, PETER HOLLAND (LEFT), AND RADARSAT INTERNATIONAL PRESIDENT, ROBERT E TACK, SHAKE ON THE RADARSAT DOWNLINK AGREEMENT.

A Network Station License Agreement between RADARSAT International and the Commonwealth, represented by AUSLIG, was signed by the President of RSI, Robert E Tack, and AUSLIG General Manager, Peter Holland on 24 November 1997. This agreement allows ACRES to directly downlink the Synthetic Aperture Radar data from the RADARSAT satellite and to produce products from this data. Data reception will be conducted at ACRES Data Acquisition Facility in Alice Springs.

This agreement brings to Australia a wide range of new remote sensing products using SAR technology. Radar images can be used in a broad range of applications including mineral/petroleum exploration and geological mapping, DEM generation, agriculture and land use monitoring, coastal and ocean applications such as ship detection and oil spill monitoring, watershed modelling, flood mapping and topographic mapping.

There is a wide range of RADARSAT image products available. Image size varies from 50 x 50 km with the Fine Beam Mode to 500 x 500 km for the ScanSAR Wide Mode. Resolutions vary from 10 to 100 metres depending on the Beam Mode selected.

ACRES will be tested for RSI's Blue Ribbon Certification in March 1998. This certification process requires ACRES to produce RADARSAT products that meet the stringent quality specification directed by RSI. It is also expected that ACRES will be applying for part certification within the Bronze, Silver and Gold Certificates at the same time.

To provide maximum assistance to our customers in placing requests for scene searches and the ordering of RADARSAT data products, ACRES has appointed the following organisations as sub-distributors.

- AGRECON Pty Ltd
- Environmental Research and Information Consortium (ERIC)
- GEOIMAGE Pty Ltd, Brisbane QLD, Darwin NT, Perth WA
- Geo Mapping Technologies Pty Ltd
- Landcare Research, New Zealand
- Remote Sensing Services, Department of Land Administration, WA

For more information on RADARSAT products, please contact these sub-distributors (see the back cover for contact details), or refer to the ACRES web pages on http://www.auslig.gov.au.

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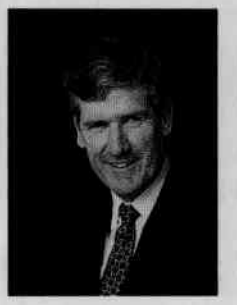


You will read elsewhere in this publication about the many new products and services which we have introduced since the last edition of *ACRES Update*. These include the release of an upgrade to our digital catalogue, and the availability of digital products on CD-R.

Many other projects are in various stages of development, with some to be released in 1998. A major project to upgrade our ground station at Alice Springs is well underway, which will provide even faster access to information on new acquisitions. Local reception and processing of RADARSAT data will be available mid-year, which will provide a faster delivery of all RADARSAT products to users. A new processor is planned to replace the ageing VAX system which we have nurtured since 1988. This will certainly provide a shorter turnaround time of all customers' orders. As well as the direct reception of RADARSAT data, new SPOT and Landsat satellites are both scheduled for launch, and ACRES will be incorporating data from these satellites into its product range. A new acquisition planning/satellite-scheduling tool will be introduced to provide improved efficiency. We look forward to announcing the completion of these projects in due course.

ACRES continues as a consortium partner in the ARIES project, ARIES being the Australian Resource Information and Environment Satellite. The feasibility study for the satellite was successfully completed during 1997, and the business structure is now being settled, before the development of the project begins in 1998. It is proposed that ACRES will have a key responsibility for the development of the ground segment of the project.

Due to changes in federal administrative arrangements during 1997, ACRES and AUSLIG are now part of the Department of Industry, Science and Tourism. In mid-1998, ACRES will be moving to the building now occupied by AUSLIG, about 100m from ACRES current location.

In February, Paul Trezise will be returning as Manager of ACRES, and I will be moving to the Information Access Program at AUSLIG. In this new role, I look forward to maintaining some contact with all users of ACRES products.

Ian Shepherd

Geocentric Datum of Australia — GDA94

Laurie Oliver

Australia is moving from the Australian Geodectic Datum of 1966 (AGD66) to a new geodetic datum, the Geocentric Datum of Australia 1994 (GDA94), for its mapping and other spatial data information products (see http://www.anzlic.org.au/icsm/icsm-main.htm). As a result, coordinates of points in Australia will change by about 200 metres in a north-easterly direction. The actual size and orientation of the change will vary from area to area. ACRES has adapted its production system to accommodate this new datum.

GDA94 is based on a global coordinate system closely aligned to the World Geodetic System 1984 (WGS84), the datum used in the Global Positioning System (GPS). GDA94 is based on the International Terrestrial Reference Frame (ITRF). This was chosen in favour of WGS84 because it is a more recently defined system. The US Department of Defence developed WGS84 over fifteen years ago. This decision was confirmed in early 1994, when WGS84 was modified to align it more closely with the ITRF. GDA94 and WGS84 are compatible at better than a metre.

Up till now ACRES map-oriented products (levels 8,9 &10) have been produced in a UTM projection based on the Australian Geodetic Datum of 1966 (AGD66) so that the raster of the image product is aligned with the Australian Map Grid (AMG) for the relevant zone.

We have set up parameters in our production system to define GDA94 and WGS84 datums **so that customers may NOW order products on these datums** too. The products will still be in a UTM projection, so products on GDA94 datum will be on MGA94 (Map Grid of Australia 1994) and products on WGS84 will be on UTM_GS84.

For the time being AGD66/AMG will be the **default** option for map-oriented products but you may order GDA94/MGA94 or WGS84/UTM products by requesting this in the comments section of the ACRES order form. This notice applies only to Landsat and SPOT products at this time.

Further information on these geodetic datums and some Microsoft Excel spread sheets for conversion calculations are a available from the AUSLIG WWW site at http://www.auslig.gov.au, click on Geodesy. See also the brochure inserted in this edition of *ACRES Update*.

ACRES Distributor Meeting

Jim Mollison

ACRES held it's annual distributor meeting from 24-26 November 1997. The meeting provided a forum for the exchange of information and ideas relating to the remote sensing market and ACRES products, services and strategic directions. ACRES received very useful feedback during a new session involving reports from each distributor.

The annual distributor awards were once again presented for distributors achieving excellence in sales performance. For 1996–97 the recipients were:

Gold award: GEOIMAGE

Silver award: Remote Sensing Services, DOLA (WA)

Bronze award: Department of Natural Resources (QLD)

There was also a new award for the distributor with the highest percentage growth in sales for ACRES data. This award went to GeoMapping Technologies (QLD).

ACRES and our distributors were fortunate in having several representatives from other data suppliers, to make presentations regarding recent developments with their respective satellite systems. In attendance were Ted Stapinski from ARIES, John Douglas from Earthwatch and Mark Judd from Geomatic Technologies/Space Imaging EOSAT. Several representatives from RADARSAT International were also present to provide applications training to RADARSAT Distributors.

The distributor dinner proved to be an enjoyable occasion and included the official signing of the RADARSAT down link agreement by AUSLIG and RADARSAT International (see separate article).

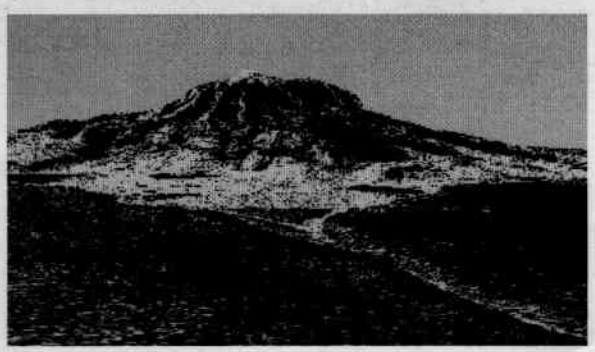
ABOVE: AUSLIG GENERAL MANAGER, PETER HOLLAND, PRESENTS THE WINNER OF THE INNAUGURAL 'HIGHEST GROWTH IN SALES AWARD' TO ADRYA KOVARCH OF GEO MAPPING TECHNOLOGIES.

CLOCKWISE FROM ABOVE: GEOIMAGE IS PRESENTED WITH ITS 5TH GOLD AWARD FOR EXCELLENCE IN ACRES DATA SALES PERFORMANCE. THE AWARD IS ACCEPTED BY GEOIMAGE'S MANAGING DIRECTOR, BOB WALKER; KEN DAWBIN OF REMOTE SENSING SERVICES, DOLA, WA, IS PRESENTED WITH THE SILVER AWARD; JO PLUNKETT ACCEPTS THE BRONZE AWARD FOR THE QUEENSLAND DEPARTMENT OF NATURAL RESOURCES.

