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A new millennium - a new era for remote sensing...?

Is 1999 to be the year when our subject finally moves into its next phase - a phase of space-borne high spatial and spectral resolution data? My own return to a more active role as Head of Remote Sensing at the British Geological Survey and the new Chairman of GRSG prompted me to take stock. And ERIM's Geologic Remote Sensing conference in Vancouver during March, the 13th conference in this excellent series, presented the perfect opportunity to do so. After two years watching from the sidelines, involving myself in the wider strategic issues facing geoscience as a whole, it seemed to me that we had entered the last year of this millennium waiting expectantly for the same new sensors that we had been expecting in 1997. There had been advances in airborne systems, such as the excellent Hy-Map, but no space-borne systems to bring these data sets to the mass market. Perhaps the dawn of the new era was still some way over the horizon?

Since the start of the year, there has been evidence both for and against this hypothesis. Landsat 7 was launched successfully on 15th April and has already commenced delivery of data from the Enhanced Thematic Mapper on board. A successful launch for an earth observation satellite! Of course, the data only inch us towards the new era, there already being higher spatial resolution data available from other sensors. But the ETM's 15m resolution panchromatic band, seamlessly merged with the multispectral TM bands that we know and love, will significantly improve our contribution to regional and even more detailed geological studies. Then there was to be IKONOS; at 1m spatial resolution, the first step into the new era. At the time of writing, it looks as if this step was followed in quick succession by two steps backwards. Following launch, contact could not be established with IKONOS. Talk is already turning to IKONOS 2. So, the jury is still out.

Later this year come the scheduled launches of ASTER, Quickbird, Orbview-3, and Envisat. At ERIM we heard of ambitious plans for a Shuttle Radar Topography Mission this September. So, there are reasons to be optimistic. Let us hope that the dawn is not too far over the horizon after all.

... and a new era for GRSG?

The end of 1998 saw two key players in the history of GRSG step aside after a decade of service to the membership and their profession. My predecessor as Chairman, Alistair Lamb, completed his turn in the hot seat and two successive terms on the committee. Deputy Chairman John Moore had served for a similar length of time and both have stepped down from the committee for a well-earned rest. Alistair and John, alongside one or two others who have already moved on, laid the foundations and then built GRSG into the organisation it is today, with over 200 members in every part of the globe. Of course, John is still active at Imperial College and Alistair is involved with a new venture based around the use of

hyperspectral data. The committee will miss them both and we thank them for their substantial and sustained contribution over the years.

Consequently, 1999 sees the new kids on the block take over! As the newly elected Chairman, I will do my best to put into practice all that I learnt working as Secretary under both Alistair and his predecessor, John Gutmanis. I will be supported in this task by an enthusiastic and able team. We intend to build on the legacy inherited from our predecessors: the Newsletter will see further improvements; the web pages will be upgraded; relations with the Geological and Remote Sensing Societies will be developed; and collaboration with international organisations such as ERIM will be furthered. But of course, we can't do all this alone; this organisation belongs to all its members and the responsibility is shared amongst them. So, I urge you to contribute to the Newsletter, send us your views, and suggest new initiatives. You might even want to volunteer for the committee! We look forward to hearing from you.

Stuart Marsh,
GRSG Chairman,
30th April 1999.

GROUP & MEMBERS' NEWS

Amendments to the GRSG Constitution

The Committee have made a few changes to the Constitution of the GRSG. The latest version is as follows:

Constitution

1 NAME

1.1 The name of the group shall be the Geological Remote Sensing Group.

2 AFFILIATION

2.1 The Group shall be affiliated to the Geological Society and the Remote Sensing Society.

3 AIMS

3.1 The purpose of the Group is to promote and to study practical geological applications of earth observation systems/remote sensing, particularly those of benefit to the community.

3.2 It will do this by:

- holding meetings and visits, particularly in conjunction with other specialist groups of the two societies and those of overseas organisations holding similar aims to the group;
- encouraging research and training by providing a forum for the presentation of research results;
- providing a focus of informed views sought by others;
- encouraging the joint activity of industry, government and universities and multi-disciplinary research;
- carrying out or sponsoring joint investigation of topics believed important to the well-being of geological remote sensing; and
- such other means as the committee of the Group may think desirable, subject to the approval of the Council of each Society.

4 MEMBERSHIP

4.1 Membership of the Group is open to Fellows, Honorary Fellows and Junior Associates of the Geological Society, and to Fellows, Members, Honorary Members and Affiliates of the Remote Sensing Society.

4.2 Membership is open to all those with special interest in geological remote sensing, in its widest sense, who are approved by the Committee of the Group.

5 COMMITTEE

5.1 The affairs of the Group shall be arranged by a committee comprising a Chairman, Secretary, Treasurer and Membership Secretary, Newsletter Editor, Publicity Officer, Student Representative and up to 6 others, elected by a ballot of the membership each year. At least one of the officers shall be a member of one or both societies.

5.2 An officer of the Societies shall be a member of the Committee ex officio.

5.3 Committee members shall serve no more than two consecutive three year terms, after which they will stand down.

6 FINANCE

6.1 The financial year shall be a calendar year, and the Group shall incur no financial obligation chargeable to the Geological or Remote Sensing Societies, unless such obligations have been authorised previously by the Council of the respective Society.

6.2 An annual summary of the financial position of the Group shall be submitted to the Societies by 31 December.

7 ADHERENCE TO THE CHARTER OF THE GEOLOGICAL SOCIETY AND THE REMOTE SENSING SOCIETY

7.1 The Group shall not take any action which may conflict with the terms of the Charters and by-laws of the respective Societies.

The Irish News

Sunday 21st March 1999

The really big Irish News story this issue is that Billy Loughlin has been replaced by a new correspondent. Sputnik Billy (please try to stay in Ireland Sputnik - ed.)

Woke up this morning. Trying to get my bearings. Where on the planet am I? O.K. Lets have a wee think here.....

It's..... Really, really, dark, the wind howling and driving heavy rain, not snow, against the windows. OK..... Vancouver, Canada, really does have the same weather as home.

But that's not right.....this can't be Vancouver as I didn't use that return ticket on Paddy's day, must be in Toronto, but Toronto definitely doesn't have Fermanagh type weather.... now I'm really confused.... think on for a while..... slow down here, sputnik.....where am I?

.....in a really comfortable bed.....nice lightweight goose down quilt (don't get those in North American Hotels).....large room (ditto)

feel around in the bed - touch some lady's warm back.....what on earth have I got myself into this time!?!

oh dear.....this isn't right.....think on.....and keep thinking.

EUREKA!! I'm home.

Talking of confused travelling Geologists, I lifted the following, with permission, from the Geological Society of Nevada Newsletter for February 1999. Now the GSN is a great organisation, with a very large membership (1,000 at last count, 700 in Nevada, 300 elsewhere), superb Great Basin geologists; these guys really know how to have monthly 'membership meetings' - drinks sponsored by the drilling companies (in turn of course, it's only fair) - none of your single pint each, like we all suffered at the exhibitor's reception in Vancouver (they cut Billy's talk for that?). This is serious hospitality. I'll tell you something else about GSN, most of the members don't even know where Cuprite is, as they are real geologists interested in finding Ore Bodies in the real world. Now let's see if there is any Irish Irish News.... Wassa, in Ghana, poured gold in January; Glencar and Moydow are happy. Ntotoso prospect in Ghana is looking really good for Moydow. Ormonde Mining of Kilkenny (Dublin and VSE) have some great success in Tanzania. Jonathan Guard of CSA produced a son last month (or his wife did) and so did David Moore of Eurogise at the National University in Galway, whilst Garth Earl's wife produced one of the female persuasion. Apparently Billy Loughlin met the sprog of Dave Moore, Ros, and reports that he is a real 'Designer Baby'. Martin Critchley and his wife had their beautiful red-haired girl with them in Vancouver.

Billy Loughlin's cat Jimmy got killed on New Year. Billy only had malaria twice in '98, bit of a record for him.

Visit the Geological Society of Nevada (GSN) web site, they are at:- <http://www.seismo.unr.edu/GSN> or

get information from:- gsn@mines.unr.edu. They have a superb collection of publications on Great Basin geology.

And that's about it for this issue

Sputnik Billy

Thanks SB, we look forward to your next report (Ed.)

And don't forget, the GRSG web page can still be found at the following address:

<http://www.brookes.ac.uk/geology/kelly/remote.html>

GRSG New Student Award

There has been a disappointing lack of response to the announcement of the GRSG Student Prize (notices in previous issues, RSS Newsletter and dispatched to relevant Universities and Colleges). We are still keen to promote this venture and to reward worthy candidates. The prize has been altered slightly in an attempt to draw more interest. The current advert looks like this:

GRSG Student Award

The Geological Remote Sensing Group would like to award a £250 student travel bursary to contribute toward conference registration, flight or fieldwork costs.

The award will be judged on the basis of a 500 word summary of your work, reason for travelling or your fieldwork objectives. Deadline for submission of the summary is the end of March.

