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1 EDITORIAL

At a meeting of the European space industry in Madrid on 25 March 2003, there was unanimous agreement amongst participants on the fact that Europe's space sector is currently in a state of crisis. At the meeting in Madrid, which was one of a series of consultation events on the European Commission's Green Paper on European Space Policy, the main factors contributing to the space industry's current parlous state of affairs were identified as a sudden decline in the commercial market for satellite launches, and decreased government spending in the space sector. It was pointed out that there is too much emphasis in Europe on the commercial space market, and that a co-ordinated effort is needed to increase the non-commercial (i.e. institutional) market. This is where the nascent European Space Policy will play a vital role. These and other issues will be addressed by the draft Action Plan on European Space Policy, which will be prepared following the closing conference on the Space Green Paper, which takes place in Paris on 23-25 June 2003.

At the March meeting in Madrid, a comparison was made between the space sectors in Europe and the United States. It was noted that the latter is largely funded through that country's enormous defence budget. Given that the main satellite application areas in Europe – i.e. Earth observation (EO), navigation, and telecommunications – can address both civil and defence-related needs, the establishment of a future European Security and Defence Policy (ESDP) was seen as another major development which would offset EU's current over-reliance on the commercial space sector. (Speaking of ESDP, perhaps something should be also done to offset the EU's current over-reliance on acronyms in its terminology: the European Security and Defence Policy should not be confused with that other ESDP – the European Spatial Development Perspective).

The current dip in the space business in Europe is also reflected in this issue of the EARSeL Newsletter: as observed by Boudewijn van Leeuwen (in his regular "Observations" column), there were no new European Earth observation satellites launched during the last three months. But cheer up, Readers! As reported in Section 4.14, a Mars observation satellite – the Mars Express / Beagle 2 expedition – was launched by ESA from the Russian "cosmodrome" in Baikonur, Kazakshtan, on 5 June 2003. The Beagle 2 probe (named in honour of the famous sailing ship, HMS Beagle, whose five-year journey in the 1830s led to Charles Darwin's theory of evolution on Earth) is scheduled to land on the Martian surface on 26 December 2003.

Apart from the current doom and gloom referred to earlier, this issue of the Newsletter also reports on some major positive developments regarding space affairs in Europe. For example, at a meeting in Paris on 26 May 2003, the Member States of the European Space Agency (ESA) gave the final go-ahead for the development of the Europe's Galileo satellite global navigation network. At a cost of 3.2 billion Euros, the Galileo programme represents Europe's biggest ever infrastructure project. When operational (in 2008), Galileo will provide significant technical improvements over the US-controlled Global Positioning System (GPS). Furthermore, because it is designed as a civilian system, it will end the dependence on the US military-controlled GPS network.

This Newsletter contains articles on a wide variety of current satellite applications for Earth observation – and also for earthquake studies. Other items include reports on recent EARSeL meetings on Imaging Spectroscopy (in Germany) and GIS (in Czech Republic), as well as reports from National Representatives describing the current status of remote sensing activities in Finland, Hungary, and Ukraine. (The report from Finland is an updated version of that published in the previous – March 2003 – issue of the Newsletter). All in all, I'm sure that this Newsletter will provide you with plenty of food for thought, as you while away the summer days on the beach…☺

The Editor

2 NEWS FROM THE ASSOCIATION & ITS MEMBERS

2.1 EARSeL annual symposium & workshops

When this issue of the Newsletter reaches you, the 23rd annual EARSeL General Assembly, symposium and workshops will have taken place in Ghent, Belgium and we trust will have proved most fruitful and enjoyable. We are now looking ahead to our 24th symposium, which is planned to take place at the Inter University Centre in Dubrovnik, a beautiful town on the Adriatic in southern Croatia. Professor Oluic, our local organiser gave a presentation in Ghent of what Dubrovnik can offer the visitor. For those who were not able to join us, there is now a web-site with the preliminary announcement: www.earsel.geosat.hr. Please mark the dates in your diaries: symposium – 25-27 May 2004; workshop on RS for land use and land cover – 28-29 May 2004.

2.2 3rd EARSeL Imaging Spectro-scopy Workshop

Andreas Müller, DLR, & Madeleine Godefroy, EARSeL Secretariat

Andreas Müller and his team at the DLR, Oberpfaffenhofen, hosted the 3rd EARSeL Workshop on Imaging Spectroscopy held during the week of 13-16 May 2003 at the Bildungstätte des Bayerischen Bauernverbandes conference centre in Herrsching, on the outskirts of Munich. Herrsching is a village bounded between the beautiful Bavarian hills and the glorious Ammersee Lake.

A pre-conference workshop on Field Spectrometry was conducted at DLR and was presented by Prof. Alexander Goetz, Director of the Centre for the Study of the Earth from Space at the University of Colorado, USA. More than 30 enthusiastic participants attended this workshop to learn trade secrets in this important area.

The conference was very well attended with international representations from 120 delegates from Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hungary, Israel, Italy, Japan, Poland, Russia, Spain, Switzerland, UK and USA. The technical sessions were organised along the following themes: Sensors and Missions; Data Enhancement; Terrestrial Ecosystems; Geology and Mining; Limnology; Vegetation Analysis. The scientific organising committee is to be congratulated for a splendid job in the selection of interesting and high quality papers for these sessions.

Congratulations go to Onnie Mutanga from ITC, the Netherlands who was awarded the best oral presentation of the workshop for his interesting and animated discussion on "Estimating In Situ Pasture Quality in the Kruger National Park using Continuum-Removed Absorption Features". The best poster was awarded to Martin Schlerfs and co-workers from Trier University for their paper entitled "Spectrometric Estimation of Leaf Pigments in Norway Spruce Needles Using Band-Depth Analysis, Partial Least-Square Regression and Inversion of a Conifer Leaf Model".

The social highlight of the workshop was a dinner-cruise on Lake Ammersee. The DLR team even managed to organise for the sun to break through the clouds to illuminate the Bavarian Zugspitze, Germany's highest summit. An authentic Bavarian dinner including Schweinsbraten, Obazda and Brezn introduced the overseas delegates to Bavarian cuisine, and the thunderstorm at sundown made time for cosy discussions.

A round-table discussion closed the workshop on a high note with recognition of the high level of European research in the field of hyper-spectral imaging. High quality airborne imaging spectroscopy data are now available operationally with such systems as DAIS, ROSIS and HyMap. Furthermore, there are new low-cost systems fostering the development of new applications on a university level. The development of future high-precision airborne instruments such as APEX and ARES promises continuous access to the latest technology in the next few years. However,

this positive development on the airborne sector is not matched in the space-borne arena. There was agreement among the audience on the need for both airborne and space-borne imaging spectrometers. The conference concluded with discussion on the upcoming HyEurope campaign, a joint effort of DLR and HyVista Corporation.