BELOW: THE ACRES DISTRIBUTORS' MEETING DINNER PROVIDED A WONDERFUL OPPORTUNITY TO SPREAD CHRISTMAS CHEER. FROM LEFT: BRIAN TUNSTALL (ERIC), DAVID HART (DEHAA), BOB JONES (ACRES), GARY TAUNTON (LIC), ADRYA KOVARCH (GEO MAPPING TECHNOLOGIES) AND TED TYNE (ENCOM).

Heard Island — Australia's Highest Mountain.

Laurie Oliver



This perspective view of Heard Island from the South-East was created using two different applications of RADARSAT imagery. Firstly, two RADARSAT scenes acquired at different viewing angles were used, along with ground control information, to derive a DEM of the island. Next, the DEM was used to orthocorrect one of these scenes and to create a precision geocoded ortho-rectified radar image that was then 'draped' over the DEM to create the perspective view.

Estimating Cotton Yields, Generating Yield Maps and Precision Farming Using Satellite Imagery

Brian Button, AGRECON

The Australian cotton industry produces more than 2 million bales of cotton annually, of which 93% is exported, making Australia the 4th largest contributor to world cotton trade. 80% of cotton grown in Australia is irrigated, with yields typically around 7.5 bales/ha (227 kg) compared to dryland cotton yields of around 3 bales/ha. Large differences in yield per hectare and total production are due to climatically induced differences (drought: 1.1 million bales in 1985 and 1.5 million bales in 1995, non-drought: 2.2 million bales in 1992, 2.5 million bales from 378,000 hectares by 1300 growers forecast for 1997) in available water supplies.

Timely and accurate cotton yield forecasts at the farm and industry level are essential for crop management, forward planning and marketing. Current methods of pre-pick yield estimation involve teams of agronomists sampling rows of cotton within fields to generate fruit counts per metre which are converted to yield estimates in bales per hectare. This is time-consuming, expensive, and not necessarily accurate, as the sample is generally too small to be representative of the whole field. A better method would be one that assessed entire fields on an industry wide basis, in a non-destructive manner, quickly and cost-effectively.

Satellite imagery provides a cost-effective method of assessing the spectral characteristics of entire fields quickly and easily. The spectral response of a canopy of cotton plants is a good indicator of leaf area, total biomass and vigour, which ultimately determines yield potential.

These principles underlie the development of a model to predict cotton yield from the spectral response of cotton crop canopies. This model, by the Canberra based firm of Agricultural Reconnaissance Technologies Pty Ltd (trading as AGRECON), represents the culmination of more than five years of research work.

To be commercially viable the model was designed so that accurate yield estimates could be generated quickly, at strategic times during the growing cycle, for any part or grouping of individual fields, enterprises or regions. The model also needed to be robust to accommodate varietal differences, planting and watering schedules, seasonal and regional differences in climatic conditions and soil types along with other parameters likely to affect spectral response.

Of even greater potential benefit than yield estimates is the development of a technique, applying the appropriate yield estimation algorithm to every pixel, to generate accurate pre-harvest yield maps for individual fields and farms with high metric integrity. In addition to highlighting yield variability and associated agronomic conditions, this promises to bring precision farming to the cotton industry in a very simple and economic way, without the expense and technicalities of machine based yield monitors.

To develop the model, US based Landsat Thematic Mapper satellite imagery was acquired in digital format three times each season - at the end of December, end of January and end of February - over nine growing seasons (1987–8 to 1995–6). Computer based processing and analysis was undertaken for a selection of fields totalling 68,000 ha for which actual yields were known.

After initial image pre-processing, spectral statistics for each field were extracted and analysed statistically to identify the best combination of input data for the model. It quickly became apparent that imagery from different dates within each season as well as drought and non-drought conditions contained marked differences in cotton canopy spectral response. Accordingly, different forms of the same model were developed to maximise the accuracy of yield estimates at different times during the season and under different conditions.

Comparison with actual yields achieved revealed that satellite based yield estimates generated were most accurate where imagery was acquired at or near the end of January.

To evaluate the accuracy of the model, cloud free early February 1997 Landsat imagery was used to generate yield estimates for 237 fields on 15 separate holdings comprising a total of 24,904 hectares, producing more than 188,500 bales or 7.66

bales/hectare (3.10 bales/acre) representing more than 6% of Australia's 1996–7 cotton crop.

A comparison of satellite and ground based agronomic yield estimates with post cotton farm yield results found that the satellite based model was significantly more accurate than conventional ground based agronomic techniques, especially at the farm and field level, but took only a fraction of the time to generate.

Satellite estimates for a further 25,000 hectares of 1996–7 cotton crops were compared with post gin yields for individual fields on 25 other well distributed holdings to evaluate accuracy of yield estimates across a wide variety of soil and growing conditions in different valleys. Similar levels of accuracy were achieved.

On a regional or composite basis, satellite based estimates were less than 1% below actual yields. At the farm level more than 55% were within 5% of actual yields and more than 84% were within 10% of actuals. At the field level, around half of all fields estimated were within 5% of actual yields and three quarters were within 10%. In absolute terms, satellite yield estimates for one quarter of all fields were within 0.25 bales/ha (0.1 bales/acre) of actual yields. Almost half were within 0.5 bales/ha (0.2 bales/acre). More than 70% were within 0.75 bales/ha (0.3 bales/acre), 85% were within 1.0 bale/ha (0.4 bales/acre) while error rates of more than 1.5 bales/ha (0.6 bales/acre) were exceeded for only 6% of all fields assessed.

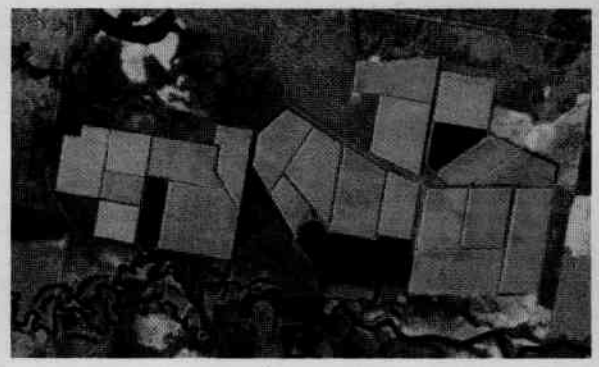
Analyses of the 6% of fields exhibiting the greatest difference between actual and estimated yields from satellite based models showed that the fields in question were generally small in size (between 10 and 75 hectares). Overestimates were typically being associated with low yielding varieties on newly irrigated country while underestimates were typically associated with high yielding varieties on established and well managed irrigation country.

Although the accuracy of satellite based estimates exceeded everyone's expectations, the model will become even more robust by incorporating paired satellite spectral response and yield data back into the model on an ongoing basis and adding further refinements.

The accuracy and timeliness of satellite based yield estimates and yield maps offer strong commercial advantages to individual farmers, bankers, processors, government commodity analysts and to the Australian cotton industry as a whole.

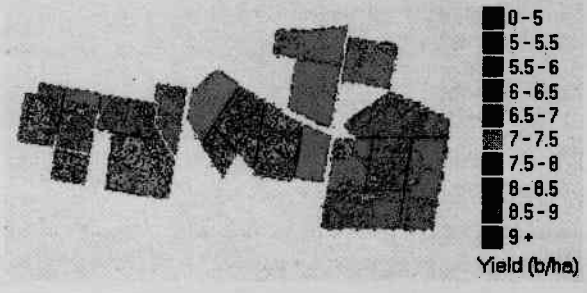
SATELLITE BASED YIELD ESTIMATES

- Are more accurate, timely, reliable and cost effective at the field, holding, enterprise, district, region, catchment and industry level being based on the entire field rather than statistically questionable samples of ground based agronomic boll counts and plant observations.
- Enable the extent and magnitude of hail and other forms of crop damage to be readily assessed.
- Provide increased certainty in managing unsold crop.
- An objective tool for early preparation and tabling of banking submissions.
- Complement yield maps for timely forward planning and scheduling of picking this year's crop and decision making for the following year.



SATELLITE BASED YIELD MAPS

- Can be generated using a 12-year database of historic imagery.
- Facilitate precision farming through site specific management 2 to 3 years ahead of machinery based harvest monitoring methods.
- Provide information regarding within-field variability up to 2 months prior to picking, or 12 months before planting by using historic imagery.
- Incur no increase in management burden or capital outlay while potential benefits of site specific management are being assessed.
- Do not need contractors or owners to install yield monitors, GPS and computer hardware and software.
- Not affected by signal failure from external reference stations and resultant gaps in yield maps.
- No different to purchasing other crop inputs.



A commercial satellite based yield estimation and yield mapping service is being conducted in conjunction with the 1997–8 cotton crop, with IAMA acting as sole distributor to rural landholders. Yield estimates and yield maps are being marketed under the Far Sight range of products. Yield maps and boundaries of green cotton within individual fields are available as coloured prints in A4 format as well as a range of digital file formats to ensure compatibility with precision farming software such as Rockwell's Vision system. Similar information in aggregated form is being made available to processors, insurance and other industry participants.