Enquiries and 500 word summary should be sent to:

GRSG Secretary
Anthony Denniss
NRSC Ltd, Arthur Street, Barwell, Leicestershiire LE9 8GZ
Tel: 01455 849219 Fax: 01455 841785
Email: adenniss@nrsc.co.uk

The award will be given at the discretion of the GRSG Committee, who will make their decision by the end of April each year.

The award is subject to provision of a brief article, describing the outcomes of the conference/fieldwork, for inclusion in the GRSG Newsletter.



Geological Remote Sensing Group

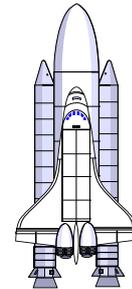
NEW SENSORS & DATA

Shuttle Radar Topography Mission - a global DEM

This is a modification of the SIR-C mission, with the addition of a new, 60m antenna. The 11 day mission is set to produce a global DEM (at both 30m and 90m resolutions) between latitudes of 60° N and 54° S (i.e. about 80% of the land earth's surface), using C-band and X-band radar. The earth's landmass will be mapped at least twice during the flight, in 225km swaths with crossing illumination. Opposite polarisations will operate simultaneously to enable rapid coverage.

All data products will be processed, geo-corrected and ready for release within 1 year of launch. Access to 30m DEM will be restricted in USA but access to 90m DEM will be unrestricted globally.

Launch is set for 16 September 1999.



<http://southport.jpl.nasa.gov/html/projects/srtm.html>

Progress on the ARIES-1 Hyperspectral Resource Information Mapping Satellite Project

The proposed new systems are:

- Hyperion
- NEMO
- Orbview-4
- ARIES-1

The project is set to kick-off again in June 1999

The estimated signal to noise ratios are 600:1 (VNIR) and 400:1 (SWIR). Scientific and practical issues already tackled are:

- large data volumes (data reduction processes are available)
- calibration
- reduction to absolute reflectance
- necessity for reproducible products
- ease of mosaicing and new forms of data integration

Distribution will be web-based and world-wide, the data archive will be held in Australia.

ARIES-1 web page <http://www.cossa.csiro.au/ARIES/index.htm>

EOS AM-1 Spacecraft

AM-1 carries 5 major systems:

- ASTER
- MODIS
- CERES
- MISR
- MOPIT



When operating, the USGS and EOS will be receiving ~ 250 ETM and 750 ASTER scenes per day from AM-1.

The next crucial question is cost!.....

approx. cost per scene \$475 level 0; \$600 level 1

Data format will be EOS-HDF. Access will be via the USGS Data Gateway, where there will be a web-based search and order system in operation. Delivery can be via ftp, hardcopy or CD. The web site is as follows:

<http://eos.nasa.gov/imswelcome>

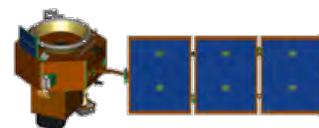
Further information about ASTER can be obtained at either:

<http://asterweb.jpl.nasa.gov> or by contacting Dr Anne B. Kahle
(Anne.B.Kahle@jpl.nasa.gov) or Hiroji Tsu (tsu@gsj.go.jp)

- Also don't miss the **ASTER Spectral Library** - a collection of over 2000 spectra. All the data are on-line at the Aster web-site and you can search the database using a variety of criteria. You can also order the entire library on CD-ROM via the spectral library site. Currently, there is no charge for the CD but please only order it if you really want it!
<http://speclib.jpl.nasa.gov>

MODIS web page can be found at

<http://ltpwww.gsfc.nasa.gov/MODIS/MODIS.html>



EO-1 (Earth Orbiter 1)

Earth Orbiter-1 is the first of a series of earth orbiting missions for the New Millennium Program. The mission will validate a number of revolutionary technologies that will provide Landsat follow on instruments with increased performance at lower cost. The centerpiece is an advanced land imager (ALI) instrument. Once on orbit, EO-1 will provide 100-200 paired scene comparisons between ALI and the Landsat 7 imager, ETM+. Such a comparison will validate the suitability of the multi-spectral capability of the ALI.

The platform will carry 3 instruments:

Instrument	Swath	Bands	Spatial resolution	Spectral resolution
Hyperion (hyper-spectral imaging spectrometer)	7.5 km	220	30 m	10 nm
Advanced Lander Imager (ALI)	185 km	10	30 m (xs), 10 m (pan)	
Atmospheric Corrector	36 km	256	250 m	6 nm

The EO-1 orbit is synchronised at 1 minute behind that of AM-1. Proposed launch date December 1999.

Home page <http://fdd.gsfc.nasa.gov/missions/eo-1.html>

NASA BRIEFING ON LANDSAT 7 MISSION

Reviewing 27 years of environmental discovery and previewing new ways of looking at our world, NASA and the U.S. Geological Survey have recently briefed reporters on the April launch of Landsat 7.



The last in a series that began with the Landsat 1 in 1972. The European archive alone contains more than half a million Landsat images. Landsat 7 is now gathering data from Earth's land surface and surrounding coastal regions. Analysis of the data will provide scientists with new information on deforestation, receding glaciers and crop monitoring. The data also will be available commercially for land-use planning and urban development issues.

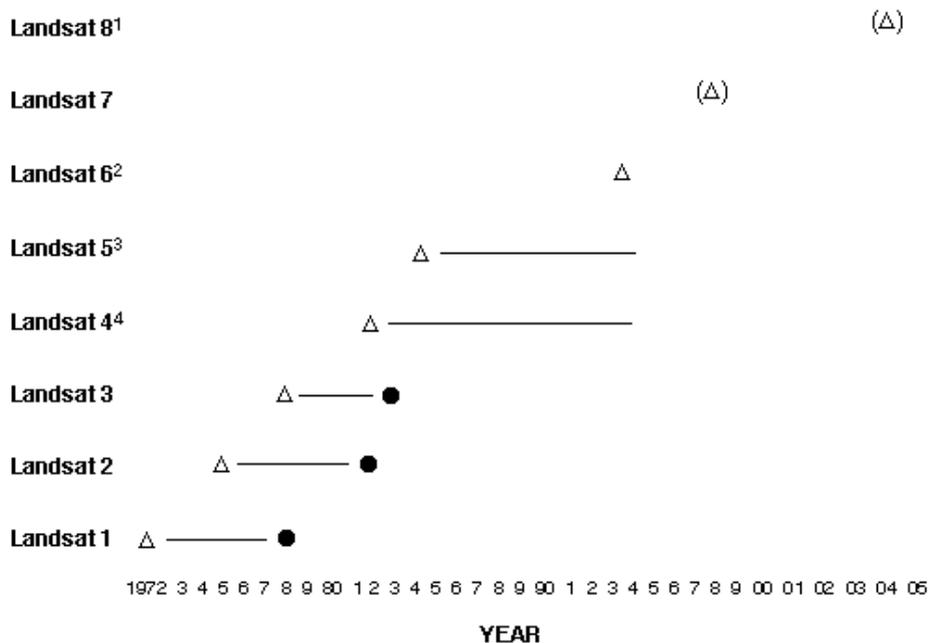
The spacecraft was launched on April 15 from Vandenberg Air Force Base, CA, atop a Delta II rocket. After the post launch check out period, NASA will/has turn it over to the Geological Survey to manage.

CONTINUITY:

Compared to Landsats 4 and 5, Landsat 7 offers:

- * Same World Reference System as Landsats 4 & 5
- * Same swath (183 km)
- * Same product format
- Same multi-spectral band frequencies and resolution, except for the improved band 6

LANDSAT COVERAGE HISTORY



YEAR

1972 3 4 5 6 7 8 9 80 1 2 3 4 5 6 7 8 9 90 1 2 3 4 5 6 7 8 9 00 01 02 03 04 05

¹ ETM+ follow-on instrument on EOS AM-2 ³ Data transmission by direct downlink only
² Launched Oct. 5, 1993. Failed to obtain orbit. ⁴ No longer transmitting TM data
 △ Launch () Anticipated
 ● End of Service

IMPROVEMENTS:

* New panchromatic band, co-registered with the multi-spectral bands, offers 15m resolution. This panchromatic band is more extended into the near infrared than other missions, giving improved signal-to-noise due to the contribution from vegetation

- The resolution of the thermal infrared band 6 has been increased from 120 m to 60m
- Improved calibration will mean a time-constant spectral signature even after many years
- World-wide data - the solid-state recorder can collect some 100 images/day from anywhere in the world
- For the latest information on Landsat 7, visit Landsat Home page <http://geo.arc.nasa.gov/sgc/landsat/landsat.html>

LOCKHEED MARTIN ATHENA - LAUNCH OF IKONOS SATELLITE EXPERIENCED AN ANOMALY

VANDENBERG AIR FORCE BASE, Calif., April 27, 1999 -- Space Imaging and Lockheed Martin Astronautics have not successfully acquired telemetry signals from the IKONOS 1 satellite following its launch this morning by a Lockheed Martin Athena II rocket. The Athena was launched at 11:22 a.m. PDT from Space Launch Complex 6 (SLC-6) at Vandenberg Air Force Base, Calif. Weather conditions for the launch were good and the countdown was normal.