The sponsors of the workshop were Applanix, Analytical Spectral Devices, Astrium, Creaso, HyVista Corporation, PCI Geomatics, IGI and, of course, DLR. The organising committee wishes to thank them for their contributions. Andreas Müller, leader of the Imaging Spectroscopy Special Interest Group of EARSeL, his efficient team at DLR and other organising committee members, should be congratulated for an excellent meeting.

2.3 International Conference: GIS Ostrava 2003

Gérard Begni, Deputy Director, MEDIAS-France

Introduction:
The 10th International Conference GIS Ostrava 2003: "GI-GIT Theory and Practice – Bringing Them Together" was held on 27-29 January 2003, organised by VSB – Technical University of Ostrava and Czech Association for Geo-information, and sponsored by DIGIS Ltd. One of the main organisers was Dr. Tomas Benes, UHUL – well known as the Czech representative on the EARSeL Council and responsible for East-West relations on the EARSeL Bureau. Dr. Benes spared no effort to give this 10th anniversary conference the widest international dimension. The Conference programme was as follows:

- Invited speakers: G. Konecny / "Mapping from Space"; G. Begni & G. Cannizzaro / "The European GMES Programme and Related EUFOREO Thematic Network – Studying Some Candidate Services"; M. Buchroithner / "Establishing an Environmental GIS for a Remote Mountain Region – the Altai Example".
- Conference topics:
  Global, European and National GI; Metadata and GIT Data Gathering; Interoperability and Standards; Geodata Management and Geodata Warehouse; Geo-information on the Web; GIT in Utilities and Transport Networks; Remote Sensing; Mobile GIT; GIT in Geology and Mining.
- In addition, some technical visits were organised, including to the University of Ostrava and Municipal Authority services.

The attendance was divided into three groups, as is usual for this kind of regional conference: (1) local students, researchers and service providers, who seem to be quite active in the GI domain; (2) regional audience – in addition to Czech attendees, there were participants from Germany, Austria, Poland, and Slovakia; (3) international audience with participants from France, Turkey, Algeria and Japan. The Conference can be mainly regarded as a regional one, bringing together highly skilled specialists of geo-information for environmental and civil engineering.

Introducing GMES:
As stated above, I had the great honour to present an invited paper, between such world-wide acknowledged and respected specialists as Prof. Konecny and Buchroithner. Following discussions between Dr. Benes, the EUFOREO team, the EUFOREO project leader, the EC officer in charge of EUFOREO (Dr. M. Cornaert) and myself, I decided to present the GMES programme, the EUFOREO thematic network, and then to precisely focus on four candidate services that appeared of specific importance for Central Europe: monitoring of indicators for biodiversity and nature protection; flood related services; forest fire-related services; other forest-related services (global carbon mass, ARD issues).

EUFOREO is a thematic network funded under the 5th EC Research Framework Programme (FP5). Its objective is to identify and describe services of potential major interest for the European GMES initiative, to analyse the role that Earth observation (EO) technology could play, in particular the hindrances and ways to overcome them in the short and medium / long term. It should be acknowledged that the first invited presentation, "Mapping from Space" by Pr. G.

Konecny, emphasised the interest (and costs) of RS technologies and was an excellent introduction to the EUFOREO presentation.

I presented the GMES Action Plan as a development of the GMES concept, before the specific aspects of the four candidate services. I underlined that, in 2008, most of Central Europe countries will be an integral part of the EU, so GMES will be their own programme for Environment and Security. It should be stated that the GMES initiative was very poorly known by the audience. Few questions were asked during the conference itself, but several "side" contacts took place in parallel with the plenary conference, partly thanks to the organisers. This allowed debates about the candidate services by themselves and more widely about GMES in Central Europe.

Conclusions – GMES candidate services:
The presented GMES candidate services did not raise specific comments from the audience and the specialists consulted in side meetings. The candidate services are well in line with regional needs. They are developed in the region mainly through "traditional" methods. It can be anticipated that GMES will offer valuable services to the region and will find enthusiastic actors and users.

The use of GI through GIS for environmental and / or management purposes is quite developed in the region. It is taught in Universities, several service providers have attractive offers, and administrative services widely use GIS to assist policy makers at all levels.

RS is poorly used simply because it is poorly known. High prices of data and processing are also perceived as a hindrance. Some service providers make use of it for general or dedicated purposes (e.g. Corine Land Cover maps). Amongst these, GISAT is well known at the national and international level. Other service providers mainly make use of traditional information (mainly aerial photos) to feed their GIS services.

That vision could be somehow biased by the scale of the applications addressed, which are mainly local or regional (in the administrative sense). So, high resolution satellites (SPOT-5, IKONOS) are the unique source that can compete with traditional sources. The accuracy of some products has to be increased, or the integrated use of several types of data should be developed and encouraged. For instance, the HRS altimetric resolution is suited to flood-modelling at the watershed scale, but is not suited to identify accurately endangered areas in highly populated zones.

On the other hand, collecting and using data suited to that specific issue in the overall modelling process is useless, and extremely expensive. This has been identified by EUFOREO all over Europe. Pricing policies can be a serious hindrance, but the situation is evolving and developing adequate methodologies could prove RS to be beneficial in an end-to-end economic approach. Research in that field is encouraged. For example, research about textural information derived from digital forest images to improve classification processes was presented during the symposium.

It could be concluded that the debates consolidated the vision of the candidate services developed by EUFOREO. The needs in that region are important; the use of EO techniques is less developed than in other European regions. This is a matter of breaking working habits in well developed operational services. So, the future can be considered as promising provided that a competitive offer could be developed. This is a matter of attracting public and private service providers.

Conclusions – other potential services of interest:
The purpose was not to summarise the GMES and EUFOREO process from the beginning! Nevertheless, the needs for some specific services were identified, in line with GMES priorities, and these should be shortly described here.

The whole region is a former mining zone. Important coal mining activities existed in that part of Czech Republic and Southern Poland (also Germany) up to the start of the 1990s. This causes soil subsidence in several places, endangering existing buildings and making decisions about new

building zones hazardous. This is also well known in other European regions. Photogrammetric- or laser-based technologies are used to monitor endangered buildings. It has been shown on an experimental basis that SAR interferometry could be used to identify and map slight terrain subsidence. This could be used as a complement to local in situ monitoring methods. This problem is quite in line with the 'S' of GMES.

Atmospheric pollution mainly (but not only) due to industrial activity is also a concern. Just as in Western Europe, measurements are made and propagation models for several trace constituents are being developed. Again, this is quite in line with one of the priorities of GMES (atmosphere).

