REMOTE SENSING IN AUSTRALIA TWENTY-ONE YEARS AFTER LANDSAT

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Abstract

The commissioning of the then Australian LANDSAT Station in 1980 heralded the unprecedented acceptance of a new technology that was able to conquer Australia's unique problems of immensity of area, isolated expanses and need for cost-effective data supply. LANDSAT cost-effectively acquired data of all of Australia and brought it to users without them having to leave the office.

However, Australia's other unique problem, that of its relative global isolation meant the development of our own supporting remote sensing infrastructure for example, hardware and interpretive techniques.

This paper looks at the last ten years of remote sensing infrastructure development in Australia as well as looking forward to the next five years.

Introduction

Principal Investigator status was accorded to an Australian research consortium for LANDSAT-1 in 1971. It was not until 1973, however, that satellite remotely sensed data was being used regularly in Australia. In 1979 the Australian LANDSAT Station, now the Australian Centre for Remote Sensing (ACRES), was established and opened in November 1980.

Since then the use of satellite remote sensing has fundamentally and permanently changed the concepts of resource evaluation, land management and environmental monitoring.

Australia has always taken a strictly user oriented approach to remote sensing. Specialists worked on the application of this technology in their area of interest. Thus the new technology was integrated with the traditional methods and the user's needs in a highly efficient manner.

However, to maximize the information content of the data the major tasks of digital interpretation and analysis required specialized equipment and techniques.

The high cost of, and need for familiarity with, image analysis systems hindered the expansion of the technology in Australia such that agencies sought the means of overcoming this problem. With experience and the need to develop expertise came the further requirement for more practitioners with remote sensing skills and the manufacture of receiving and processing equipment.

These then were the areas where the major Australian developments have taken place with the overriding factor being "cost minimisation". This single factor also makes these developments attractive to developing countries.

This paper looks at the last ten years of remote sensing infrastructure development in Australia as the means of generating cost effective products through the use of efficient interpretation and analysis techniques.

While mainly focusing on Australian initiatives this paper has as its underlying theme the requirement of making remote sensing technology more and more accessible by minimizing, where possible, component costs.

The Australian Centre for Remote Sensing

Perhaps the most significant event to the Australian remote sensing community in the last ten years, was the Australian Government's recognition of the potential benefits to the Australian community of Thematic Mapper and SPOT data. Their recognition, in 1986, resulted in the approval of funding for a A$15M upgrade to the ACRES facilities to enable the direct reception and processing of not only TM and SPOT data but also NOAA AVHRR (Advanced Very High Resolution Radiometer) data for Australia wide environmental monitoring.

The principal function of ACRES is to receive, process, archive and distribute remotely sensed earth resource data from satellites for use in research, mapping, land-use monitoring and the discovery and development of non-renewable resources. Distribution of data is assisted through a network of Distributors most of which are situated in the State mapping centres or centres of excellence in remote sensing applications.

Routine recording and archiving of multispectral scanner (MSS) data began in Australia in December 1979 and continues today. In 1986 the joint ACRES/CSIRO Signal Processing Experiment commenced and enabled the reception, archiving and distribution of Thematic Mapper data. Following the launch of SPOT-1, also in 1986, an arrangement with SPOT Image allowed the distribution of SPOT data. Following the 1986 approval to upgrade fully operational TM and SPOT reception and processing commenced.

Recently the Australian designed and built AETHERS Fast Deliver Processor was installed at ACRES to process the Synthetic Aperture Radar (SAR) data received from ERS-1.

Today ACRES is being further upgraded to allow the reception and processing of LANDSAT 6 and JERS-1 data. Part of these upgrades has included other Australian designed and produced equipment thus supporting the growth of the local space industry.

A major step was taken towards the long term preservation of the ACRES archive. Three optical tape recorders are installed and will be used for the transcription of data from the existing HDDTs. Transcription of the archive to optical tape will also result in space savings and the ability to back-up the archive.

The need for ERS-1 SAR data of the Southern Ocean to help in our understanding of the environmental role of this great ocean has led to the establishment of a prototype ground station near Hobart, Tasmania. To minimise establishment and operating costs a number of data reception and recording innovations have been employed. The data itself will be processed into products by ACRES.

The development of these "add-on" type systems means that the reception of data in Australia from future satellites is assured at a much lower cost and is seen to be valuable in supporting lower cost access to satellite data in the region.

While the need for data acquisition and processing equipment has seen the development of some versatile Australian electronics and computing there have been other notable Australian advances.