Intellectual property rights over the model remain with AGRECON which will generate all yield estimates and yield maps. Administration and industry liaison with IAMA and non-landholders is being conducted through Precision Ag Services Pty Ltd, a new service company co-located with AGRECON.

AGRECON is also collaborating with IAMA with the objective of developing satellite based crop monitoring and pre-harvest yield estimation tools for other major crops including winter cereals, oilseeds, rice and sugar.

For more information please contact Associate Professor Brian Button (see the back cover for contact details).

SPOT Variable Window — Increase in Maximum Size

Jim Mollison

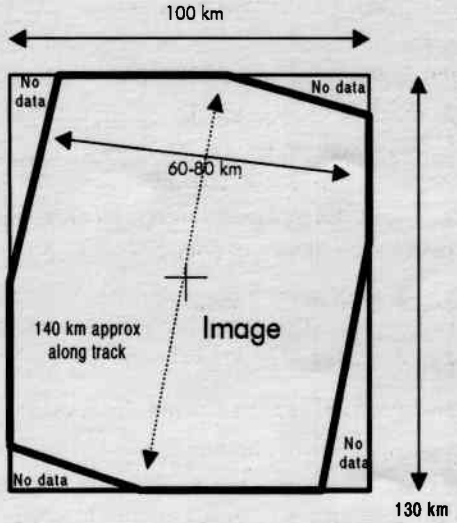
All ACRES products that are map-oriented (aligned to the AMG) can also be termed variable window products. These products give customers greater flexibility in choosing the amount of imagery included in a product. The customer selects a rectangular window by specifying the latitude and longitude of its centre and the extent, in kilometres, East–West and North–South. A particular path and date of imagery is also nominated by the customer, and all imagery from that path (image swath) falling inside the specified window is extracted to form the product.

The ACRES processing system necessarily contains limitations with regard to the maximum sized variable window that can be specified. For SPOT data, these limitations have recently been increased in two ways:

- The maximum area that can be specified has been increased from 10,000 sq km to 13,000 sq km
- The maximum North-South dimension is now 130 km

Please note that despite the increase in window size our processing system still has an along-track limit of 140 km for SPOT data, and any pixels in the product extending beyond this limit will be blank. The accompanying diagram shows this effect in the NE and SW corners of the product. The amount of these blank pixels will depend on the N-S dimension of your variable window, the latitude of acquisition and the viewing angle of the satellite. Of course if 10,000 sq km still satisfies your needs, this area can continue to be ordered to avoid the larger data volume associated with the new 13,000 sq km limitation. Your distributor or ACRES can provide further details and explanations.

Despite this increase in maximum window area available, the price of the maximum sized SPOT variable window has remained unchanged, allowing greater value and flexibility for ACRES customers.



NB: EXACT SHAPE OF IMAGE AREA DEPENDS ON SWATH WIDTH AND ANGLE OF SWATH FROM NORTH

A Product for New Users - Customised Sample Product

Jim Mollison

In March 1997, ACRES introduced the new Customised Sample Product to aid in market development of Landsat and SPOT satellite imagery. This product is aimed at expanding the awareness and distribution of satellite data in Australia. The product consists of a subsidised digital data set, covering a small area as defined by the customer. It is a special offer, available only until 31 March 1998, and sold primarily through distributors.

Customers may order up to 625 sq km (eg 25km x 25km) for Landsat, or up to 225sq km (eg 15km x 15km) for SPOT over any area they desire. This allows new users to try satellite imagery over their own area of interest at a more affordable price compared to standard products. There is a limit to the number of Customised Sample Products available per client.

Prices for the product are:

LANDSAT TM 4 bands	$300
LANDSAT TM 7 bands	$340
SPOT XS or PAN	$340

Please contact your distributor for details.

A Short History of Landsat MSS

Mike Linney & Paul Wise

INTRODUCTION

The Multi-Spectral Scanner (MSS) technology carried on board the Landsat series of satellites, one through five, gave users of its data a regular view of the earth never available before. ACRES estimates that over the 17 years of MSS data collection, in excess of 309,000 MSS scenes have been archived with the most popular eras being that of Landsats 2 and 5.

LAUNCH DATES AND SATELLITE SERVICE

While the first Landsat satellite (then called ERTS for Earth Technology Resources Satellite) was launched in 1972, ACRES did not directly downlink data into Australia until 1979. The following table summarises the launch dates and satellite service periods for Landsat.

Landsat 1: July 1972 to January 1978 (5.5 years)

Landsat 2: January 1975 to February 1982 (7 years)

Landsat 3: March 1978 to March 1983 (5 years)

Landsat 4: July 16 1982 to July 1988 (6 years)

Landsat 5: March 1 1984 to current (13+ years)

The first MSS dataset that ACRES has in its archive is path 106, acquired 14 September 1979, from Landsat 2. This path is similar to the current Landsat 5 path 99 which covers a swath through the Gulf, down the east side of Alice Springs, over the Simpson Desert, Lake Eyre North and out over Port Lincoln. The last MSS dataset is path 108, acquired from Landsat 5, at the end of November 1997. This path covers the swath from Cape Londenderry to Esperence through the Great Sandy, Gibson and Great Victoria Desserts.

At the time of termination, Australia was the only country still receiving MSS routinely, all other groundstations having terminated MSS downlinks several years previously. This conscious effort on ACRES part to provide continued access to the MSS dataset was driven by the value it saw in having a useful long term archive for the national good.

LANDSAT 1

Landsat 1, which was launched in July 1972, was immediately used in the first phase of Resources Survey program. NASA's first manned space station Skylab and NASA aircraft were teamed up with selected Landsat passes to obtain supplementary information on the spectral signatures of ground features. This helped in the location of new energy sources and improved geological mapping techniques, and to determine which data could be most effectively and economically obtained via manned or unmanned service satellites and instrument subsystems.

Due to electrical malfunctions and power budgeting that first year, the three Return Beam Vidicon (RBV) cameras and one of the Wide Band Video tape recorders, needed for acquiring images outside of North America, were deactivated. The rest of the payload functioned normally until 29 March 1973.

The second tape recorder then malfunctioned, causing image coverage of the rest of the world outside the United States and Canada to be reduced to those countries with U.S. Tracking Stations. Australia had the tracking capabilities through the antennae set up for the early Mercury, Gemini, Apollo and Skylab manned missions and continued to supply NASA with recorded real time image data on a small scale.

ERTS-1, primarily a military satellite, was renamed to Landsat-1 (Land Satellite) and released to allow world access to its data as a Scientific and Land Management Remote Sensing tool. It went full term, providing data routinely for six years, until its instruments finally began to deteriorate the worst of which was a sensor failure in the last year of operation. Transmission was finally terminated in January 1978.

LANDSAT 2

Landsat 2 was launched in January 1975 and, since Landsat 1 had far exceeded expectations as an experimental scientific earth resources tool, potential rewards were estimated in the billions of dollars annually. This cut costs by 1/20th to industry, commerce and government, complementing the data collection from Landsat 1, and resuming world coverage through wide band video tape recording and playback. Landsat-2 performed as expected but began to suffer degradation of the solar power panel arrays after about four years in orbit placing some limitations on the amount of data available. This was followed some time later by intermittent attitude control problems, which affected both the geometry and availability of the data. Nevertheless, it continued to provide significant amounts of data as a backup satellite for Landsat 3 until it was taken out of service in July 1983 with a frozen yaw wheel.

LANDSAT 3

Landsat 3 was launched in March 1978 but after the first year of operation it developed faults in the onboard electronics system. This resulted in the intermittent loss of about 28% of data on the western side of the path. The problem, known as 'late line start', required groundstations to develop special software to recover the remainder of the data. Switching between backup systems on board the satellite gave extended periods of proper operation over the next year. However, by the beginning of 1982 the fault could not be overcome and further degradation to the MSS data stream started to become evident. First the end of line code then the beginning of line code failed. Landsat 2 was brought back into service to help support the

(Cartoon: Copyright Kookaburra Productions 1994)

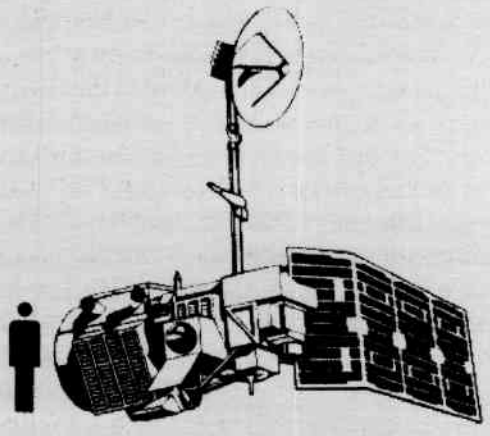
ailing Landsat 3 spacecraft acquire world coverage until Landsat 2 failed. Landsat 3 was taken out of service in September 1983.