"We are gravely disappointed that we have not established contact with the IKONOS satellite as of this time," said John Copple, Space Imaging's chief executive officer. "We are working through the anomaly with Lockheed Martin. Space Imaging had established contingency plans in case something like this happened," he said. "Although our business plan will be delayed, we are confident that with the launch of IKONOS 2 we will achieve our goals."

Space Imaging and its prime contractor, Lockheed Martin Corporation, have begun an investigation into the anomaly and will determine as quickly as possible the appropriate corrective actions. IKONOS 2, an identical twin to IKONOS 1, has already been built as a backup in case of an anomaly such as this. No launch date has been set. Lockheed Martin Astronautics built the Athena II launch vehicle. Lockheed Martin Missiles & Space built the satellite for Denver-based Space Imaging. Reporters may hear a recording of the anomaly news conference for a 24-hour period beginning at 6:00 p.m. (PDT) by phoning 800-257-4607 and then entering this reservation number: 12232977. Space Imaging's Mark Brender (director of Washington operations) can be reached by leaving a voicemail message at 703-558-0309 or by pager at 888-808-1927. Linda Lidov (public relations manager) can be reached at 303-254-2106 or by pager at 877-832-2195.

GRSG CORPORATE MEMBERS

New Corporate Members in 1998 are:



NPA Group

Crockham Park, Edenbridge, Kent, TN8 6SR

Tel: 01732 865023 Fax:017322 866521

<http://www.npagroup.co.uk>



ERIM International, Inc.

P.O. Box 134008, Ann Arbor, Michigan 48113-4008, USA

Tel: +1 734 994 1200 Fax: +1 734 994 5123 <http://www.irim-int.com>



Analytical Spectral Devices (ASD) Inc.

5335 Sterling Drive,

Boulder, Colorado USA

Tel: +1 303 444 6522 Fax: +1 303 444 6825

Email: info@asdi.com

Web: <http://www.asdi.com>



ERDAS (UK) Limited

Telford House, Fulbourn,

Cambridge, CB1 5HB, U.K.

Tel: 01223 880802 Fax: 01223 880160

<http://www.erdas.com>



Natural Environment Research Council

Directorate of Science and Technology, Polaris House,

North Star Avenue, Swindon SN2 1EU

Tel: +44 (0)1793 411500

<http://www.ner.ac.uk>

Corporate Member Reminder

NPA, ERIM, ERDAS & NERC are reminded that they have not yet taken advantage of their right to place a full page advert in the Newsletter and should contact the Editor when they wish to do so.

If you are a Corporate Member and your logo is not here, then please send it (as tiff, jpg or bmp) to the Editor.

If you would like your company to become a Corporate Member, then please contact the Membership Secretary.

NEW PRODUCTS

Field spectrometer

The new **PIMA SP** (Field Portable Infra-Red Spectrometer, produced by Integrated Spectronics) is supported by **PIMAVIEW 3.0** Spectral analysis for Windows (presumably Win95/NT).

Integrated Spectronics also produce the **HYMAP™** system for airborne hyperspectral imaging for mineral exploration, environmental monitoring and defense research. HYMAP™ operates in VIS, NIR, SWIR, MWIR and TIR spectral ranges, depending on user specifications.

Contact ispl@intspec.com for further details

or check-out <http://www.intspec.com>

ESA-ESRIN INSI Collection

The ESA-ESRIN SAR Interferometry pages have been developed to cope with the varied user interest and as a general approach to the subject. The topics cover the following areas:

- applications and case studies
- scientific background
- baseline listings
- documentation and reference documents
- feedback and help services
- access to **INSAR Sample Images (INSI)** quick looks

for details contact: eohelp@esrin.it

or check-out: <http://earthnet.esrin.esa.it>

Transportable Ground Stations

MacDonald Dettwiler's Fast TRACS is a complete, modular transportable, multi-sensor Earth Observation ground station. The Precision Product Generation System (PPGS) supports all current and planned optical earth observation satellite sensors. The Multi-Sensor Synthetic Aperture Radar (MS-SAR) system process all operational and planned SAR sensors.

Complete setup and tear-down of Fast TRACS takes about 8 hours (by two experienced operators).

For details contact MacDonald Dettwiler at: sales@mda.ca

or check-out <http://www.mda.ca>

SIMIS hyperspectral products

The suite of packages includes:

- ImageViewer 1.0 stand-alone bitmap viewer
- FeatureSearch 1.2 semi-automatic mineral identification, using data from PIME, ASD or GER instruments
- Field 2.9 automatic analysis of field (or lab) spectra
- Simbase 1.0 project management and database tool (for spectra, XRD, images, descriptions etc.)

For details, contact: Dr S. Mackin stephen.mackin@uam.es

Eurimage News

- Faster processing for ERS data. The European Space Agency has announced the introduction of a Rush Commercial order category. Rush orders will be processed in 3 working days from the acknowledged receipt of the order. Time for shipment, normally 2 days by DHL in Europe, also needs to be factored in. Rush production carries a 50% surcharge to the normal product price. The service will be available from ESA PAFs. Normal handling and production times have also been reduced: within Europe ESA data will be produced in 5 days, plus shipping time via courier.

For information on ERS products, come to

<http://www.eurimage.com>

Eurimage is also working to reduce delivery times from other international stations. Contracts recently signed with ISA in Israel and CCRS in Canada mean that data from these stations is available directly from Eurimage.

Rush delivery is available NOW from CCRS stations Gatineau and Prince Albert

- The Eurimage Newsletter is sent to a large group of Remote Sensing professionals throughout the world. If you would like to receive the newsletter all they have to do is send an email to

ienews@eurimage.com

with the word "subscribe" in the subject line. To be taken off our mailing list, just reply to this message putting "unsubscribe" in the subject line.

[caution - I tried this but the message bounces back (Ed.)]

ERDAS and Equipe

Equipe™ Electronics Limited, integrators and suppliers of image generators and displays, have been contracted by the British Royal Air Force to supply a Blue Sky™ visual system for its Hawk Weapons and Tactics Simulator in North Wales. The system, which runs on a top-of-the-range Silicon Graphics Onyx2 InfiniteReality™ workstation, provides a fully interactive, real world 3D model of the UK to meet the demanding requirements of flight simulation.

Available as commercial-off-the-shelf equipment, Blue Sky™ can provide continuous photographic image updates on 3D terrain down to 1m resolution. This will enable the Hawk simulator trainee pilots to 'fly' from one end of Wales to the other at altitudes down to 250 feet, whilst navigating from 1:50,000 scale OS maps.

Equipe recently purchased ERDAS IMAGINE software for processing the geographic imagery used within the Hawk Project's visual database for the simulator. Specifically, IMAGINE is being used to georectify and mosaic the 10 meter resolution satellite imagery and high detail aerial photography. The Resolution Merge function is used to sharpen a lower-resolution multiband image by merging it with a higher-resolution monochrome image.

ERDAS Releases IMAGINE VirtualGIS™ - Version 8.4

ERDAS announces the latest release of IMAGINE VirtualGIS, an integral part of the ERDAS IMAGINE Geographic Imaging software suite.

VirtualGIS is a visual analysis tool that offers GIS functions and capabilities in a 3D environment. It enables the user to perform real-time queries and interact from a 3D perspective with almost any type of raster or vector geospatial information. New features in version 8.4 include interactive 3D models, intervisibility and threat analysis, VRML 2.0 support for creating 3D web content, real-time anaglyph stereo (as well as frame sequential and interlaced stereo on specialised graphics cards), the ability to generate high-resolution 3D images for printing, and the ability to create "virtual worlds" of unprecedented size.

VirtualGIS 8.4 is available now on the Sun Solaris, SGI, DEC, and Microsoft Windows 95, 98 and NT 4.0 platforms. Shipments for the HP and IBM platforms will commence in quarter 1 of 1999. The software can also be downloaded for a free, limited-time trial at www.virtualgis.com .

In a recent survey, the US National Imagery and Mapping Agency (NIMA) voted VirtualGIS number 1 out of over 40 other systems, for scene visualisation capabilities.

The study, Pathfinder 99, considered over 40 market leading software solutions. The aim of the study was to identify, evaluate and recommend terrain visualisation packages to military agencies to use in mission planning projects.

To read the findings of the Pathfinder 99 report, please visit:
http://164.214.2.59/TAT/pf99/path_finder99.html or www.erdas.co.uk

ERDAS branches out in Forestry

Forest Surveys, an independent forestry specialist, is involved in the Forest Resource Inventory and Mapping at Kielder Forest on behalf of the Forestry Commission. The project requires analysis of the present and prospective conditions of the forest in order to maximise the long-term sustainable income from the woodlands whilst observing environmental considerations.

Forest Surveys is using IMAGINE to create a map and database of internal forest boundaries based on crop classification. They are also using IMAGINE for ortho-rectification and mosaicing of aerial photography, forest maps and Ordnance Survey map data, and for production of 3D views of the landscape.