Conclusions – developing GMES in Central Europe:

As stated above, considering that the countries of that region are fully integrated within FP6, and that most of them will join the EU in 2004, they should be fully involved in the GMES preparation process, and will be fully involved in 2008, when GMES will be operational. It must be acknowledged that the situation is perceived as rather "deceitful" in that respect. It appears quite difficult to many laboratories and service providers wishing to be involved or actually involved in FP5, to find their way in FP6, and in particular in GMES preparation.

The concept of the European Research Area, the implementation of such new instruments as Integrated Projects or Networks of Excellence, are undoubtedly a challenging way to promote a strongly structured and competitive European research, that request specific care and efforts in that region. Several hindrances were underlined. Similar comments are often heard from Western actors. Careful attention has to be paid to such comments, which in no way should be perceived as negative or "conservative", but as an invitation to better take into account the "real world" in an ambitious way to encourage more efficient and competitive European research.

Personal considerations on the future of the Ostrava conferences:

Having such regional conferences and bringing together an international audience is indeed a positive initiative. The proper use of GI and the related management and processing systems to address regional environmental and development issues, indeed needs to be addressed, linking regional concerns to research and technology on a wider scale. This regional community shows a strong will to take advantage

Gottfried Konecny and Gérard Begni visiting coal mines during the Ostrava 2003 Conference. Subsidence due to mining operations is an important regional security concerns

of such innovative technologies to manage their own sustainable development. They deserve to be encouraged. In my opinion, this could be done in several ways. Firstly, this series of symposia is not fully acknowledged as endorsed by EARSeL. Having them under our banner should be beneficial to both sides. The fact that Dr. Benes is responsible for East-West relations within the EARSeL Bureau is a key factor in this respect. Secondly, the GMES initiative, and more widely the ERA concept, should be a leading keyword of that series of conferences. Thirdly, EO space techniques should be better taken into account. This could mean to somehow revisit the ambitious terms of reference of that series of Conferences, keeping the regional aspects as a key issue. In counterpart, this should also mean a better sponsoring of relevant international institutions.

2.4 News from the Special Interest Groups

2.4.1 Multi-Lateral Environmental Agreements

This SIG now has its own web-site, which can be consulted at: medias.dsi.cnrs.fr/sigmea/pages. In the framework of the 20th ISPRS Congress that will be held in Istanbul on 12-23-July 2004, SIG-MEA will organise its first Workshop dedicated to Multi-Lateral Environmental Agreements and RS.

Multi-Lateral Environmental Agreements play a key role in protecting the global environment and ensure sustainable development. Global, regional, national and local monitoring systems are mandatory to better understand processes at work, help local, national and international authorities to plan efficient measures, and monitor compliance and achievements. RS techniques are a unique tool to collect spatially exhaustive, objective information on a periodic basis. Nevertheless, that information cannot be used in itself: description of processes at work, adequate modelling, assimilation techniques and use of in situ collected information are mandatory. Facing these issues, the objective of the tutorial is to address the state-of the art, identify gaps and hindering factors. Three conventions are targeted: UNFCCC (UN Framework Convention on Climate Change), UNCCD (UN Convention to Combat Desertification) and UNCBD (UN Convention on Biological Diversity). For each convention we are looking for lecturers and moderators for the forums, and we request your knowledge and expertise to organise successfully this Workshop.

2.5 RS activities in Finland

Martti Hallikainen (martti.hallikainen@hut.fi), Helsinki University of Technology, Laboratory of Space Technology, Finland

The national space strategy was updated in 2002 from the previous (1999) version. The present strategy covers the period of 2002-2004. The focal point of space activities is being shifted from scientific research to commercial applications and utilisation of satellites in public services. Satellite positioning and remote sensing (RS) are seen as important growth areas. The strategy emphasises the importance of RS for society. RS provides efficient and economical tools for environmental monitoring, map production and maritime traffic in winter. According to the new strategy, the use of RS methods could be increased in the public sector's data acquisition and GIS.

Finland used 43 M€ for space activities in 2000. In the near future, space activities will expand in all areas, and the public expenditure is expected to reach a total of 50 M€ in 2005. This increase will mainly be due to the increased use of satellite positioning and RS.

The main public funding sources in Finland for RS activities are the National Technology Agency (Tekes), Academy of Finland and projects funded by the EU and ESA. The average annual level of Finnish contribution to ESA's RS programmes is 5 M€, including participation in ENVISAT, EOEP-1, EOEP-2 and Earth Watch programmes. Additionally, the annual national contribution to EUMETSAT is 3 M€. National funding for RS activities is 9 M€, mostly from research institutes and univer-

sities. Tekes provides 1 M for the OMI sensor project. Many Finnish institutes are interested in participating in GMES activities.

Tekes recently initiated a new national RS programme called AVALI for the development of space business in (a) satellite instruments and related software, and (b) space-based applications. The programme is effective from March 2002 to December 2005. In the first case, the emphasis is on satellite subsystems, sensor subsystems (e.g. detectors, lasers), electrical and optical components and software. In the second case, the emphasis is on RS, satellite communication and navigation. Development of new applications in areas that are important for the national economy is also included. The goal of AVALI is to create Finnish space business with customers outside ESA and EU. Consequently, companies play a major role in the programme, with research institutes and universities transferring their know-how to companies. The total volume is about 15 M€.

The Academy of Finland and Tekes started in 2001 a three-year programme Antares, which concentrates on space science and environmental RS. The essential areas are participation in large ESA instrument programmes and research programmes utilising large space data archives, preparation of new research programmes, and development of satellite-based optical and microwave observation techniques for environmental monitoring. The programme also aims at increasing international and national networking. An international evaluation board selected a total of eight projects to receive funding from the programme. The total funding of Tekes is 4.5 M€, and that of the Academy of Finland is 4 M€.

Construction of instruments and sub-systems for RS satellites is pursued primarily by companies. The GOMOS ozone sensor on ENVISAT and the SEVIRIS sensor on MSG-1 have contributions by Finnish companies and institutes. The OMI ozone sensor for NASA's EOS-Aura satellite and a millimetre-wave radiometer for the ODIN satellite are further examples of Finnish contributions. The ENVISAT Finnish data Processing Centre ESA Operations (FINCoPAC) is located in northern Finland. Finland participates in the ESA SMOS programme with the main interest in sensor development and calibration.

Operational applications using satellite data have been developed or are under development for meteorology, forest inventory, water quality, hydrology (snow), sea ice monitoring and oil spill monitoring. Existing applications employ satellite data primarily from US and Canadian satellites, including NOAA-series, Landsat, Terra / Aqua and Radarsat. The use of data from European satellites is expected to increase, when data delivery from ENVISAT starts.