LANDSAT 4

Landsat 4, launched in July 1982, soon experienced power faults and the eventual loss of two solar arrays due to thermal stress on the power cables from the array panels. The remaining solar panels were offset to minimise cable stress as the loss of these cables would have shutdown the satellite. By now the power restrictions and other electronic failures had resulted in the Landsat 4 data downlink contaminated with coherent noise effecting the image data, a situation that was never resolved. Operations continued as a backup to Landsat 5, after its launch, but Landsat 4 was eventually released from services in July 1988.

LANDSAT 5

Landsat-5 was launched in March 1984. The deployment of Landsat 5 was earlier than planned due to the failures with Landsat 4. Nevertheless, apart from the failure of the S-band telemetry antenna in May 1990 and some faults and failures that had been covered by redundant electronics the most significant recent problem was the total failure of MSS band 4 on the 29 April 1994. Landsat-5 has been the most successful and reliable satellite yet in the Landsat series and is alive and well and celebrated its thirteenth birthday on 1 March 1997. Recent reports from the operator indicate that it may last beyond 2000, if required.



AFTER MSS

The Thematic Mapper (TM) sensor and the newer Enhanced Thematic Mapper (ETM) sensor became the technological followers to MSS. Landsat 6 (RIP wherever you are) and its successor, Landsat 7, due for launch mid 1998, did/do not have MSS capability. MSS technology will cease with the demise of Landsat 5.

CONCLUSION

As a whole, the Landsat series of satellites have been very successful. With the exception of Landsat 6, all the satellites have well exceeded their three year design life. Failures have however impacted on the quality of the MSS data, especially from Landsats 3 and 4. MSS datasets from Landsat 2 in conjunction with recent acquisitions from Landsat 5 have provided Australia with an unprecedented opportunity to determine environmental change during the 70s, 80s and 90s. This valuable data archive has proven to be an important tool in understanding Australia's natural history.

Vale MSS!

Landsat 5 MSS Data Acquisition Ceases

ACRES acquired, archived and processed Landsat 5 MSS data up until 30 November 1997. Since 1989 these acquisitions have largely been duplicated by the more popular and universal Landsat 5 TM coverage.

There were significant costs to ACRES in maintaining the MSS acquisition/archiving chain and, as part of the current upgrading of the Alice Springs reception facility, there would have been significant additional costs to include MSS reception. The minimal sales of newly acquired MSS data forecast during the short interim period between the launch of Landsat 7 and the expected cessation of Landsat 5 could not support these costs.

For these reasons, ACRES decided to terminate MSS data acquisition. ACRES has carefully safeguarded all its existing 17 years (1979 to 1997) of MSS data on optical tape and will maintain an ongoing capability to process these data. For interest, the earliest Landsat MSS pass in the ACRES archive is a Landsat 2 MSS pass, acquired on 14 September 1979. In addition,

ACRES is building its archive of RESURS data which has the same MSS bands with 160m pixels and a scene size of 600 km x 600 km.

We realise that historical MSS data is a convenient data source for some important applications, so we are committed to maintaining this archive, together with the ability to process it. However, our records show that the use of new MSS data is extremely small, and we have concluded that users are already using TM as an alternative.

MSS: A great beginning with no end in sight!

Dean Graetz, CSIRO Earth Observation Centre, Dean.Graetz@eoc.csiro.au

I write to praise the MSS, not to farewell it. The good that instruments do (their data archives) lives after them. Their inadequacies are soon forgotten. This is my personal reflection on the recent termination of the MSS data stream.

I was privileged to have been involved with MSS data from the beginning. I joined CSIRO in 1972 and one of my first tasks was to attend a national briefing on the soon to be launched Earth Resources Technology Satellite (ERTS).

In 1972, CSIRO was heavily committed to remote sensing research. The effort was focussed in the geosciences by Dr Ken McCracken, then Chief of the Division of Mineral Physics. Ken and his staff had pro-actively organised a national meeting in anticipation of ERTS-1 that was open to all potential users. My memory was of a crowd of more than 500 excited but bewildered exploration, foresters, agronomists and other assorted professional strays. We had no actual data at that time but could work hands-on with multispectral photography from NASA and CSIRO. A summary of our collective reaction was 'Wow!'

That was July 1972. By early 1973, the first photographic products of Australian imagery became available and satellite-based, remote sensing began. It was taken up by many groups in many locations using a variety of innovative techniques. All products were analogue; digital data was yet to arrive.

The 1970s were an exciting decade. There were many involved groups, from almost every state agency, and there were some colourful, feral characters about. Overall, the applications projects were imaginative and exciting. Satellite images were everywhere. I do not exaggerate when I say that MSS data changed my life. In a small rural town on a leisurely February morning in 1973, I opened a small parcel and help up to the light a 1: 1,000,000 scale BW film positive of WRS 102_082, the Broken Hill scene. The information that I could extract from this simplest of product was staggering. As a rangelands ecologist, I was instantly empowered. I've never forgotten the excitement of that beginning; never. Twenty five years later, I still get a great kick from working with satellite data and take pleasure in introducing it to others.

In the beginning, access to MSS data was not well organised and painfully slow. Much was happening. The quite severe (ENSO) drought of 1969–1972 gave way to the unprecedented wet period of 1973–1974, which was in turn followed by the widespread wildfires of 1975-1976. Much of this was captured by the then renamed Landsats 1 & 2. The three channel Return Beam Vidicon (RBV) data stream from these craft was discontinued and the Multispectral Scanner (MSS) became the workhorse but still retaining the odd channel nomenclature MSS4, MSS5, etc. MSS data was the only data for 12 years until the arrival of Landsat TM about 1984.

SO WHAT HAVE BEEN THE CONTRIBUTIONS OF MSS DATA?

I see these three contributions – all equally important.

First: Because MSS data was the first widely available set, it was the one that catalysed the application of satellite remote sensing to both problems and solutions. MSS data sparked the continuing process of sensitising Australian society to the intrinsic nature of the Australian continent and the consequences of its use of the land and water resources. I cannot believe that the current high level of environmental understanding and responsibility could have arisen without MSS data and associated tribe of enthusiastic proponents. Moreover, this high level of understanding and appreciation is most unlikely to diminish in the future. The activities and consequences of renewable resource management agencies, public and private, are open to the scrutiny of all. Competence can be applauded and ineptitude dealt with. From 1972 onwards, there was no place to hide!

Second: MSS data fostered new and exciting areas of applications research. Prospective applicants of MSS data were forced to reconcile the unusual spectral and spatial dimensions of the data which came in digital rather than analogue form. In the spectral domain, the tangible world was captured in just four broad wavebands, two of which had no visual equivalent. Whatever analogue product resulted, it was always a 'false colour composite'. From this flowed the slow realisation by plant and soil scientists that their familiar and complex world could be simply captured in just two spectral dimensions, the red and near-IR and that simple indices based on the geometry of this 2D spectral space, such as the legendary NDVI, could be extremely powerful. Graph paper and simple texts on PCAs became best sellers overnight. Statisticians suddenly found new friends who bought them beers and asked about MLC and the advisability of CVA. People muttered and wrote about scene modelling.

The spatial domain of MSS data, ie. pixels of approximate area 1 ha, was less successful in forcing a revolution in applications thinking. A few, and I count myself in, accepted the universal reality of mixels and explored the pathways of mixture modelling. For this group, understanding the yet to arrive AVHRR data would not be a problem. Unfortunately, the majority of players retained a deep yearning for the high spatial resolution of air photography and flocked to Landsat Thematic Mapper (TM) data searching for the 'pure pixels' to feed their MLC programs. This group are presently poised to flock again and roost on the newly promised 1–5m resolution data. I wish them well - farewell!

Third: There is now an archive of MSS data for the Australian continent beginning late 1972 which, though episodic from 1972–1979, now spans 26 years. This timespan is of sufficient length to begin to address the long term issues of Climate Variability and resource management policies because it can be used to tell us what actually happened - not what individuals or agencies thought happened. Our collective understanding (intelligence) is constrained by the available information (extelligence). I cannot over emphasise the importance of an objectively acquired data archive. It is not just the Democrats who 'keep the bastards honest'. Satellite data is far more effective.

To illustrate: I am currently using MSS to measure the rate of landcover clearing and regrowth for the entire continent during the 1980–1990 decade. These figures will support Australia's future negotiations within the United Nations Framework Convention on Climate Change. There are no other measurements of clearing – only expert opinion – and such opinion usually has a hard time in a court of law.

Mike Linney and Paul Wise end their informative history with the words 'vale MSS'. The MSS instrument is dead but its data lives on and that archive can be seamlessly integrated with that which follows. From now on, if necessary, it is possible to constitute MSS data from TM. SPOT and IRS data are MSS lookalikes.