FREE ER Mapper 6.0 licences for students

ER Mapper is willing to give all remote sensing and GIS students **FREE** ER Mapper 6.0 licences for their final dissertation projects. The licence will run from 1st June to 30th November 1999 when the students need licences to run on their home PC to complete their dissertations.

The scheme is to be run under the CHEST agreement, so universities wanting to participate must be running ER Mapper under the CHEST scheme. The scheme will operate as follows:

- Course tutors must provide ER Mapper EAME region with a list of all participating students
- The students load ER Mapper on to their PC and fax the site code details to ER Mapper EAME region (01784 430 692)
- ER Mapper will then send all serial numbers to the course tutor who will distribute them accordingly.
- Any support questions that cannot be answered on campus can only be given to ER Mapper through nominated Technical Contacts.

ER Mapper is interested in the usage of their software and is willing to reward the most innovative use of ER Mapper in a student dissertation. The reward will be **£250**. Abstracts of no more than **500** words describing the project should be forwarded to donna@ermapper.co.uk no later than **1st October 99** for assessment by the ER Mapper team. Licence extensions beyond November will be given on assessment of individual requirements put forward by the Course Tutor.

We hope that this initiative will release some of the pressures faced by both universities and students in obtaining software for their projects and look forward to seeing some interesting results.

Universities that are not currently running ER Mapper and would like to be part of this initiative can obtain unlimited copies of ER Mapper through CHEST for **£2100** per annum.

ER Mapper links in South Africa

The Centre for Interactive Graphical Computing & Earth Systems (CIGCES) of Cape Town University have chosen ER Mapper 6.0 as *the* remote sensing solution for their research projects. ER Mapper will be used at CIGCES for both training of students (geology & physics) as well as research (geology, geophysics, and mineral resources) involving large, multiple datasets data at varied scales up to the continental scale. The CIGCES is a research centre of the University of Cape Town that provides a forum for students of different national, cultural and academic backgrounds to develop skills in integrated graphical computing and data management.

English National Parks go image processing.

The North York Moors National Park Authority and Snowdonia National Park Authority have both purchased ER Mapper to enable them to rectify and mosaic their large archives of aerial photography. These have joined Exmoor and the Lake District who have also recently purchased ER Mapper.

ER Mapper will be used for base level mapping of Exmoor from aerial photography to enable the monitoring of rare habitats. This monitoring is essential if the Parks are to protect the species within these habitats for future generations. The vegetation maps to be created will enable more efficient targeting of resources to areas of high risk.

The Park was flown by GeoTechnologies with a Kodak digital camera. Instead of using a conventional film, the camera captures the image digitally onto an array at the back of the camera. The data can be directly loaded to a PC thus removing the need for scanning the photographs, saving time and money.

Kodak ADP System

The Kodak Aerial Digital Photographic System (ADPS) has been developed by GeoTechnologies consultancy based at Bath Spa University College. A GPS handset records the co-ordinates at which each image is taken, allowing later assembly into a composite photograph. Kodak's high resolution DCS560 system, which has 6 million elements per image, can resolve objects as small as 50cm from a height of 5000 feet. The complete system comprises Kodak DCS560 camera, GPS handset, intervalometer, camera mount, VirtuoZo software, Silicon Graphics O2 workstation, map plotter and two days training; and costs between £65,000 and £75,000 (UKP).

For more information, contact: a.koh@bathspa.ac.uk

Free Land Cover Map of Canada

A new land cover map of Canada has been produced through a co-operative project between Canadian Centre for Remote Sensing (CCRS) and the Canadian Forest Service. Generated using NOAA and 100 Landsat TM scenes, the map has a nominal resolution of 1km.

The map is available in digital form as a research product, free of charge, subject to accreditation of the government agencies that produced it. It can be retrieved from the CCRS ftp site:

ftp ccrs.nrcan.gc.ca

/ad/EMS/landcover95

the map file name is lc95V1_1.tif or lc95V1_1.pix

Further information from Josef Cihlar: josef.cihlar@ccrs.nrcan.gc.ca

Download Free Data from GeoGratis

GeoGratis is a new service of the CCRS developed jointly with the Canadian Geospatial Data Infrastructure. GeoGratis is a web based and ftp site where data are available free of charge.

The data include:

TM mosaics; National Atlas base maps between 1:2 million to 1:30 million (on 2 projections); Drainage; boundaries (federal, provincial etc.); infrastructure.

GeoGratis can be found at: <http://geogratias.cgdi.gc.ca>

PLANETARY REMOTE SENSING NEWS

DEPLOYED ANTENNA SENDING STREAMS OF NEW MARS IMAGES

A steady stream of new data from Mars, including high-resolution images, will begin arriving next week at Earth receiving stations following yesterday's deployment of the Mars Global Surveyor's high-power communications antenna.

"Having a deployed, steerable high-gain antenna is like switching from a garden hose to a fire hose in terms of data return from the spacecraft," said Joseph Beerer, flight operations manager for Mars Global Surveyor at NASA's Jet Propulsion Laboratory.

"Up until now, we have been using the high-gain antenna in its stowed position, so periodically during the first three weeks of our mapping mission, we had to stop collecting science data and turn the entire spacecraft to transmit data to Earth," Beerer explained. "Now that the high-gain antenna is deployed and steerable, we have the ability to simultaneously study Mars and communicate with Earth."

The antenna was deployed at about midnight EST, Sunday, March 28. It had been stowed since launch in November 1996 to reduce its chances of being contaminated by exhaust from the spacecraft's main engine, which was fired periodically throughout the mission. The spacecraft entered orbit around Mars in September 1997 and used the aero-braking technique to gradually lower the spacecraft's altitude to the desired orbit for mapping. The mapping mission began March 9; full-scale mapping began on April 4.

With the antenna successfully deployed, Mars Global Surveyor will return a nearly constant stream of observations of Mars for the next two years.

Further information about the mission is available on the Internet at:

<http://mars.jpl.nasa.gov/mgs/index.html>

HUGE SPRING STORMS ROUSE URANUS FROM WINTER HIBERNATION

If springtime on Earth were anything like it will be on Uranus, we would be experiencing waves of massive storms, each one covering the country from Kansas to New York, with temperatures of 300 degrees below zero.

A dramatic new time-lapse movie by NASA's Hubble Space Telescope shows for the first time seasonal changes on the planet. Once considered one of the blander-looking planets, Uranus is now revealed as a dynamic world with the brightest clouds in the outer Solar System and a fragile ring system that wobbles like an unbalanced wagon wheel. The clouds are probably made of crystals of methane,

which condense as warm bubbles of gas well up from deep in the atmosphere of Uranus.

The movie, created by Hubble researcher Erich Karkoschka of the University of Arizona, clearly shows for the first time the wobble in the ring system, which is made of billions of tiny pebbles. This wobble may be caused by Uranus' shape, which is like a slightly flattened globe, along with the gravitational tug from its many moons.

The seasonal changes on Earth are caused by our planet's rotational pole being slightly tilted. Consequently, the Earth's Southern and Northern hemispheres are alternately tipped toward or away from the Sun as the Earth moves around its orbit. Uranus is tilted completely over on its side, giving rise to extreme 20-year-long seasons and unusual weather. For nearly a quarter of the Uranian year, the sun shines directly over each pole, leaving the other half of the planet plunged into a long, dark, frigid winter.

The Northern Hemisphere of Uranus is just now coming out of the grip of its decades-long winter. As the sunlight reaches some latitudes, it warms the atmosphere. This appears to be causing the atmosphere to come out of a frigid hibernation and stir back to life. Uranus does not have a solid surface, but is instead a ball of mostly hydrogen and helium. Absorption of red light by methane in the atmosphere gives the planet its cyan color.

Uranus was discovered March 13, 1781, by William Herschel. Early visual observers reported Jupiter-like cloud belts on the planet, but when NASA's Voyager 2 flew by in 1986, Uranus appeared as featureless as a cue ball. In the past 13 years, the planet has moved far enough along its orbit for the sun to shine at mid-latitudes in the Northern Hemisphere. By the year 2007, the sun will be shining directly over Uranus' equator.

Hubble has been used between 1994 & 1998 to take images of Uranus in both visible and near-infrared light. The movie is also available on the Internet at:

<http://opposite.stsci.edu/pubinfo/latest.html>

<http://opposite.stsci.edu/pubinfo/pictures.html>

And here's a note about those remote sensors who are more interested in what goes on on other planets, than in earthly matters.

The **UK Planetary Forum** was founded around two and a half years ago following a groundswell of enthusiasm from graduate students working in this subject. A meeting was held at UCL in Feb '97 attended by around 60 people, where it was decided that the community would be in a much stronger position if it were to have an open forum within which information could be easily circulated

The Forum exists as a loose alliance of scientists, working in Britain, with research interests involving all aspects of planetary science. The web-site is the main manifestation of the group, where details of future events are posted along with appointments and a comprehensive list of members. Membership is free and open to anyone involved in planetary work.