Helsinki University of Technology conducted a survey in September 2002 in order to get statistics on national RS activities and personnel. The personnel of the institutes and companies that provided information to the survey represented 159 person-years in 2002 in the field of RS (excluding photogrammetry). This figure is estimated to be about 80% of the total national RS personnel. 77% of persons have an equivalent of MSc degree or higher. Based on person-years, the activities consist of research (59%), commercial activities (24%), operational activities in public administration (12%), with teaching and additional activities (5%). Development of applications based on satellite and airborne RS data are 33% and 19% of the total volume, respectively. During 1999-2002, the number of EU-funded RS projects has remained stable, whereas the number of ESA-funded projects has increased. Over the same period, the number of awarded degrees above the MSc level has increased.

There are two national RS organisations: Finnish Society of Photogrammetry and Remote Sensing, and Remote Sensing Club of Finland. The latter held its annual Remote Sensing Symposium in September 2002, with invited presentations from ESA and EU. There were over 100 attendees. Additionally, the URSI National Committee of Finland organised in October 2002 its XXVII National Convention of Radio Science, with RS as one of the main topics. The event highlighted the 50th anniversary of the National Committee.

The Ministry of Education recently awarded funding to the national Graduate School of Remote Sensing (GSRS) for the period of 2003-2006. The Board of GSRS selected in December 2002 the first five students for Doctoral studies in RS. The aim is to produce PhDs with improved supervision and utilising high-level short courses and summer schools. Helsinki University of Technology co-ordinates the activities. Regular graduate studies in RS are pursued in national universities with emphasis on each university's own interests.

The Space Directory of Finland 2002 (www.tekes.fi/eng/publications/Space Directory 2002.pdf) gives an overview of Finnish space activities. It describes space programmes with Finnish participation, government sector resources and developments in industry.

2.6 RS activities in Hungary

Dr. Peter Winkler, Scientific Director of FOMI, Budapest, Hungary

National Crop Monitoring and Production Forecast Programme (CROPMON):
In the framework of the Hungarian Agricultural Remote Sensing Programme (HARSP), supported by the National Committee for Technological Development (NCTD) and Ministry of Agriculture and Regional Development (MARD, earlier MoA), 300 man years of R&D were invested by FÖMI Remote Sensing Centre (FÖMI RSC). The original final objective of the program was to introduce RS to the operational agro-information system in Hungary. The R&D phase (1980-96) of HARSP was fundamental to the operational CROPMON (1997 to date). In the CROPMON programme, that has been operational for six years, FÖMI RSC provides county- and country-level crop production forecast based on RS, measuring the areas and expected yields of the eight main crops. These crops together represent the 78-82% of the entire Hungarian cropland. The area and forecasted yield data are reported by a strict calendar to the Ministry of Agriculture and Regional Development, 4-5 times in a season, synchronised to the existing traditional production forecast system of MARD.

THE **Crop Area Assessment** in CROPMON is based on the quantitative analysis of multi-temporal high-resolution images (Landsat TM and IRS-1C/1D LISS-III) providing precise crop area estimation at different levels: locally, in the counties (19) and for the entire country. The actual standard crop maps were also provided to MARD. THE **Crop Yield Forecast** is accomplished by the application of FÖMI RSC developed model which combines high-resolution satellite (Landsat TM and IRS-1C/1D LISS-III or SPOT) data and NOAA AVHRR time series. An HRPT receiving station had been installed and operated in FÖMI RSC from May 1998, to provide secure and real-time NOAA AVHRR data access for the models. FÖMI RSC provided yield estimates for the counties and expanded them to Hungary using a regional-historical correlation scheme. Because of the method applied, yield spatial distribution maps could also be reported for the major crops.

Area-Based Subsidy Control by RS:
The principal national crop area-based subsidy programme has been operative in Hungary, for many years now. Both the crop subsidy and the ad-hoc partial loss compensation programmes, that are responses to extreme natural disasters (e.g. waterlog / flood damages), work in a sound legal framework. In 1997 FÖMI RSC introduced to MARD the use of RS for the control of the subsidy and partial compensation programmes. The subsidy controls were performed on the CROPMON basis. Using FÖMI RSC's operational RS-based technology, a three-county sample was controlled in a pilot project in 1999. The target area for RS-based subsidy control was extended to a 7%, 4% and 6% sample of all the dossiers, in 2000, 2001 and 2002 respectively. In addition, control with RS was extended to sites (12) representing all the counties (19) of Hungary in 2002. On the basis of CROPMON the automatic control can be an important part of the control of area-based subsidies in Hungary.

ProMePAR Project:
The **Development of the Physical Block-Based Hungarian Land Parcel Identification System (LPIS) for IACS on Pilot Areas** (ProMePAR) project was also accom-

plished by FÖMI RSC in 2002, to develop the country-wide LPIS ("MePAR" in Hungarian) on pilot sites with ortho-photo-based physical blocks in harmony with the requirements of the Integrated Administration and Control System (IACS) of the EU.

ProMePAR is an experimental system working on 6 settlements (3 counties) with voluntary participation of the farmers. It builds on the existing facilities and institutions and fulfils the EU requirements of the IACS area-based subsidy handling through the work-flow of applications (farmer - office - control - payment – farmer) with special emphasis on land parcel identification and RS control over the physical block LPIS. On the basis of ProMePAR, the building of the county-wide Hungarian LPIS started in 2002 and the system will be fully developed by FÖMI by the end of 2003.

Additional applications implemented on the CROPMON basis:

The CROPMON makes the implementation of other monitoring programmes possible and very cost effective, using the same data, infrastructure and know-how at FÖMI RSC. The **Waterlog and Impact Monitoring** programme was launched for MARD, covering the most affected 4 (1998) and 8 (1999) counties of about four million hectares. Reliable waterlog maps and areal measures were derived. Beyond the static status assessment of the areas under water or having saturated soil, impact analysis on the crops and the dynamics of changes could also be monitored quantitatively. This assessment made use of high- and medium-resolution optical data (i.e. Landsat TM, IRS-1C/1D LISS-III, and WiFS). The resulting GIS database and printed maps were utilised by MARD intensively, and provided fast, operational information for decision-makers. Moreover RS can successfully be used at the parcel specific disaster compensation programme for the control of claims.

On 9 April 2000 the Hungarian government declared parts of eastern Hungary a disaster area due to the serious flood event that occurred on Hungary's second largest river, the Tisza, and several tributaries. FÖMI RSC immediately initiated the **Remote Sensing-Based Flood Monitoring** operations with its available resources, to help the effort, providing real-time satellite data for the disaster area. As soon as the NOAA data were recorded by the FÖMI RSC receiving station, they were processed and analysed each day and transmitted directly to the Ministry of Transport, Communications and Water Management, and to the Regional Water Management network headquarters in the most threatened areas, plus the MARD. Even the slower and less frequent high resolution data were acquired and processed relatively quickly to monitor and document the flood.