Image Processing Systems and Networks

Image processing systems initially catered to experienced users. This emphasis needed to shift for remote sensing technology to become an every day tool. Many potential users such as foresters or marine scientists only required occasional access to remote sensing techniques. Thus they could not justify acquiring

expensive hardware or the considerable personal expertise to use it. The technology needed to be compatible with their interests and access to, and use of it, made simple.

The change in the processing of remotely sensed data was significantly aided by the introduction of high-performance, low cost microcomputer-based image processing systems.

However, effective use of such systems required not only access to these tools but an appreciation of how image processing maximizes the information contained in the digital data and how to interpret this information.

To minimize processing costs powerful interpretation techniques that extracted and displayed the maximum information content of the data as well as allowing the integration of other relevant data sources were sought.

Competence in software design was thus developed and now the powerful software packages, which represent a significant proportion of the overall cost of any remote sensing image analysis system, exist. As there is a requirement for small stand-alone systems to multi-level networks Australian expertise is being focussed on the whole range and more particularly where software development is guided by detailed applications experience.

Examples are the PC and workstation based packages now available. These packages are cheap and user-friendly yet contain powerful and sophisticated algorithms. The workstation software has the added advantage of being device independent. Such software is in use in Australian agencies and there is a commitment to its maintenance. Furthermore, the ability to integrate new algorithms, as they emerge, is an added advantage.

Because of their low cost and easy maintenance PC systems are most cost-effective in education, training and research establishments where the processing of small data sets is required. For production areas requiring through-put workstations that can be networked are more suited. Even a mix of both is possible.

The results of the Australia - Philippines Remote Sensing Project are a demonstration of where such equipment has been installed and operationally implemented successfully within a very short time frame.

Two PC based systems were also installed at the UN in Bangkok for training and familiarisation purposes.

Value Added Services

These services cover areas of applications expertise. Due to the global nature of satellite remote sensing Australia with its demonstrated competence in a number of applications is not bound by geographic location. Thus countries with significant arid, tropical or coastal zones can take advantage of the already documented Australian experience.

Education and Training Courses

The acceptance of remote sensing technology in the region has resulted in the setting up of remote sensing application units. This has led to a growing demand for skilled personnel to run such establishments. To enable the knowledge base to be continually expanded different levels of training are required.

At this point it is important to note that while education and training are used interchangeably education aims at producing remote sensing experts. Generally, as the majority of users see remote sensing technology as one of a number of tools for problem solving such expertise is not a requirement. Rather these users, who are primarily expert in their own fields and not remote sensing, need training.

Access to training courses which include hands-on image processing is now available particularly now that the course material and the hardware is transportable.

Several Australian educational institutions have taken advantage of this "transportability" offering courses in remote sensing ranging from short courses to single subjects. More and more the leading centres will also devise and run appropriate courses for client organizations inside and outside Australia. When required the Australian Centre for Remote Sensing has trained staff from other stations and furthermore several specialist training course have been developed and run in Australia with participants brought from the surrounding region and the middle-east.

International Activity

In the past few years, participation in international and global activities has increased. Notable among these are:

- active membership of the Committee for Earth Observation Satellites;

- participation in the Global 1KM data project whereby Australian data will form an Australian data base as well as being copied to the USGS;

- collaboration with the UK, to provide the infrared focal plane assembly for integration into the Along Track Scanning Radiometer for ERS-2. Scope for participation in the Advanced Along Track Scanning Radiometer also exists;

- a study to be undertaken to assess the feasibility of an Atmospheric Pressure Sensor able to measure atmospheric pressure at the earth's surface from a satellite platform;

- calibration of the ERS-1 SAR using radar reflectors and transponders;

The Future

The future will hopefully see Australian users having access to products from LANDSAT 6 and JERS-1 complemented by ERS-1 SAR data. Data of the Southern Ocean will start being received through the prototype Hobart station and made available to researchers.

The Australian archive will be safeguarded on optical tape.

Australia will continue to play its part in the development and manufacture of specialised space instrumentation as well as components for reception and processing.

As part of the global family we will continue to assist and cooperate in the region and participate internationally.

Summary

Because of its unique geographical location Australia has attempted to capitalise on this isolation by developing its own expertise and remote sensing infrastructure. These developments include cheap yet powerful and sophisticated software, PC and workstation based image analysis systems, reception and processing equipment and respected educational and training institutions.

While these developments have been well received it is believed that their widespread use would allow a more rapid familiarisation and subsequent acceptance of remote sensing technology particularly in the developing countries of the region.

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