The main aim of the Forum is to promote planetary science in the UK. For many years some of the excellent research done in this country has not received the

media attention it deserves simply because the journalists have not been made aware of substantial involvement British institutions have in the exploration of the Solar System. The Forum web-site now provides an almost comprehensive list (around 160 people) of who is doing what, where, and how to contact them directly.

Since its formation, information on meetings, news and jobs can be sent out as a Planetary Forum e-mail bulletin to almost everyone at once, allowing for greater efficiency in the organisation of meetings.

The Forum has also held several successful meetings of its own, attracting guest speakers from the US and Europe. The venues for meetings have been provided by the goodwill of universities and the Royal Astronomical Society, to which the Forum is affiliated. As well as an annual general meeting, there have been several specialised symposia on diverse subjects as ice in the solar system and planetary atmospheres and magnetospheres.

Apart from the meetings, though, the Forum has been most useful as a tool for members of the community to pass on useful information, and for the media to contact planetary scientists in the UK. Many overseas scientists have subscribed to the e-mail bulletins as a means of keeping up to date with research in Britain. In addition to the media, various politicians are now more aware of Britain's participation in the rapidly evolving planetary field due to the news circulated by the Forum.

For more details contact the organiser, David Hawksett at: d.hawksett@lancaster.ac.uk

Homepage for the UK Planetary Forum is: <http://ast.star.rl.ac.uk/forum>

GRSG MEETINGS

GRSG Annual General Meeting Radar - Still peering through the Clouds

24 November 1999

The Geological Society of London, Burlington House,
Piccadilly, London

Call for Papers

Please send abstracts to: Rob Wright

Open University, Milton Keynes

Email: r.wright@open.ac.uk

OTHER MEETINGS

GEOTECHNICA '99

INTERNATIONAL TRADE FAIR FOR THE GEOSCIENCES AND GEOTECHNOLOGY

18-31 May 1999

Cologne, Germany

For further information contact: KolnMesse

Tel: +49 221 821 0

Fax: +49 221 821 74

EARSeL 19th SYMPOSIUM - REMOTE SENSING IN THE 21ST CENTURY : ECONOMIC AND ENVIRONMENTAL APPLICATIONS

31 May – 2 June 1999

Valladolid, Spain

For further information, contact: **EARSeL Secretariat, M. Godefroy, 2 Avenue Rapp, F-75340
PARIS, Cedex 07, France.**

Tel: +33 1 455 67360

Fax: +33 1 455 67361 **Email: earsel@meteo.fr**

EARSeL / ISPRS JOINT WORKSHOP

3-4 June 1999

Contact: Dr. Manos Baltaviasias

Email: manos@geod.ethz.ch

IUFRO CONFERENCE

REMOTE SENSING & FOREST MONITORING

1-3 June 1999

Rogow, Poland

For further information, contact: Conference Secretariat, A. Nowicki, W. Karaszkiwicz, Faculty of Forestry, Rakowiecka 26/30, 02-528 Warsaw, Poland.

Fax: +48 22 491375

<http://giswitch.sggw.waw.pl/rogow99>

GEOMATICA'99

1-3 June, 1999

Madrid, Spain

EARSeL / ISPRS Joint Workshop

3-4 June 1999

Valladoid, Spain

Workshop themes include: Remote sensing and vision theories for automatic scene interpretation; Integration of image analysis and GISS; Computer assisted image interpretation and analysis; data fusion.

Contact: Dr. Manos Baltaviasias

Email: manos@geod.ethz.ch

EAGE Oil & Gas

7-11 June, 1999

Helsinki, Finland

GEOSPECTRA'99

9-15 June 1999

Dusseldorf, Germany

150 N. Michigan Ave., Suite 2920, Chicago, IL 60601 USA

**4th INTERNATIONAL AIRBORNE REMOTE SENSING
CONFERENCE AND EXHIBITION**

21-24 June, 1999

Ottawa, Ontario, Canada

For further information, contact: ERIM Airborne Conferences, Box 134001, Ann Arbor, MI 48113-4001, USA

Tel: +1 734 9941200

Fax: +1 734 9945123

Email: wallman@erim-int.org

Web: <http://www.erim.org/CONF/conf.html>

IGARSS'99

28 June – 2 July 1999

Hamburg, Germany

Contact: Prof. Werner Alpers, Inst. F. Meereskunde, University of Hamburg, Troplowitzstr. 7, D-22529 Hamburg, Germany

Fax: +49 40 4123 5713

Email: alpers@ifm.uni-hamburg.de

2nd INTERNATIONAL SYMPOSIUM:

OPERATIONALISATION OF REMOTE SENSING

16-20 August, 1999

Enschede, The Netherlands

Natural hazards; coastal zones; new methodologies; education and training needs.

Email: colenbrander@itc.nl

<http://www.itc.nl/ags/symposium.htm>

**RSS99 25th ANNUAL CONFERENCE AND EXHIBITION OF THE
REMOTE SENSING SOCIETY**

EARTH OBSERVATION – FROM DATA TO INFORMATION

8-10 September 1999

University of Wales, Cardiff

For further information, contact: P. Pan, Dept of Maritime Studies and International Transport,
University of Wales, Cardiff, P.O. Box 907, Cardiff, Wales, CF1 3YP

Tel: +44 1222 874271

Fax: +44 1222 874301 Email: Pan@cardiff.ac.uk

EOS/SPIE SYMPOSIUM ON REMOTE SENSING

20-24 September, 1999

Florence, Italia

<http://www.EuropeanOpticalSociety.org>

**JOINT WORKSHOP OF ISPRS WGs I/1, I/3 & IV/4 ON
"SENSORS AND MAPPING FROM SPACE"**

27-30 September, 1999

Hannover, Germany

Contact: Dr. Karston Jacobsen

Fax: _49 511 762 2485

Email: karsten@ipi.uni-hannover.de

LEVERAGING SPATIAL INFORMATION

4-6 October 1999

Business Geographics Conference, Navy Pier, Chicago

info@BGC99.com

THE 14th WILLIAM T. PECORA MEMORIAL REMOTE SENSING SYMPOSIUM

6-10 December 1999

Call for Papers

Doubletree Hotel Denver, Denver, Colorado

250 word abstract submission to the following site:

http://www.asprs.org/satellite_imaging_conference

Abstracts by April, 1999

Notification: May 15, 1999

Paper deadline: October 7, 1999

Tel: 00 1 510 654 6980

Fax: 00 1 510 654 5774

19TH ISPRS CONGRESS – GEOINFORMATION FOR ALL

16-23 July 2000

Call for Papers

Amsterdam, Netherlands

Abstract deadline: September 1999

Manuscript deadline: March 2000

Preliminary programme: April 2000

For further information, contact: Prof. Klaas-Jan Beck or Secretary: Dr Freek D. van Meer, ITC Hengelosestraat 99, P.O.Box 6, 7500 AA Enschede, The Netherlands.

Fax: +31 53 487 4335

Email: isprs@itc.nl

31ST INTERNATIONAL GEOLOGICAL CONGRESS

August 6-17, 2000.

Call for papers

Rio de Janeiro, Brazil,

Among its activities, four General Symposia will be devoted to Geological Remote Sensing:

15-1: Remote Sensing and Geologic Applications: Case Histories

15-2: Remote Sensing in Mineral and Petroleum Exploration

15-3: Hyperspectral Remote Sensing

15-4: Microwave Remote Sensing

More info about the 31st IGC (Rio'2000) can be found at: <http://www.31igc.org>

Abstract submission deadline is Sept. 1st, 1999.

The 2nd Circular is due to be release soon and those willing to receive it contact: 31igc@31igc.org

CONFERENCE REPORTS

Thirteenth Thematic Conference on Applied Geologic Remote Sensing

1-3 March 1999, Vancouver, BC, Canada

The meeting was well attended and held in the rather grand surroundings of the Hotel Vancouver, in the heart of the city. The weather was very British, if you get my meaning, but the setting was quite definitely Canadian. When the cloud actually lifted, you felt you could reach out and touch the mountains, they were so close. Snowy wilderness on your doorstep! Following the usual quiet start of Sunday workshops and field excursions, and relaxed ambles around town, the week kicked off well and truly on Monday morning.

The opening session on mineral exploration was followed by thought provoking talks from Robert Vincent, John MacDonald, Floyd Sabins and Greg Lipton, in a keynote forum on "historical perspective and the current state" of remote sensing in geology.

GRSG had invited Professor Ron Lyon to talk about his lifetime's experience of geological remote sensing, at its Monday lunchtime slot. There was a buffet lunch thrown in (though no wine) and the room was packed. Many subscriptions were collected - thanks to new members who joined on that day and also to old members who renewed. The afternoon also proved interesting listening and yielded several talks on INSAR applications and mineral exploration.

The icebreaking reception, following the usual discussions and catching up with old friends, consisted of a reasonable spread of food, including what looked like a large hunk of buffalo (it turned out to be a cow though) and a huge smoked salmon both of which were delicious.