For the serious flood situation along the upper Tisza river, FÖMI RSC mobilised its operational capabilities in spring 2001. For the first time in 53 years, the dike along the Tisza was breached, flooding neighbouring areas via a 120 metre-wide gap, threatening tens of villages and thousands of people. The extent of flooded areas was evaluated both on the Ukrainian and Hungarian sides, and high-, low- and medium- resolution flood maps were forwarded electronically to central and local management authorities.

In addition to waterlog and flood, a wide-area drought also hit Hungary in 2000 and **Satellite Based Draught Monitoring** were carried out for the detection of extension and intensity of the drought at regional level, based on NOAA AVHRR data received at FÖMI. FÖMI provided a rapid drought report to MARD including county-level drought maps and temporal profiles of the most affected crop (wheat), comparing actual data of 2000 to the data of previous years having normal (1991) or drought conditions (1992, 1993).

FÖMI RSC started to develop methods for **Satellite-Based Vineyard Area Assessment** to monitor the real extent of production vineyard areas in Hungary. In 1997-98 this was carried out in marked area of Mór, Etyek, and Szekszárd wine-districts using high resolution satellite data (Landsat TM, SPOT, IRS-1C/1D LISS-III.). The complete survey of the vineyard area of Heves county, including Eger and Mátraalja wine-districts, was also done in 1999. FÖMI RSC also implemented a test survey of orchard

areas in 2000 for eight settlements. In December 2000, in accordance with EU regulations, the Hungarian Government obliged the Central Statistical Office (CSO) to conduct a census in 2001, in order to have up-to-date information on vineyard and orchard areas in Hungary. In preparation, FÖMI RSC assessed the potential vineyard and orchard areas covering the whole country (19 counties) using high resolution satellite data in a very short (two months) surveying period in 2001. This applied high-tech RS-GIS technology and resulting vineyard and orchard map for the country gave a really good basis for the census. Based on the previous results, another project is on-going, aimed at GIS support for the existing HEGYIR vineyard databases providing vineyard cadastre for all the vineyard communities (2001-2003).

Examination of high resolution image processing and GIS service system:
The main objective of this R&D project was to develop efficient pre-processing and temporal-spectral data integration methods for high-resolution digital image data (aerial photos and high resolution multi-spectral satellite images). The digital RS images used were: aerial photos with high geometric accuracy (< 1 m), from the "Aerial Photographic Survey of Hungary 2000" project; high resolution (30 and metres) multi-spectral and panchromatic satellite data (Landsat 5 TM, Landsat 7 ETM+, IRS-1C/1D LISS-III and PAN); super-high resolution (4 and 1 metres) multi-spectral and panchromatic satellite data (IKONOS).

The main objective – the fusion and contents integration of RS images obtained from different data sources with different parameters – was actually a very important task and required innovative R&D activities in several fields. In addition, to achieve better geometric accuracy in rectifying large number and more increasingly available satellite images, the planned method led to the enhancing of spatially accurate but spectrally limited aerial photos or panchromatic satellite data, with the rich spectral and temporal attributes of the multi-temporal and multi-spectral satellite images.

After the comparison and quantitative evaluation of the different applied pixel-based image fusion methods, further analysis of the selected methods producing the best performance (HFA) was carried out through the assessment of the results of different thematic applications from the fusioned image data (high resolution land cover and crop maps, soil erosion spots). The use of the generated new database yielded more efficient identification of land surface objects at the level of agricultural fields or within parcels (0.01-0.001 ha), utilising more specific information for crop development in terms of spectral and temporal resolutions.

Application development for the use of ENVISAT data in regional RS-based flood / waterlog and drought / crop monitoring (2000-2003):
The main objective of the Prodex-ENVISAT R&D project (ESA Contract no. 14525/00/NL/SFe(IC)) is to develop the application of ENVISAT satellite data for regional RS-based flood / waterlog and drought / crop monitoring (2000-2003). The effectiveness of these techniques has been proved by the implementation of the operational satellite based National Crop Monitoring and Production Forecast Programme (CROPMON) at FÖMI RSC. Other related monitoring programmes (waterlog and impact monitoring 1998-1999, experimental flood and drought monitoring 2000) were also carried out based on CROPMON. Further extension of the developed methodologies was proposed for rapid, regional monitoring of the spatial extent and temporal changes of flood / waterlog and drought affected areas involving the ESA ENVISAT satellite data.

The processing and comparative analysis of currently available, operational satellite data (NOAA AVHRR, SPOT VEGETATION, IRS-1C/1D WiFS, Landsat, ERS SAR) were carried out on a regional (2-3 counties) test area to accomplish the model setting, extension, testing (data from 1998-2001) and semi-operational (data from 2001) monitoring phase of the project. Further extension of the model is being carried out with real-time monitoring (data from 2002), including the integration of radar and optical data and the planned use of experimental ESA ENVISAT (MERIS imaging spectrometer, ASAR radar) data.

National CORINE Land Cover 1:50,000:
As part of the fulfilment of the government resolution on the "Development of Environmental Information Systems", the implementation of the CORINE Land Cover database at scale 1:50,000 (CLC50) has started within the frames of the Acquis National Programme in 1999. The database supports Hungary's accession to the EU in various programmes, such as the planning of sustainable agriculture, rural development, agri-environmental planning and nature conservation.

CLC50 has direct links to the standard European CORINE Land Cover project. However most elements of the methodology were upgraded according to the present level of technology in geo-data processing. The CLC50 nomenclature used has been developed from the standard (level-3) nomenclature and includes nearly eighty level-4 and level-5 classes, which have been adapted for Hungarian conditions. Ortho-rectified SPOT-4 satellite images taken in 1998-99 and computer-assisted photo-interpretation enable high positional accurate delineation. The 0.04 km^2 minimum mapping unit (0.01 km^2 for lakes) provides enhanced geometric detail. A rigorous internal supervision and an external quality control (performed by the National Park Directorates and the counties' Plant Health and Soil Protection Service) are other key elements of producing a high quality database. At the end of 2002, 87% of the country area has been processed. Completion is expected in summer 2003. Several users are interested in applying the database (government, academia and private).

Participation in the European Topic Centre on Terrestrial Environment (ETC-TE):
The ETC-TE (web-site: terrestrial.eionet.eu.int) is one of five Topic Centres designated by the European Environment Agency (EEA) for the period 2001-2003 to assist in its work of collecting, analysing, evaluating and summarising information relevant to national and international policies for environment and sustainable development. ETC-TE concentrates on providing relevant information on past trends, current status and prospective developments relating to land and soils in Europe, in order to support legislative frameworks on sustainable land use, soil protection and integrated coastal zone management. ETC-TE, which started operations in summer 2001, is an international consortium composed of ten partners from eight countries in Europe. The consortium is led by the Universtitat Autonoma de Barcelona. FÖMI experts participate primarily in the work of database development (TERRIS) and implementation of CLC2000 (the update of CORINE Land Cover database in Europe).