I suggest that the contribution of MSS will never die. It will live on as the principal foundation of earth observation understanding that is held, refined and transmitted by current practitioners. MSS data spawned the first national remote sensing conference (1979) that continues now as an international event. MSS data, as large prints on walls and in magazines irrevocably changed Australian's view of their own continent. Remotely sensed data is now regularly accepted as evidence in courts of law.

Above all else, I remember that it was MSS data which catalysed remote sensing, and that it was remote sensing which supported a significant change in our national environmental perception and values. Personally, I have no doubt that this change has been for the better. Of this I am sure because by chance, I was privileged to play a part in that change.

So, Rock on Remote Sensing!!

Second RADARSAT Distributors' Meeting, Vancouver, Canada

John Payne

In May 1997 I was fortunate enough to attend, on behalf of AUSLIG, a RADARSAT Distributors' meeting in Vancouver, Canada. The meeting, the second since the RADARSAT satellite was launched in 1995, was attended by forty-three other distributors or potential distributors representing twenty-eight countries. The objectives of the meeting were to allow feed-

THE INTERNATIONAL DELEGATES AT THE SECOND RADARSAT DISTRIBUTORS' MEETING

back and interaction from distributors, the transfer of important RSI messages and to allow distributors an insightful view of future developments.

The President of RADARSAT International, Bob Tack, opened the meeting emphasising the relationship that RSI wanted to establish with its distribution network. He outlined the company aims of ensuring that RSI was the easiest and best partner in the remote sensing industry with whom to do business.

I must say that the meeting was certainly structured to achieve these aims. Detailed presentations occurred on operational issues, market development and sales. Each presentation with the aim of determining how to make the system work better to meet client needs. Major developments in these areas were discussed in detail as well as explanations of how the areas worked together. Key RSI staff from each area were introduced to the audience.

An open forum on distributor feedback proved a popular session. Although it was disappointing to have this session cut short because of time constraints. Many interesting subjects were raised with topics such discounts and pricing dominating. It is pleasing to see that RADARSAT have responded favourably to this feedback with new bulk prices for DEMs, large area coverage and monitoring.

A series of eight informal concurrent technical and marketing sessions were held that had the aim of assisting distributors to identifying prospects and to develop proposals containing the features that needed special emphasis. These sessions were followed by a series of commercial success stories on topics such as ship monitoring and oil slick detection.

An interesting aspect of the meeting was the presentations by companies from both the USA and Canada demonstrating the use of RADARSAT data in the generation of mapping value added products. It was also an example of RADARSAT's desire to work in partnership with not only distributors but also value adders.

Overall I considered the meeting extremely worthwhile. It gave participants an opportunity to learn of new applications and techniques to increase their sales and at the same time to discuss with other distributor matters of mutual benefit and concern. The attitude of RSI to its distributors and its overall customer and marketing support was refreshing and to be commended.

Workshop on RADARSAT, Ship Surveillance, Oil Spills and the Marine Environment

Madeleine Clark

Illegal fishing, disposal of bilge and the spilling of oil will be difficult to hide in the near future, as ACRES gears up to down link data from the Canadian RADARSAT satellite. RADARSAT is a powerful tool in the war against illegal activities in Australian waters. RADARSAT is capable of acquiring data at night, in cloud covered regions and with frequent revisit capabilities.

A workshop titled 'RADARSAT, Ship Surveillance, Oil Spills and the Marine Environment' was held at the Australian Defence Force Academy on Friday, 21 November 1997. AUSLIG in conjunction with UNSW and RADARSAT International hosted a workshop on the use of RADARSAT in the marine environment.

A range of topics were covered by Australian and Canadian speakers including:

- the use of data for monitoring oil spills
- ship detection and surveillance (ships can be identified by the signal returned) and
- near real time delivery of data for ice navigation

This technology will assist Australian Government better manage our vast territorial waters.

Approximately 40 people attended with representation from many key organisations including Department of Defence, Australian Fisheries Management Authority (AFMA), Australian Maritime Safety Authority (AMSA), Coastwatch and the Environment Protection Group.

At the conclusion of the workshop a discussion was held on a 'National Framework for Marine Surveillance and Applications' where ACRES is trying to develop a national approach to satellite based marine surveillance in Australia. Organisations with similar needs will be able to collaborate on data use and data purchase making the data more accessible for large monitoring projects.

For more information please contact Madeleine Clark by telephone on 02 6201 4130.

ACRES Receives Full Endorsement for Quality Recertification

Paul Wise

In 1995 ACRES, under AUSLIG's quality plan, was first certified to AS/NZS ISO 9002:1994 'Quality systems – Model for quality assurance in production, installation and servicing'. This certification ran for three years with annual external audits to ensure system maintenance.

On Friday 19 December 1997, Det Norske Veritas (DNV), the external auditing and accrediting agency, ran a complete, one-day audit of the ACRES quality system to assess ACRES for a further three-year certification period.

The auditor said in his report 'The organisation's quality system is very mature – (and) well worthy of a recommendation for recertification'.

ACRES is very pleased with this achievement being (to our knowledge) the only ground-station so certified. However, the real benefits go to all our clients who can continue to expect the highest standards of product quality and service delivery.

ACRES 1996–97 Sales Report

Daniel Jaksa

It was another record year for the sales of ACRES products and services, with a total of $6.9 million in gross sales for the 96–97 financial year. Although slightly down on 95–96 figures, Landsat TM sales were again at the top of the product sales list. Landsat sales made up 60% of the total sales made by ACRES last FY (see figure 1).

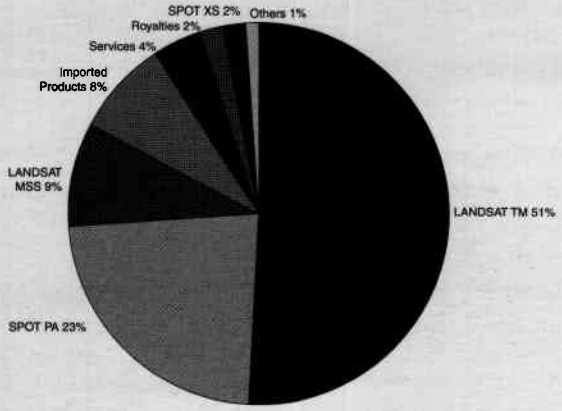


FIGURE 1

SPOT PAN increased its market share by 9%, bringing its total gross sales past $1.5 million. Radar image sales also increased significantly with increased sales of ERS, RADARSAT and JERS data.

Sales to the mining/exploration sector decreased by over one quarter last financial year. Sales to users in agriculture and topographic mapping also declined. These decreases were however counterbalanced by increases in sales to the environmental monitoring, marine, defence, forestry, water resources and urban/regional planning sectors (see figure 2).

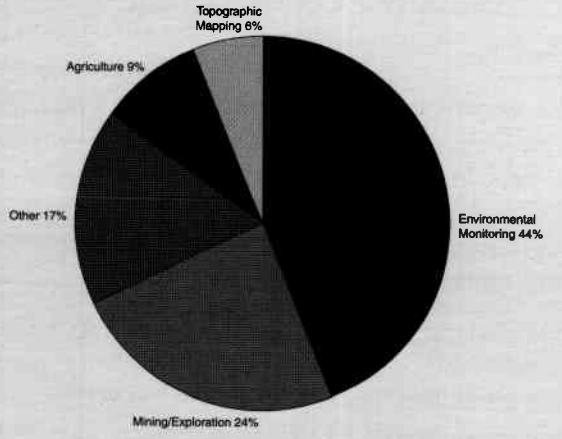


FIGURE 2

The largest number of data sales made in the 96/97 FY were processed at level 4 and 5. While level 10 and 8 sales were up level 9, 4 and 5 were down slightly.

Total Gross Sales

Year	$Million
1995/96	6.53
1996/97	6.90

Summary of Gross Sales 1996/97 Financial Year

Landsat	$ Sales	Percent of Total
ACRES MSS	597 850	8.7
ACRES TM	3 573 451	51.8
EOSAT (Mainly TM)	281 302	4.0
NRCT – Thailand (TM)	104 025	1.5
EROS (MSS)	2 035	0.1
Total	**4 558 663**	**66**
SPOT		
Panchromatic	1 559 132	22.6
Multispectral (XS)	147 047	2.1
New Zealand	20 100	0.3
Papua New Guinea	3 800	0.1
Total	**1 730 079**	**25.1**
Other		
ERS SAR	14 140	0.2
RADARSAT	137 784	2.0
JERS	11 196	0.2
IRS	1 803	0.1
Customised Sample	11 400	0.2
Image Writing	241 597	3.5
Royalties	105 920	1.5
Freight	15 039	0.2
Priority Processing	28 915	0.4
Specialty Products	20 596	0.3
Miscellaneous	21 216	0.3
Total	**609 606**	**8.9**

WA Digital Image Mosaics

Remote Sensing Services, Department of Land Administration, WA.