Tuesday's talks began with geological hazards and engineering geology, and then radar applications. This was followed by regional exploration and mapping after lunch. The last session on new data sources was, not surprisingly, well attended, with talks on ASTER, MODIS and Landsat 7; Hymap hyperspectral data; shuttle radar topography mission; ARIES-1; MERIS data and EO-1. With many new sensors and new data, the coming year should make an exciting prospect for the remote sensing community.

The evening dinner/banquet seemed to go with a bang and even included some wild west can-can girls.....whatever next?!

Wednesday morning's sessions comprised "Advances in data processing and hyperspectral geology". The conference was then concluded with a luncheon and forum on opportunities and challenges. At the back of the dining room, however, it was a little difficult to hear the speakers and so our own, no less interesting discussions tended to dominate the lunch! Finally, the week's prizes were awarded and the 13th ERIM conference was officially closed. See you all next year.

P.M. (Ed)

SHORT FEATURES

Volcanoes spotted using satellite imagery

A volcanic eruption at Pacaya, Guatemala was successfully predicted with the use of GOES image data 10 days before eruption. Infra-red detectors picked up a heat signal on May 13, indicating that hot magma was bubbling toward the surface. The eruption on May 20 sent an ash cloud 13 miles away.

A team consisting of Andrew Harris (and Rob Wright) of Open University and Luke Flynn of University of Hawaii have been working together to research the technique. The team have also used the thermal precursor principle to detect an eruption of Popocatepetl, near Mexico city.

The Times, December 8 1998

<http://www.sunday-times.com.uk/cgi-bin/BackIssue?1833091>

And the University of Hawaii site where they base their GOES hotspot alarm tool. Basically it monitors the amount of shortwave infrared radiance emitted at ~3.7 microns emitted by a range of different volcanoes. People can find out more about it here....

<http://volcano1.pgd.hawaii.edu/goes/>

Surface observations reveal sub-surface hazard - landslides in NW Italy

Setting:

Gently dipping Cenozoic geology (thinly inter-bedded, highly fractured smectite rich mudstones and sandstones), snowy & rainy winters, hot & humid summers. During the last serious storm-induced landslide episode (November 1994), 70 people were killed by landslides and floods.

Problem:

- Landslides occur every 20 years or so
- Heavy rainstorms every year in the region
- No evidence of a seismic trigger
- Difficult remote sensing target
 - Extensive vegetation cover
 - Landslides small (<100 x <300m) except in final, catastrophic phases
 - Landslides difficult (almost impossible) to detect when incipient
 - Both TM and SPOT Pan have limited capability to resolve landslides

**Evidence:**

- Strong structural control on landslides (along bedding and fracture surfaces)
- Very closely spaced and extensive fracture networks - act as water conduits and are strongly iron-stained
- Soils above fracture networks are stained with iron-oxides leached from rocks
- Depth of landsliding directly related to depth of fracture development

Hypothesis:

- When fractures reach certain depth and development, the size, water bearing capacity and bulk weight of the blocks tips the balance between shear strength and shear stress and sliding initiates.
- Strongly iron-stained soils are indicative of intense fracturing and water movement and therefore of landslide-vulnerable areas.

Investigation:

- Collect spectra from a sample grid across the area and examine for characteristic amorphous iron-oxide absorption features (typically goethite type absorption features).
- Compare the distribution of iron-rich spectra with the localities of major landslides.

Results:

There is spatial correlation between iron-oxides in soils and the occurrence of large, damaging landslides.

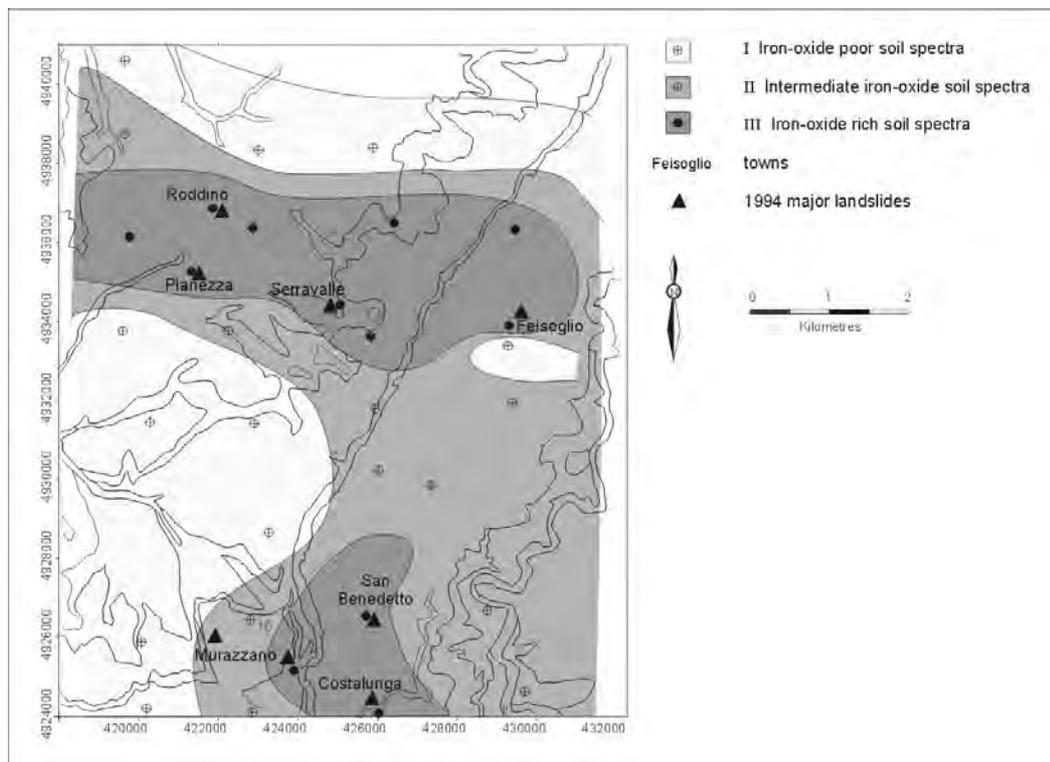
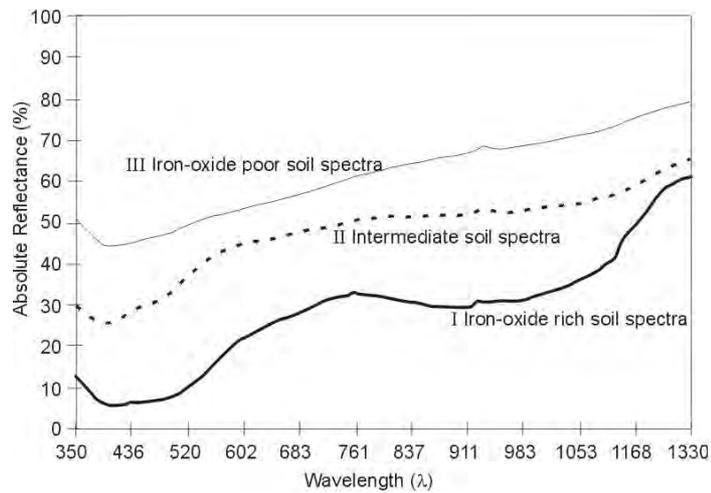


Figure 2a Soil spectra; 2b map showing relative iron-oxide content in soils (measured August 1996).

Disclaimer:

- Coarse sampling
 - Poor illumination conditions and therefore low signal/noise ratio in some data
 - Qualitative analysis (rather quick & dirty at the time!) - further work needed
-However, lack of concrete proof does not disprove the hypothesis.

Landslides are an ongoing hazard so the only working solution is to use remote sensing, geotechnics, DEMs & GIS together to try and identify the most vulnerable areas; and to help the inhabitants understand the problem a little better.

'Births, Deaths and Marriages' of Satellite Sensors and Platforms

Claire Cotton and Colm Jordan, BGS, Keyworth

Landsat 7 was successfully launched on 15th April and has already returned its first images. The proliferation of satellite platforms and sensors in orbit will increasingly confront users with a bewildering array of choices when selecting imagery for a geological project. The days when Landsat Multispectral Scanner (MSS) or Thematic Mapper (TM) image datasets were the automatic choices are fast disappearing. The World Wide Web currently provides unprecedented access to image archives and acquisition sites in every corner of the globe.

To illustrate the choices now becoming available this text summarises recent developments in the field of orbital sensors detailing additions, failures, or the publication of updated information and price lists. The information was derived from the Internet, and is therefore readily accessible to all. The sensors are grouped under three headings: high spectral resolution sensors, high spatial resolution sensors and other systems. The information is then summarised in a table, and the article ends with a list of relevant Internet links.

High Spectral Resolution Sensors

Advances in the development of high spectral resolution satellites are causing considerable interest in the geological remote sensing community. The implications for geological mapping and other related applications are considerable. One of the most promising developments is the Australian Resource Information and Environment Satellite (ARIES) designed by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Auspace Ltd. With the promise of continuous coverage from 400nm in the visible and near infrared (VNIR) to 2500nm in the short wave infrared (SWIR), and a spatial resolution of 30m at nadir for the hyperspectral bands, this is set to be the world's first commercial hyperspectral satellite sensors.