In October 2002 G. Büttner was appointed by EEA as the co-ordinator of CLC2000 Technical Team (TT). The CLC2000 TT is a group of international experts to help the implementation of CORINE Land Cover 2000 project (CLC2000). CLC2000 aims at updating CLC databases in 26 countries of Europe (15 EU member states, 10 Accession Countries and Liechtenstein). The CLC2000 TT is responsible for training national teams, verification of results, providing ad-hoc support during the implementation of the project and European database integration / validation.

GIS support for EU level and National level Land Use / Cover Area Frame Statistical Survey (LUCAS) project in Hungary:
Land cover and land use are of high importance in the definition and evaluation of common sectoral policies (e.g. environment, agriculture, transport) and especially in the integration of those policies in a comprehensive assessment and planning. Eurostat, the EU's Statistical Office, has the mission to provide the EU with a high quality statistical information service. To support policy formulation Eurostat launched – in close co-operation with the Directorate General for Agriculture – the LUCAS pilot project, following Decision N°1445/2000/EC of the European Parliament and Council of 22 May 2000, on the "application of area-frame survey and RS techniques to agricultural statistics for 1999-2003".

In 2002, Hungary, as one of the candidate countries, got the possibility for the land area frame statistical survey according to

EUROSTAT classification. The Hungarian Central Statistical Office decided to carry out the LUCAS statistical survey not only at European level (18x18 km grid), but also at national level (9x9 km grid). On the base of available data at FÖMI, during a short period the necessary GIS support (orthophotos, topo-maps for more then 1,100 PSUs) was provided for the statistical survey, which was completed in three months. Respective international authorities have expressed their satisfaction.

2.7 RS activities in Ukraine

Prof. Dr. Vadim I. Lyalko, Chairman, Scientific Council of Remote Sensing, National Academy of Sciences and National Space Agency, Kyiv, Ukraine

Status of Remote Sensing in Ukraine:
The main contribution to the evolution of remote sensing (RS) have been made by the Ukrainian scientists, designers, and engineers who participated in all Space Programmes of the former Soviet Union. Under the leading participation of the Ukrainian Academy Institutes, in this period there has been a number of unique International Sub-Space Experiments, including "Interkosmos-Chornoe More", "Tien Shan-Interkosmos-88", "Atlantica-87", "Atlantica-89", "Kosmos-1500", "Priroda" for oil-gas prospecting, Chernobyl accident consequence evaluation, etc.

Ukraine, as a sovereign state, is now continuing these studies in the frame of the National Space Programme, in collaboration with international agencies and other countries. In 1995 the first Ukrainian natural-resource satellite "Sich-1" was launched. It was equipped with tools to image the Earth in the optical and radio wavebands. In 1999 the joint Russian-Ukrainian natural-resource space vehicle "Okean-O" was launched. The new natural-resource satellite "Sich-1M" will be launched in December 2003.

Two National Space Programmes have been implemented. Currently the 3rd National Space Programme (2003-2007) is underway. In Ukraine for the last decades the scientific schools internationally recognised in the RS sphere include:

- Centre for Aerospace Research of the Earth (CASRE) at Institute of Geological Sciences, National Academy of Sciences: energy-mass exchange in geosystems – development of physical and mathematical models for spectral signals from Earth and, based on these, the formation of new oil-gas prospecting technologies and environment control from RS data.
- Marine Hydrophysical Institute (MHI), National Academy of Sciences: satellite oceanology – new control and forecasting methods for ocean, ecological and synoptic processes.
- Kalmykov Center for Radiophysical Sensing of the Earth (CRSE), National Academy of Sciences and National Space Agency: aerospace radar systems, for generation of unique on-board radar equipment and methods for interpretation of survey data to address navigation problems under ice conditions, synopsis, forecasting etc.
- State Design Office "Yuzhnoye" (SDOY) (named after M. K. Yangel): construction of natural-resource space vehicles.
- Environmental and Resource Research Institute of Ukraine at National Security and Defense Council of Ukraine, Ukrainian Land and Resources Management Center (ULRMC): application of satellite technologies to environment improvement.

There is considerable experience in RS, as manifested by the design of on-board equipment (e.g. the side-viewing radar setting on "Sich-1"), methods and software for thematic image decoding, GIS technologies, and modelling for energy-mass exchange in geosystems, ground unit infrastructure involving Evpatoria and Chernigiv satellite receiving centres, State Scientific Production Centre of Aerospace Information, Earth RS and Environmental Monitoring "Pryroda" in Kyiv, etc. The National Space Agency collaborates with all RS groups, in Kyiv, Kharkov, Lviv, Dnipropetrovsk, and Sevastopol, in the frame of the 3rd National Space Programme. There are calibration and validation sites in Ukraine, including Chernobyl and the Black Sea, where air-borne spectroradiometric tools are controlled, and spectrometric surveys in gamma, visible, infrared, microwave ranges are done as

ground validation. Since 1998, Ukraine participates in international co-operation on scientific and technical validation of RS from the International Space Station.

A number of grants were won from National Space Agencies of Germany, France, Europe. The first Centre for Aerospace Research of Earth has developed some necessary technologies such as satellite oil-gas prospecting for land and sea-shelf, estimation of toxic pollution for land and water areas (in particular, radionuclides from Chernobyl accident zone), evaluation of phyto-sanitary and fire risk condition for forests, prediction yield crop production, floods and submerge forecasting, etc. These technologies are used in practice for Government Departments such as Ministry of Emergency Situations, the Joint Stock Company "UkrNafta", National Joint Stock Company "NaftoGas Ukrainy", Kyiv and Kherson municipal administrations, etc.

We are continuing to gain proficiency in current fields of satellite and information technologies through the national system of raising the level of professional skill, as well as by means of probation periods in the world RS centers. For example, in 2000 our collaborators have been on probation in ESA-ESRIN, where they assimilated the experience in radar interferometry. This has been used successfully to estimate Earth's surface subsidence for the Donbas area as a result of the mass shutting of coal mines. A concrete example of the organisation and coordination of the investigations in the framework of the National Space Programme, is the compiling of the Atlas "Ukraine from Space" in 2001, where the results of computer thematic interpretation of the "Okean-O" images and other satellites are shown.

Further development of RS of Earth (RSE) in Ukraine:

The main task of the new National Space Programme of Ukraine (2003-2007) in the field of RSE, prepared by the National Space Agency of Ukraine together with the National Academy of Sciences of Ukraine and different departments, is the development of the first line of the national observation system of the Earth from space, to address the socio-economic, security and defence needs of the State. Moreover, in framework of "Scientific Space Research" special-purpose programme, a priority has been given to studying of the Earth.