The Remote Sensing Services (RSS) branch of Western Australia's Department of Land Administration (DOLA), provides specialised service for the acquisition, processing and analysis of satellite data.

As a new service, RSS is creating seamless satellite image mosaics to provide our customers with 'off the shelf' data solutions over major regional areas throughout Western Australia. These data are available in a variety of forms to make satellite data more accessible and to meet individual needs. For example, imagery can be purchased in 1:100 000 or 1:250 000 map sheet tiles or individually extracted areas of interest, and supplied in BIL, ER Mapper, ArcView or TIF format on CD-ROM or 8 mm Exabyte tape. If customers do not have access to image viewing capabilities, for approximately $100 we can supply image processing software such as Terrascan, included with your digital data purchase.

Digital image mosaics are being created using a variety of satellite data including:

- Landsat Thematic Mapper data,
- SPOT Panchromatic data and
- NOAA AVHRR data.

The images within the mosaics are radiometrically calibrated to minimize across scene variations caused by the atmosphere, seasonal conditions and sensor effects to provide the user with a seamless, continuous digital dataset. The following table indicates the image mosaics presently available. Additional mosaics currently in progress include Western Australia's Canning, Kimberley and Gascoyne regions.

For further information contact:

Peter Sanders
Remote Sensing Services
Department of Land Administration.
Tel. (08) 9340 9330
Email: sanders@uranus.dola.wa.gov.au

COVERAGE	DIGITAL MOSAIC DETAILS	
	*South-West Agricultural Region TM Mosaic*	
	Data used:	Landsat Thematic Mapper Data
	Resolution:	25m x 25m
	Number of scenes:	Approximately 16 scenes
	Bands available:	1,2,3,4,5,7
	Dates of imagery:	Majority are summer 1996 scenes
	Availability:	1:250000 and 1:100000 map sheets; any customised area of interest.
	Format:	BIL, ER Mapper, Arcview, TIF
	Medium:	CD ROM, 8 mm Exabyte
	*Pilbara Region TM Mosaic*	
	Data used:	Landsat Thematic Mapper Data
	Resolution:	25m x 25m
	Number of scenes:	Approximately 23 scene portions
	Bands available:	Bands 1,2,3,4,5,7
	Dates of imagery:	Majority are 1994 (September to April)
	Availability:	1:250000 and 1:100000 map sheets; any customised area of interest.
	Format:	BIL, ER Mapper, ArcView, TIF
	Medium:	CD ROM, 8 mm Exabyte
	*South-West Region SPOT Panchromatic Mosaic*	
	Data used:	SPOT Panchromatic Data
	Resolution:	10m x 10m
	Number of scenes:	Approximately 60 scenes
	Bands available:	1 panchromatic band
	Dates of imagery:	Majority are summer 1996 scenes
	Availability:	1:250000 and 1:100000 map sheets; any customised area of interest.
	Format:	BIL, ER Mapper, ArcView, TIF
	Medium:	CD ROM, 8 mm Exabyte
	*South-West Region SPOT Pan. / Landsat TM Merged Mosaic*	
	Data used:	Landsat TM and SPOT Panchromatic Data
	Resolution:	10m x 10m
	Number of scenes:	Approximately 60 SPOT and 6 TM scenes
	Bands available:	Bands 7,5,3 (red, green, blue) fused with SPOT pan (Note: customised band combinations are available on request)
	Dates of imagery:	Majority are summer 1996 scenes
	Availability:	1:250000 and 1:100000 map sheets; any customised area of interest.
	Format:	BIL, ER Mapper, ArcView, TIF
	Medium:	CD ROM, 8 mm Exabyte
	*Australian NOAA AVHRR Mosaic:*	
	Data used:	NOAA AVHRR data
	Resolution:	1 km x 1 km
	Number of scenes:	4 scenes
	Bands available:	Bands 1,2,3 and 2,2,1 (red, green, blue)
	Dates of imagery:	1987
	Availability:	Australian coverage, any customised area of interest.
	Format:	BIL, ER Mapper, ArcView, TIF
	Medium:	CD ROM, 8 mm Exabyte

ACRES New-Look Catalogue

Donna Scott

The ACRES Digital Catalogue has had a facelift. ACRES has upgraded the operating software (v2.6) of the Web Client, so as to increase and improve functionality. Many of these improvements and additional features were a direct result of enhancements requested by frequent users.

We have also managed to modify the Web Client to now include a number of features already existing with the ACRES PC Client tool.

The additional features now available on the Web Client include:

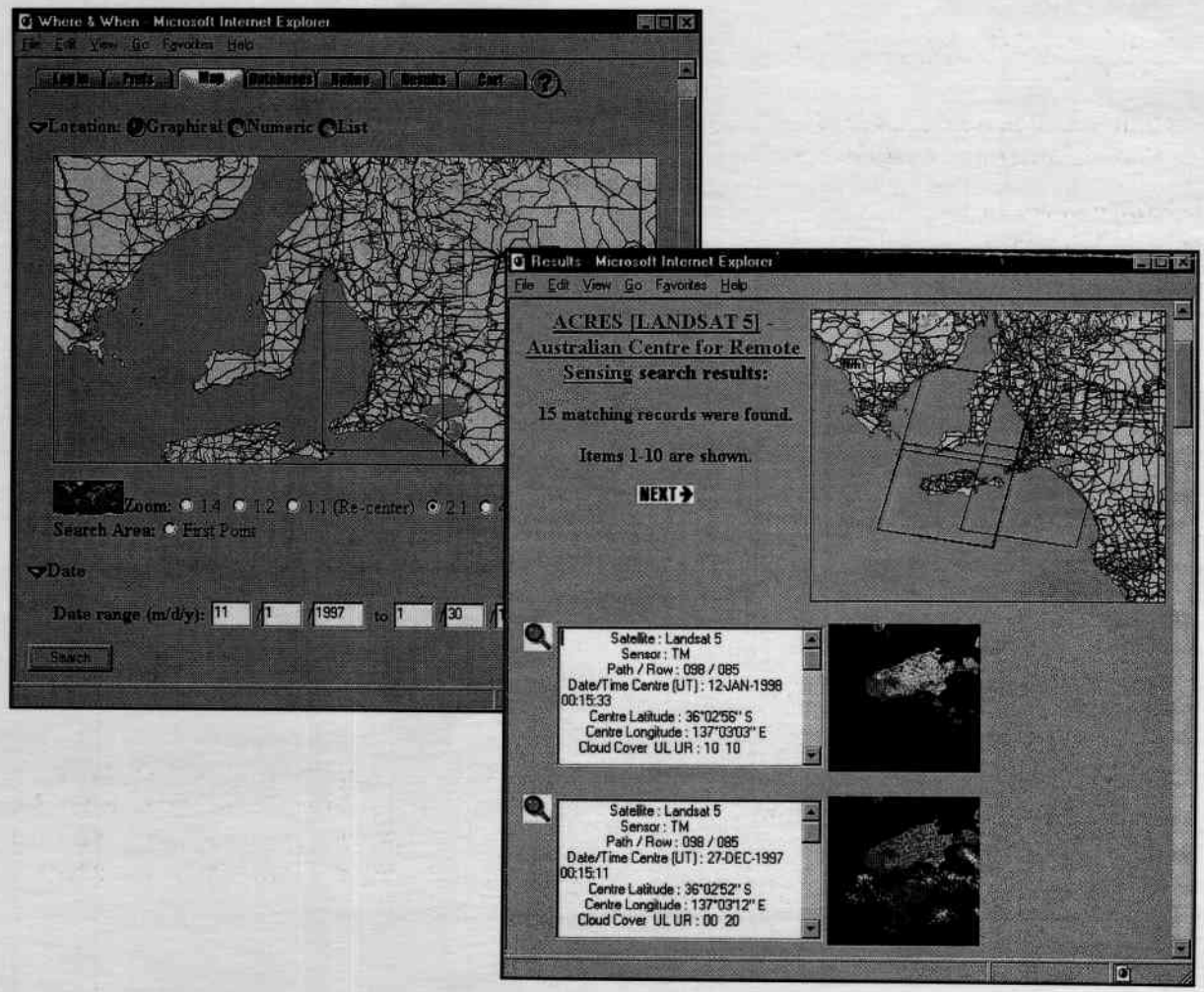
- *Geographic selection*: You can use a Digital Chart of the world map to define location or rectangle area of interest, with zoom and pan features. You can select with latitude and longitude for points or areas. Select from a list of regions, or place names in Australia and New Zealand.
- *User Preferences*: The user can select how search results will be displayed and be remembered between searches. The display formats include tabular listing of metadata.
- *Additional selection criteria*: The refinement options now include: path/row single or range, satellite, sensor (SPOT only), cloud cover, off nadir angle (SPOT only), season and results sorted according to the user selection.
- *Footprints* of the search results on Digital Chart of the world map.
- *User Registration*: This allows us to notify all registered users quickly of changes and activities on the catalogue.