The concept behind ARIES has evolved over a period of twenty years and has culminated in the development of a system capable of delivering a new suite of geological and mineral alteration maps almost anywhere in the world. The system will have a revisit time of seven days and, due to its sun-synchronous orbit, this will include full earth coverage (excluding that of the extreme polar regions). The ARIES satellite is due for launch in the year 2000, becoming fully operational in 2001.

The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) is also aimed at the geological user. It is thought that the data provided will greatly improve geologists' abilities to produce more accurate geologic maps at a fraction of the cost of conventional ground-based methods. ASTER is a co-operative effort between NASA and the Japanese Ministry of International Trade and Industry. The spectral range of the system is from 0.52-11.65 μ m. It includes 5 bands in the SWIR and multiple thermal bands; the first time such data have been available from a space borne sensor. The spatial resolution ranges from 15 – 90m.

Although ASTER is not yet in orbit, simulated data from airborne sensors is available. This is made possible by a joint project between the Moderate Resolution Imaging Spectroradiometer (MODIS), developed by Raytheon Santa Barbara Remote

Sensing (SBRS), and ASTER. The airborne simulator is therefore aptly named MASTER and simulated data is currently available on the Internet. A new launch date of 15th July 1999 has been confirmed for the ASTER system, on board the Earth Observing System (EOS) -AM1 spacecraft.

The current objective of the MODIS project is to provide global observations of the Earth's land, oceans, and atmosphere in the visible and infrared regions of the spectrum every two days. The MODIS instrument will have 36 spectral bands which will range in wavelength from 0.4 μ m to 14.4 μ m. The spatial resolution of the spectral bands varies from 250m resolution at nadir for two of the 36 bands, 500m for five bands, and 1,000m at nadir for the remaining 29 bands.

The MODIS system was due to be launched in June 1998, and has completed system level testing. In fact the system will now be integrated into the EOS -AM1 spacecraft and will therefore have the same rescheduled launch date as the ASTER system above.

The Advanced Earth Observation Satellite (ADEOS) is a recent success story. The system was successfully launched on 17th August 1996. It is designed to contribute to the explanation of various Earth-system phenomena, through the observation of a number of geophysical parameters. The sensors of the system include:

- Ocean colour and Temperature Scanner (OCTS).
- Advanced Visible and Near Infrared Radiometer (AVNIR): five visible/ near-infrared bands (0.42 to 0.89 μ m).
- NASA Scatterometer (NSCAT): active Ku-band scatterometer.
- Total Ozone Mapping Spectrometer (TOMS).
- Polarization and Directionality of the Earth's Reflectance (POLDER): Multi-spectral, multi-angular and multi-polarising wide field imaging optical radiometer.
- Improved Limb Atmospheric Spectrometer (ILAS): infrared occultation device.
- Retroreflector in Space (RIS).
- Interferometric Monitor for Greenhouse Gases (IMG): nadir-looking Fourier transform infrared spectrometer.

Near real time data distribution has been possible since November 1996. The AVNIR provides the system with 5 visible/ near infrared bands ranging from 0.42 to 0.89 μ m with a spatial resolution of 16 or 8m. Practical applications of the system include weather forecasting, elevation measurement and land cover surveying, with particular emphasis on vegetation cover.

High Spatial Resolution Sensors

Major developments have also taken place with respect to the spatial resolution of orbital sensors. One such development has been the recent EarthWatch initiative. EarthWatch were poised to become the supplier of digital imagery products of a resolution, quality and clarity formerly only available to U.S. and Russian military and intelligence agencies. Unfortunately communications were lost with the first satellite, EarlyBird, shortly after launch on December 24, 1997. EarthWatch

decided not to continue with the EarlyBird satellite series, believing that the market for 3m resolution imagery had closed. Instead, focus was turned to the QuickBird sensor that has a 1m resolution in panchromatic mode (0.45-0.90 μ m) and 4m resolution in multispectral mode, where four bands are available: B1 (0.45-0.52 μ m); B2 (0.52-0.60 μ m); B3 (0.63-0.69 μ m); and B4 (0.76-0.89 μ m). The spacecraft will have fore-and-aft and side-to-side pointing capability, enabling stereoscopic imagery to be acquired. The launch date is due to be in the last quarter of 1999, but the exact date is yet to be confirmed.

The first IKONOS satellite, launched on 27th April 1999, is the first in a new generation of satellites collecting very high-resolution image data. Unfortunately, at the time of writing, IKONOS has experienced an anomaly, which has prevented contact with the satellite. IKONOS 2, an identical twin of the first IKONOS satellite developed as back up, may now be launched early.

When fully operational the satellite will provide imagery that will have the highest spatial resolution of any commercial satellite. This will include a 1m resolution panchromatic sensor and a 4m resolution multispectral sensor. The satellite is said to be an 'agile' platform which means it can be positioned in order to collect imagery for a particular area of interest. The table below lists the spectral parameters of the sensors on board IKONOS, and shows the capability of merging the two sensors to provide high spatial resolution multispectral image data.

Product Name	Spatial Resolution	Spectral Bands (μ m)
IKONOS 4m Multispectral	4m	B1: 0.45-0.53 (Blue) B2: 0.52-0.61 (Green) B3: 0.64-0.72 (Red) B4: 0.77-0.88 (N i/r)
IKONOS 1m Panchromatic	1m	Pan Band: 0.45-0.90
IKONOS 1m Pan Merged with 4m Multispectral	1m	B1: 0.45-0.53 (Blue) B2: 0.52-0.61 (Green) B3: 0.64-0.72 (Red) B4: 0.77-0.88 (N i/r)

The Orbimage satellite family is soon set to include OrbView-3 and -4. OrbView-3 has a 1m resolution panchromatic channel (0.45-0.90 μ m) and 4m multispectral image data in four bands located at 0.45-0.52 μ m, 0.52-0.60 μ m, 0.625-0.695 μ m and 0.70-0.90 μ m. A swath width of 8km will provide imagery covering an area of 64km². The ability to turn from side to side up to 45° will enable a revisit time of less than 3 days, and supply stereoscopic imagery when required.

OrbView-4 carries the same specification instruments as its predecessor, but with the notable inclusion of a hyperspectral sensor. This will acquire image data with a spatial resolution of 8m in 200 channels between 0.45 and 2.5 μ m. The Orbnet online electronic catalogue currently contains OrbView-2 imagery products, with OrbView-3 data due to come online in January 2000 following its launch in

September 1999. OrbView-4 has a scheduled launch date of June 2000 and the data should be available by August or September 2000.

Another planned mission is ENVISAT, which is part of the European Space Agency Earth Observation programme using a platform design based upon the proven SPOT-5/ERS-2 heritage. Due for launch aboard Ariane 5 in July of this year, the payload compliment of ENVISAT-1 is impressive, with a total of 10 instruments:

ENVISAT-1 Payload		
AATSR	Advanced Along-Track Scanning Radiometer	Optical / IR Radiometer
ASAR	Advanced Synthetic Aperture Radar	C-Band SAR
DORIS	Doppler Orbitography and Radio-positioning Integrated by Satellite	RF Orbitography
GOMOS	Global Ozone Monitoring by Occultation of Stars	UV + Optical Spectrometer
LRR	Laser Retro Reflector	Passive Optical Reflector
MERIS	Medium Resolution Imaging Spectrometer	Visible and Near-IR Spectrometer
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding	Limb-Viewing IR Interferometer
MWR	Microwave Radiometer	Two-Channel Nadir View Radiometer
RA-2	Radar Altimeter 2	Pulse Radar
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Cartography	Multi-Channel Nadir + Limb View UV / VIS / IR Spectrometer

Clearly, some of the instruments onboard ENVISAT-1 will not be of direct value to geological applications, but the list does demonstrate the broader range of imagery which will become available for more general environmental applications.

Another development based on an established sensor is the new SPOT initiative. The SPOT system has provided continuous coverage since SPOT 1 was launched on 22 February 1986. The next addition to the SPOT family will be SPOT 5 due to be ready for launch in 2002. The SPOT 5 spectral bands will be the same as those for SPOT 4: B1 (0.50-0.59 μ m); B2 (0.61-0.68 μ m); B3 (0.79-0.89 μ m); and MIR (1.58-1.75 μ m). However, the panchromatic band will return to the values for SPOT -1/-3 (Pan: 0.51-0.73 μ m) ensuring continuity of spectral bands since SPOT 1. There will be increased spatial resolution, with PAN available at 5m and 2.5m and B1, B2 and B3 available at 10m, a clear improvement from SPOT 4's 20m resolution. The stereo mode will also be upgraded from 10m to 5m resolution.

The new specifications for radiometric and geometric quality demand planimetric accuracy of 10m (RMS) and an elevation accuracy of 5m (RMS). These are

compatible with conventional mapping standards at 1:50,000 scale. The radiometric quality of the imagery is expected to be equal to or better than that of SPOT 4.