The RSE specific programme aims at increasing efficiency of using space facilities for rational nature resource use, economical and technological safety. The development of the national observation system "Sich", generation of anti-crisis space monitoring, modernisation of the ground programme and instrumentation for receiving and processing information for a wide user range, are expected. The tasks involve the following concepts: orientation toward real users; development and application of information technologies; providing conditions to apply space technologies into different branches of economics, and commercialisation of space activity; multi-level international collaboration; enlisting additional financial sources beyond the State budget.

The RSE specific programme addresses the following general problems: providing satellite information for state authority bodies to support decisions in management and security; participation in the general national tasks on monitoring of rational natural resource use, prediction of technological and natural accidents; development of international co-operation in RS to tackle global and national problems by means of satellite information exchange, and contribution to international research programmes on the Earth; elaboration of new instruments and programmes means for RSE, new information technologies, and ground infrastructure supported by Ukrainian enterprises in the international space service markets.

Fulfilment of the National Programme for Earth observation from space, "Sich", is a principal step in the ecological safety, quantification of natural resource use, agriculture, weather forecasting, geological prospecting, and monitoring of large-scale processes at the land and sea surface. In particular, the following abilities will be exploited: provide State authorities with useful satellite information for supporting decisions in emergency situations; delivery

of land cover images to customers; ecological monitoring of environment; estimation for the agricultural land resource conditions; etc.

The development of space sciences in RSE is the most important requirement for supporting the general scientific-technical needs of the State, and international collaboration on large-scale and prestigious space projects. The results of Ukrainian studies in RSE are published in special Ukrainian journals such as "Space Science and Technology", "Geological Journal", "Marine Hydrophysical Journal", "Herald of Geodesy and Cartography", etc., and in international journals and publications. Specialists in RSE study and train at the Geographical Department of Kyiv's National University and Kyiv's Polytechnic Institute, as well as in post-graduate courses at the academic institutions. CASRE, of the Institute of Geological Sciences, NASU, has own Special Council on PhDs and candidate's theses from the "Aerospace RS Research" specialisation (physical-mathematical, technical, and geological sciences).

In Ukraine RS activities are financed by the National Academy of Sciences and National Space Agency in the frame of the National Space Programme. Some studies are conducted in co-operation with the European Space Agencies (ESA, CNES, DLR), NASA, Rosaviakosmos (Russia). RS laboratories, institutes, and centres are based mainly on governmental and (to a lesser extent) commercial funding. 2002 marked the 10th anniversary of the National Space Agency and Centre for Aerospace Research of the Earth. Further information is available on our web-site (casre.kiev.ua), or by e-mail (casre@casre.kiev.ua), or by phone / fax (+38-044-2169405).

3 NEWS FROM ESA, THE EC, & INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 Europe's GPS network gets green light

On 26 May 2003 European governments gave the final go-ahead for the launch of the Galileo satellite navigation network, Europe's answer to the US-controlled Global Positioning System (GPS). The long-delayed 3.2 billion Euro system, Europe's biggest ever infrastructure project, will be based on 30 satellites, and should be operational by 2008. Final agreement on the network was reached at a meeting in Paris of members of the European Space Agency (ESA).

Galileo will be used to improve traffic management on land, sea and in the air around the world, as well as aiding all forms of navigation and activities such as oil prospecting, scientific research and even hiking. "This is a great day for Europe in general and its space community in particular," ESA director Antonio Rotota said in a statement. "Our Member States have reached agreement in the common interest." ESA says the Galileo programme will give a much-needed boost to Europe's ailing space industry, creating about 140,000 jobs and "a 460% return on investment."

Unlike the US GPS system, Galileo will be under full civilian control. The US satellite network is controlled by the Pentagon, which can downgrade or totally disable non-military access during conflicts. Galileo's civilian signal will also give locations accurate to within one metre – a significant improvement on that offered by the GPS system. The US regards Galileo as a challenge to its superiority in space technology and argues that it duplicates GPS. Last year Deputy US Defence Secretary Paul Wolfowitz warned that the European network would "significantly complicate our ability to ensure availability of critical military GPS services in a time of crisis, and at the same time assure that adversary forces are denied similar capabilities." ESA is playing down any rivalry with the US system, saying in its statement Monday that Galileo

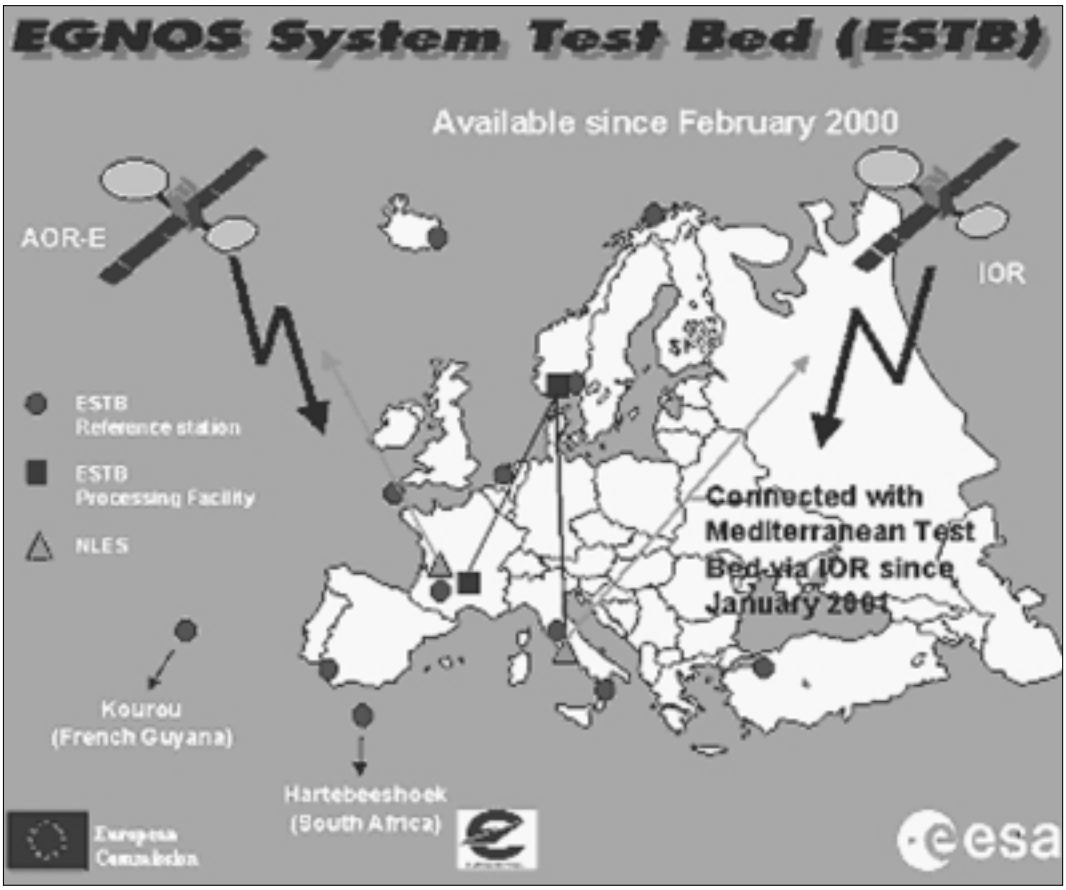
would "complement" the GPS network. The agency says devices for receiving Galileo's signals will be interoperable with equipment used on GPS and GLONASS – the partially operable Russian-built network.