Future plans for the ACRES catalogue and its tools include:

- To be able to export files in MapInfo format (presently available with the PC Client)
- MSS quicklooks and metadata
- ACRES JERS and ERS archive holdings.

ACRES understands that improved tools for searching and identifying data requirements are essential to the promotion of remotely sensed data and its applications. We welcome feedback on the both the PC Client and Web Client tools, and catalogue anomalies. For assistance or comment please contact Rosalie Booth on 02 6201 4116 or email r.booth@auslig.gov.au

The ACRES Catalogue can be viewed via the web at http://acs.auslig.gov.au/intro.html



ACRES Products on CD-R

Donna Scott

ACRES was pleased to announce the release of image data on CD-R, from Monday 3 November 1997. Since its launch more than 90% of products ordered have requested the CD medium. Landsat and SPOT products are currently available on CD-R. A new order form has been provided by ACRES which allows for the selection of the CD medium and the recommended file formats for the data. In summary the file formats are:

- EOSAT Fast Format, recommended for Landsat TM & MSS
- SPIM, the SPOT Image format recommended for SPOT only
- ACRES/CCRS, the standard ACRES Landsat and SPOT format currently used for tape products

Following international practice the files presented on the CD are the same as those on a tape product. So when ordering data on CD-R users will now have to nominate the file format they require. The new order forms will no longer offer CCT 9 track or Floppy disk media. More information on the formats and ACRES recommended selection can be found on the ACRES web site at: www.auslig.gov.au/acres/techdocs/formats.htm

YOUR ATTENTION IS ALSO DRAWN TO THESE FEATURES OF THE CD PRODUCT

Disk capacity is 650 MB.

Initially only a single scene/product will be written to each CD-R because of current system limitations.

A single CD will hold all size products up to a standard Landsat TM level 10 scene of 7 bands covering 40,500 sqkm. It will not hold the maximum size TM product. There is no method of having a product spread over 2 CDs. However a maximum area TM product (60,000 sqkm) with 6 bands will fit on a CD.

The hardcopy product report accompanying current tape products is dispensed with for CD-R products and is provided as a text file on the CD-R to reduce materials handling in the production and dispatch areas.

A README.TXT file outlining the file naming conventions is placed in the root directory of each CD-R product to assist customers.

Loading instructions are provided with each CD.

When developing the platform to produce this medium, ACRES took the opportunity to introduce a superior quality assessment checking station allowing for products to be quality assessed before writing to CD. This will aid in providing fast output to customers.

ACRES is now working on extending the CD media to our SAR product range.

GEODATA SPOT–LITE — A New Remote Sensing Product for the GIS Industry

Daniel Jaksa

ACRES is currently investigating the feasibility of producing a new product designed for the Geographic Information Industry. The product aims to fill the existing gap in the GIS market for low-cost satellite imagery.

Named GEODATA SPOT–LITE, this product provides black and white, georeferenced image tiles of Australia that can be used in a broad spectrum of applications. They can be used as illustrations in documents, backdrop imagery in Geographic Information Systems or for sophisticated analysis of terrain and land-cover.

GEODATA SPOT–LITE tiles are sourced from SPOT Panchromatic imagery used in the revision of AUSLIG's topographic map series. The SPOT–LITE tiles are produced from a mosaic of georeferenced, orthocorrected SPOT Panchromatic imagery covering a standard AUSLIG 1:250,000 map sheet area and acquired at near vertical viewing angles during the past 5 years. This mosaic is divided into 24 separate SPOT–LITE tiles, each corresponding to a standard 1:50,000 scale map sheet area, that is approximately 25x25 km. Exact radiometric matching of adjacent scenes may not always be possible due to changes in the environmental conditions and viewing geometry that may occur between the dates of acquisition of these scenes.

The SPOT Pan imagery was georeferenced using Ground Control Points digitised from 1:25,000, 1:50,000 or 1:100,000 scale topographic maps and orthocorrected using AUSLIG's GEODATA 9 Second Digital Elevation Model.

To help us gauge user requirements for the proposed SPOT–LITE product, a survey was conducted in October 1997 both on the Internet and through post. Preliminary analyses of the results indicate that the product would be welcomed by the GIS industry and would be predominantly used as a backdrop to fill in the details not available in vector form. It would also be used as a background image that can be used to trace-off additional information.

The final product specifications are not yet complete, but there were strong responses in favour of providing the imagery on CD in the GeoTIFF format. There were also a large number of respondents keen to have the tiles provided on both the new Geocentric Datum of Australia 1994 and the older Australian Geodetic Datum 1966. The proposed image size and resolution were received by those surveyed as appropriate.

Satellite Images Enhance DEHAA's Royal Adelaide Show Stand

Image Data Services, Resource Information Group, South Australian Department of Environment, Heritage and Aboriginal Affairs.

The theme for the South Australian Department of Environment, Heritage & Aboriginal Affairs exhibit at the Royal Adelaide Show for this year was Sustainable Living. To illustrate the many elements addressing better management of our resources, a selection of satellite images were displayed at the department's stand.

'Each of DEHAA's groups were well represented in the exhibit and with each having a specific function and responsibility to the community, the satellite images focused on the relevant study areas', said Robert Rusk, Marketing Coordinator for the Resource Information Group of DEHAA.

The groups include Water Resources, Natural Resources, Land Services and Native Vegetation.

'A merged Landsat TM image with a SPOT Panchromatic image highlighted the many land uses within a fragile water catchment area. Other images of the whole state of South Australia and the greater metropolitan area of Adelaide generated great interest with the public', Robert said.

Level 10 Prices Confirmed

ACRES has been producing ortho-corrected (level 10) products, using AUSLIG's 9 Second Digital Elevation Model for some time. In August 1997, ACRES proposed that level 10 prices would be $100 more than the equivalent level 9 price. This proposal was confirmed a month later.

If a client wishes to use their own DEM during the production of an ortho-corrected product at ACRES, the price will be the level 9 price plus $350. In this case the client should contact ACRES in regard to the format we require.

A YOUNG MEMBER OF THE SOUTH AUSTRALIAN PUBLIC INSPECTING THE SATELLITE IMAGERY ON DEHAA'S SHOW STAND.

Specifications for Precision Geocoded Products

The system incorporating the 'Quote for Product Requiring Ground Control Point Identification' form was designed to ensure that customers' expectations of quality of ACRES Precision Geocoded Products are fully met. Following a recent review of this system and assessment of Distributors' feedback and ACRES staff suggestions, several significant changes have been made to the system; the most obvious will be those to the form returned to customers, i.e.:

- Change of name to 'Specifications for Precision Geocoded Products'
- Table heading 'Likely RMS Error' to replace 'Maximum Likely Error of Generated Product'
- The values listed under 'Likely RMS Error' will be annotated +/-
- A note #3 will be added stating 'Further information regarding Likely RMS Error calculation is available from ACRES Customer Services'

This information is now contained on the front page of relevant quotes provided by ACRES. Previously known as the Quote for Product Requiring GCP identification form, this form has proven to be a useful tool in achieving clients desired product quality. The form was designed to give feedback to clients, indicating the level of accuracy that they could expect for their ordered precision geocoded products, based on mapping availability and scale, and to act as a checklist of production options available, e.g. addition of customer supplied GCPs or DEMs or use of customers maps.

Other benefits include ACRES improved ability to predict product delivery date, and its use as an advanced notice to GCP operators, allowing them time to retrieve mapping that is stored off site. It also has the important function of notifying ACRES that the ordered data is to be used for mosaicking.

ACRES Warranty Period Changed

As from 1 July 1997 ACRES changed its warranty period on ACRES products to 30 days from date of despatch. Users will need to be aware of the warranty period defined for data, obtained by ACRES on their behalf from overseas agencies, as the period may differ.

RADARSAT Photographic Products can now be Produced at ACRES

ACRES has signed an agreement with RADARSAT International to permit ACRES to image write RADARSAT data and produce photographic prints from that data. This will facilitate quicker delivery of photographic products to customers, and ensure that customers receive a photographic product consistent with ACRES high quality.

Prices for such photographic products will be according to the normal RADARSAT price list. However, please note that the specific negative scale, print scale and print size may in some cases be slightly different from the RADARSAT specifications, due to Acres' and RADARSAT's differing image writing facilities and capabilities.

In negotiating the agreement, RADARSAT were impressed by the quality of the ACRES photographic product, which made their acceptance of our proposal a great deal easier.