Other Sensor News

LANDSAT-7 was successfully launched on 15th April 1999. The primary new features of the Enhanced Thematic Mapper sensor onboard are:

- a panchromatic (0.52-0.90 μ m) band with 15m spatial resolution
- on board, full aperture, 5% absolute radiometric calibration
- a thermal IR channel with 60m spatial resolution.

It is planned that full scenes corrected for sensor effects and spacecraft geometry (Level One processing) will be available from the Sioux Falls site in limited quantities within a year after launch, at a price not to exceed U.S.\$600 each. The primary mission of LANDSAT-7 is to acquire and periodically refresh a global archive of daytime, generally cloud-free images of land and coastal areas. To achieve this approximately 250 scenes per day will be captured and transmitted to the primary U.S. receiving station at Eros Data Centre (EDC) near Sioux Falls. Electronic access to information about each day's acquisition will be available within 24 hours after ground reception of data.

These are just a few of the developments which lie ahead. Looking further ahead, Radarsat 2 is scheduled for launch for 2002 and will feature a full polarimetric system with 3m resolution. Other radar satellites are also planned. A shuttle Radar Topography mission will fly in September 1999 this will produce a 30m grid DEM for 80% of the planet at 20m vertical resolution. To conclude this article, a table of operational and prospective satellites has been included, indicating the spatial and spectral resolution of each sensor.

Satellite / Platform	Sensor	Status/ Launch Date	Resolution	
			Spatial	Spectral
ARIES	Hyperspectral imaging spectrometer	2000	30m	400-2500nm
ADEOS	AVNIR	Still Operational	8-16m	0.42-0.89m
EOS-AM1	ASTER	15 th July 1999	15-90m	0.52-11.65 μ m
EOS-AM1	MODIS	15 th July 1999	250-1000m	0.4-14.4
ERS 1-2	AMI	Still Operational	12.5m	
ERS 1-2	ATSR: IRR	Still Operational	1000m	1.6-12 μ m
IKONOS	PAN	27 th April 1999	1m	
IKONOS	MS	27 th April 1999	4m	
IRS-1A/B	LISS II	Still operational	36m	
IRS-1C/D	PAN	Still operational	5m	
IRS-1C/D	LISS III	Still Operational	24m	
IRS-1C/D	WiFS	Still Operational	188m	

LANDSAT 4-5, 7	TM	Still Operational	30m	0.45-12.5 μ m
LANDSAT 7	PAN	15 th April 1999	15m	0.52-0.90 μ m
LANDSAT 7	TM	15 th April 1999	60m	0.45-12.5 μ m
ORBVIEW 4	Hyperspectral Sensor	June 2000	8m	0.45-2.5 μ m
ORBVIEW 3-4	PAN	Sept 1999 and June 2000	1m	0.45-0.90 μ m
ORBVIEW 3-4	MS	Sept 1999 and June 2000	4m	0.45-0.90 μ m
QUICKBIRD 1	PAN	Late 1999	1m	0.45-0.90 μ m
QUICKBIRD 1	MS	Late 1999	4m	0.45-0.89 μ m
RADARSAT-1	SAR	Still Operational	8m	
RADARSAT-1	SAR	Still Operational	100m	
RADARSAT-2	SAR	2001	3-100m	
SPOT 5	HRV-PAN	Late 2000/ 2001	5m	0.51-0.73 μ m
SPOT 5	HRV-XS	Late 2000/ 2001	10m	0.50-1.75 μ m
SPOT 4	HRVIR-P	Still Operational	10m	0.61-0.68 μ m
SPOT 4	HRVIR-XS	Still Operational	20m	0.50-0.89 μ m
SPOT 4	VEGETATION	Still Operational	1100m	0.43-0.47 and 0.61-0.68 μ m
WIS	EROS-B PAN	2001	1m	
WIS	EROS-A PAN	2001	2m	

All information summarised in this text is available through the Internet with the following pages proving most useful:

Remote Sensing Organisations

	http://www.vtt.fi/aut/ava/rs/virtual/organizations.html
NASA	http://www.earth.nasa.gov
European Space Agency	http://www.esa.int
Spy Satellite Data	http://www.fas.org/eye/imint.htm
EARTHWATCH	http://www.digitalglobe.com
EarlyBird	http://www.digitalglobe.com/applications/05.html
ORBIMAGE	http://www.orbimage.com
Satellites FAQ	http://www.geog.nott.ac.uk/remote/faq-1.html
Clark and Lewis	http://geo.arc.nasa.gov/sge/landsat/clark.html
ADEOS	http://www.eorc.nasds.go.jp/ADEOS/Project/
Links to ADEOS	http://www.eorc.nasda.go.jp/ADEOS/RelatedLinks.html

MISCELLANEOUS MATTERS

Food for thought..

Stratospheric platforms as an alternative to rocket launched satellites

On our increasingly interconnected Earth, we are relying more and more on smooth flow of info through our networks. Over dependence on this fallible type of communication for our vital global links may however place the whole network at risk. Stratospheric, low-cost platforms (LCAPs) may be practical and affordable way of developing network links to back-up the communication web and ensure its survival.

There is a considerable back-log of satellites awaiting launch vehicles. Our demand is expected to grow beyond capacity over the next 5 years. Yet rockets still blow up and satellites fail unexpectedly. Capital and insurance underwriting markets will ultimately demand alternatives.

Orbital debris is a growing problem. Every new launch creates more debris. It has been shown that should there be an explosion of a satellite in orbit, the resulting debris would scatter across other occupied orbits creating a very high risk of hitting and exploding other satellites. With thousands of satellites to be launched over the next 10 years, we could have a veritable cloud of space flotsam and jetsam. This could in turn make human space flight rather dangerous.

Another threat comes from meteor showers and solar storms.

Stratospheric vehicles do not require rockets to reach deployment altitude and the payloads are recoverable. They transmit and receive signals from between 19 - 30 km above the surface. There is also a great decrease in the signal relay times and lasers are possible for communication links between platforms and ground stations (under certain conditions).

The political and technical hurdles are:

- no military payloads or funding
- no surveillance capabilities
- open architecture to all, i.e. no secrets, with details publishable on the internet
- nations could develop and operate their own platforms

J. Scott Campbell, Earth Space Review

Remotely sensible movie challenge

Have you recently been to the flicks to see a good film and found yourself laughing or yawning in disbelief at the technical and scientific implausibilities or inaccuracies? such as 'Enemy of the State', which I saw on the way to Vancouveror D. H. Lawrence's 'The Rainbow', where two lovers bathe on a moonlit night in a lake on top of Chalk cliffs!

Please, please email (etc.) about any such films for entry to the *GRSG Top 10* of techno-clanger movies, the number one position being filled, of course, by the most ridiculous. Do also provide your interp. of the offending scene or plot, in case we haven't seen the film.

Thanks (Ed.)

And finally.....The great basin experience

By Ol' Three Toe and Club Tail (Please don't tell my mother I'm a geologist, she thinks I play a piano in a brothel in Gabbs) or....

You might be a geologist if:

1. Your kids cry when you come home because they were taught never to talk to strangers.
2. You have more pick-up trucks at the office than the local Ford dealer.
3. You open a new bar of soap and immediately cut it down to motel size.
4. Your favorite drink with breakfast is beer.
5. You drink fruit flavored beer to get your daily vitamin C.
6. You go behind a tree in your backyard to relieve yourself.
7. Your spouse claims to sleep better when you are not home.
8. The hammer you use for home repairs has a point on one end.
9. You have more baseball caps than the entire San Francisco Giants.
10. Most of your baseball caps have logos of companies that are no longer in business.
11. Your dress and field clothing look the same except for the degree of fading.
12. You think a five star restaurant is one with a no smoking section.
13. You have trouble walking on level ground.
14. At parties you admire your friends gold chains around their necks and they quietly observe your hand lens rope.
15. You have a white (or tan) pick-up.
16. You are on a first name basis with the local Ford dealer.
17. Your rock garden has better specimens than the Smithsonian.
18. People comment on your sage brush cologne.
19. You own only one tie and use it only for interviews.
20. You have a sport coat that you wear with jeans and (you think) it looks really good with the one tie you own.
21. You have more hair on your face than on your chest (usually only applies to men).
22. You have worked for more than three companies in the last three years.
23. You have called yourself a consultant more than you have called yourself a company employee.
24. You give only "qualified" answers to direct questions.
25. You don't understand Dilbert (who on earth is Dilbert? - S.B.)
26. You never attend your kid's birthday parties.
27. You never attend your spouse's birthday parties.
28. You are never home for your wedding anniversary.

29. You are on first name basis with a really good divorce attorney.
30. You have to look at the telephone directory in the morning to find out what town you are in.
31. You know one GOOD joke, and have been telling it for 15 years.
32. The highlight of your month is attending the GSN membership meeting.
33. Your best friends are also your competitors.

.....To be continued next month! (S.B.)



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