RESURS Sub-Distributors Appointed

ACRES has appointed 4 sub-distributors to sell data acquired from the Russian-built RESURS-O1 satellite. They are:

- GEOIMAGE Pty Ltd
- Environmental Research & Information Consortium Pty Ltd (ERIC)
- AGRECON Pty Ltd
- Department of Land Administration (WA)

Please refer to the back page for contact details.

RESURS-O1 Information

Launched on 4 November 1994, RESURS-O1 is the third in a series of Russian RESURS satellites designed for environmental monitoring and mapping Earth's natural resources. The 'O' in the name stands for operational, and refers to the rapid transmission of the image data from the satellite to Earth. With a medium resolution and wide swath width, RESURS-O1 data fills the gap between LANDSAT/SPOT and NOAA AVHRR, providing a solution for large area, or regional projects.

ACRES has an agreement with the Swedish Space Corporation, SSC Satellitbild, to provide imagery from the MSU-SK instrument on-board the RESURS-O1 satellite. Via an agreement with the Russian operators of the satellite, SSC Satellitbild acquires RESURS-O1 data at the SSC Esrange ground station, outside Kiruna, in northern Sweden. Programmed services are made possible by the use of the on-board tape recorder, enabling worldwide coverage.

ORBITAL CHARACTERISTICS

Orbital Parameters	Details
Launch Date	4 November 1994
Orbit	Sun-synchronous, circular
Average Altitude	678 km
Inclination	98.04
Eccentricity	0.0128
Argument of Perigee	88.93
Orbit Period	98 minutes
Orbit Repeat Cycle	21 days
Potential Repeat Coverage	~ 4 days at the equator

SENSOR CHARACTERISTICS

Sensor Parameters	Details
Sensor Name	MSU-SK
Imaging Mechanism	Conical scan
Viewing Angle	39
Aperture	200mm
Swath Width	600km
Pixel Size	160m
Wave Bands	0.5-0.6, 0.6-0.7, 0.7-0.8, 0.8-1.1μm
Quantisation (dynamic range)	8 bits (256 levels)

ARCHIVED IMAGES

There are two archives containing RESURS-O1 imagery. A Local Archive is held at ACRES and contains images of Australia. A Worldwide Archive is held in Sweden and contains images of other parts of the world. All archived images cover about 600x600km.

MAPPING SERVICES

This service provides cloud-free imagery (<10% cloud - unless otherwise stipulated by SSC Satellitbild at the time of ordering) over a client's area of interest. To produce cloud-free imagery two services are required to be completed before the product can be processed. Programming of the satellite to acquire the image of the area of interest is first performed. An image evaluation and pre-processing is then completed. Imagery can be ordered in either digital or positive film media. Scenes of a customer-defined area can be either system corrected, geocorrected or in a mosaic form that has been geocorrected. Geocorrected Satellite Image Maps can also be produced at 1:500,000 or 1:1,000,000 scales and mosaicked if necessary.

MONITORING SERVICES

The monitoring service is a data subscription service where RESURS imagery is programmed to be acquired over the one regional area for a fixed period of time, for the same product type. Once the service has been programmed, tailor-made images from within one swath width, either system corrected or geocorrected, can be produced onto digital or positive film.

DATA AVAILABILITY

RESURS-O1 has had full operational capability since early 1995. Production of direct-mode data became fully operational in November 1995. The images were processed and the Quick Looks are now available on EiNet (http://www.eurimage.it). Reception of tape-recorded images started in October 1995. To date acquisitions have been made over almost all of the surface of the planet, and a good archive of images acquired in different seasons is growing.

Long-term data continuity is assured, as the Russian operators plan to launch the fourth in the series, carrying the same instruments as the current satellite, by the end of 1997. This will be followed by the first satellite in the RESURS-O2 series, a series that will take the RESURS program well into the 21st century.

APPLICATIONS

RESURS-O1 data is excellent for land use monitoring and mapping. Its resolution of 160 metres is perfect for many agricultural applications in Australia, especially where large properties are involved. Recent work has demonstrated that RESURS-O1 data is able to discriminate large-scale vegetation types, such as in forested areas, being ideal for studying biomass and growth patterns.

For environmental mapping and planning, marine and coastal zone observations, disaster and hazard monitoring and geomapping, RESURS-O1 imagery provides a good global and regional data set. RESURS-O1 data has been very successfully used to monitor the progress of forest fires and alerting and guiding authorities to new outbreaks almost in real time.

For general ice cover mapping purposes, RESURS-O1 proves to be a valuable resource. With its high frequency coverage, every opportunity is given to capture imagery offered by breaks in cloud cover.

9th Australasian Remote Sensing Photogrammetry Conference

ACRES will have a strong presence at the 9th Australasian Remote Sensing Photogrammetry Conference at UNSW in Sydney in July 1998. A large stand has been booked by ACRES to display its remote sensing products. Emphasis will be placed on displays of RADARSAT and RESURS imagery and services.

Two papers will be presented by ACRES staff members covering GEODATA SPOT–LITE and ground station preparations for ARIES.

For more information on the details of the conference please refer to www.geog.unsw.edu.au/arspc98.

Calendar

30 March – 4 April 1998 — **Florida, USA**

American Society for Photogrammetry & Remote Sensing and Resource Technology Institute Annual Conference

Contact: ASPRS/RTI Annual Conference, 5410 Grosvenor Lane, Suite 210, Bethesda, MD, 20814-2160
Tel: 1 301 493 0290
Fax: 1 301 493 0208

29–30 April 1998 — **Sydney, Australia**

Australian Timber & Forestry Industry Conference

Contact: AIC Conferences Pty Ltd, GPO Box 3924, Sydney, NSW, 2000, Australia
Tel: 61 2 9210 5700
Fax: 61 2 9223 8216
Web: www.aicgroup.com

24–28 May 1998 — **Fremantle, Australia**

National Conference of the Mapping Science Institute

Contact: Promaco Conventions Pty Ltd, PO Box 890, Canning Bridge, WA, 6153, Australia
Tel: 61 8 9364 8311
Fax: 61 8 9316 1453
Email: promaco@promaco.com.au

1–3 June 1998 — **Florida, USA**

First International Conference on Geospatial Information in Agriculture and Forestry

Contact: Robert Rodgers, ERIM, Box 134001, Ann Arbor, MI, 48113-4001, USA
Tel: 1 313 994 1200
Fax: 1 313 994 5123
Email: raeder@erim.org

17–19 June 1998 — **Beijing, China**

Geoinformatics '98

Contact: Secretariat of Geoinformatics '98, CPGIS Beijing Laboratory, Institute of Remote Sensing Applications, Chinese Academy of Sciences, PO Box 9718, Beijing, 100101, China
Tel: 86 10 6491 9458, 9268
Fax: 86 10 6491 5035
Email: proj@irsa.irsa.ac.cn

6–10 July 1998 — **Townsville, Australia**

14th Australian Geological Convention

Contact: 14th AGC, School of Earth Sciences, James Cook University, Townsville, QLD, 4811
Tel: 61 7 4781 5061
Fax: 61 7 4781 5522
Email: jcu.agc@jcu.edu.au

20–24 July 1998 — **Sydney, Australia**

9th Australasian Remote Sensing and Photogrammetry Conference

Contact: Australian Convention and Travel Services Pty Ltd, GPO Box 2200, Canberra, ACT, 2601, Australia
Tel: 61 2 6257 3299
Fax: 61 2 6257 3256
Email: arsc98@acts.ccmail.compuserve.com
Web: www.geog.unsw.edu.au/arspc98

18–20 August 1998 — **Cairns, Australia**

Spillcon '98. Oil Spills: Causes and Cures

Contact: The Meeting Planners, 108 Church Street, Hawthorn, VIC, 3122, Australia
Tel: 61 3 9819 3700
Fax: 61 3 9819 5978
Email: spillcon@meetingplanners.com.au

5–7 October 1998 — **San Diego, California**

Fifth International Conference on Remote Sensing for Marine and Coastal Environments

Contact: Nancy Wallman, ERIM, Box 134001, Ann Arbor, MI, 48113-4001, USA
Tel: 1 313 994 1200 ext. 3234
Fax: 1 313 994 5123
Email: wallman@erim.org

1–3 June 1999 — **Warsaw, Poland**

Remote Sensing and Forest Monitoring Conference

Contact: Tomasz Zawila-Niedzwiecki and Heronim Olenderek, SGGW, Warsaw Agricultural University, Faculty of Forestry, 26/30 Rakowiecka str., 02-528, Warsaw, Poland.
Fax: 48 22 491 375
Email: tzawila@giswitch.sggw.waw.pl

5–7 July 1999 — **Darwin, Australia**

4th North Australian Remote Sensing and Geographic Information Systems Conference

Contact: NARGIS 99, Science Faculty, Northern Territory University, Darwin, NT, 0909, Aust
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Email: nargis@ntu.edu.au

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