The first experimental Galileo satellite is due to be launched in 2004 and will act as a test bed for the network's systems. When complete Galileo will comprise 30 satellites (27 operational and 3 spares) positioned in three circular orbits 23,616 above the Earth. This article is from a report at www.cnn.com/2003/TECH/space/05/27/europe.galileo

3.1.2 1st signal from EGNOS – Galileo's precursor

On 27 May 2003 it was reported that, after several years of initial definition, detailed design, production and deployment activities, the EGNOS (European Geostationary Navigation Overlay Service) system has started its first signal transmission tests in April 2003. This system is Europe's first venture into satellite navigation, and by early 2004 will deliver the first European Satellite Navigation service. It will augment the two military satellite navigation systems now operating – the US GPS and Russian GLONASS – making them suitable for many mass market applications such as car navigation, bus and truck fleet management, but also for specific applications such as assisting blind people when walking in an unknown area. In addition, after a certification process, EGNOS will be used for safety-critical applications such as flying aircraft or navigating ships through narrow channels.

When completed, EGNOS will consist of three geo-stationary satellites and a network of ground stations that will transmit signals containing information on the reliability and accuracy of the positioning signals sent out by GPS and GLONASS. It will enable users in Europe and beyond to determine their position within 2 metres compared with about 20 metres with GPS. Since 2000 a prototype of the system (ESTB – EGNOS System Test Bed) has been providing test signals, fully demonstrating its



Ground locations of the EGNOS System Test Bed

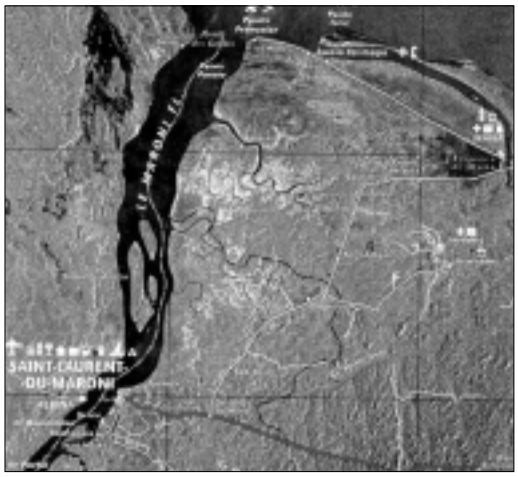
worth and validity. By spring 2004 the full network needed for this augmentation system will have been deployed all around Europe and beyond. It will comprise monitoring stations, called RIMSs (Ranging and Integrity Monitoring Stations), and several Master Control Centres, the first of which is already installed in Langen, Germany. Altogether, nearly 40 stations will be deployed. This installation phase includes the testing of all equipment. This necessitates the availability of a signal in space and that is why the first signal is so important.

EGNOS is a joint project of ESA, the European Commission and Eurocontrol, the European Organisation for the Safety of Air Navigation. It is Europe's contribution to the first stage of the global navigation satellite system (GNSS) and is a precursor to Galileo, the full global satellite navigation system under development in Europe.

This "first signal in space" of the satellite system was relayed from the first EGNOS master control centre in Europe, located in the DFS air traffic control centre in Langen, near Frankfurt, Germany. The event, organised by ESA and DFS, took place on 6 June 2003 at the headquarters of DFS Deutsche Flugsicherung GmbH, Am DFS-Campus 10, 63225 Langen, Germany. Dieter Kaden, DFS Chairman and Chief Executive Officer, and Claudio Mastracci, ESA Director of Application Programmes, were present to describe the various functionalities of the system. For more information on EGNOS, contact ESA Applications Directorate, Dominique Detain (e-mail: dominique.detain@esa.int).

3.1.3 ESA eyes French Guyana's tropical forests

On 5 June 2003 it was reported that ESA is providing data from its Earth observation (EO) satellites to monitor the tropical forests in French Guyana, and help the French government meet its obligations under the international Kyoto Protocol agreement on global warming. Like all the so-called "Annex I" signatories to the Kyoto Protocol, France is required to measure and reduce its overall greenhouse gas emissions. But France is also the only such country possessing tropical forests, most of which are in French Guyana. Tropical forests represent a vast store of carbon, while their deforestation represents a significant source of man-made greenhouse gas emissions. 90% of French Guyana, or around 80,000 km^2, is covered with tropical forests and woodlands. French Guyana is also home to the European spaceport, shared by the French and ESA, at Kourou.



Space-maps based on ERS SAR images, such as this, have been produced for all of French Guyana by the French Defence Ministry, supported by the French Geographical Institute (IGN) and the University of Paris (UPMC). Credits: J. P. Rudant (Université de Marne La Vallée, France), Copyright DGS / CEGN / IGN Espace / UPMC / STAT

"The final objective is to estimate afforestation, deforestation and land-use changes," stated Alain Chaudron, technical advisor for international forests affairs at the French Ministry of Agriculture, Food, Fisheries and Rural Affairs. "The project is a continuation in tropical forests of the ones (ESA) is doing in eight European countries in the temperate zone." Chaudron explained that the estimates should be provided at 0.5-hectare increments, or 5000 m^2, and include corresponding carbon analyses to fulfil Kyoto Protocol commitments. They are provided as part of ESA's GMES (Global Monitoring for Environment and Security) Programme.

Representatives from ESA met back in early April with the French Inter-Ministerial Mission on Greenhouse Effects, the French Ministry of Agriculture and Forestry, and the French Ministry of the Environment to discuss details of the project. In addition,

the project involves others, including the Inter-professional Centre of Technical Studies of Atmospheric Pollution, the National Forest Inventory, and the National Office of Forests. Two French research organisations, SILVOLAB and GIP ECOFOR, have been commissioned to implement the field collection in French Guyana.

The project to assess the tropical forests in French Guyana grew out of a January meeting in Paris between Professor José Achache, director of ESA's EO programmes, and Pierre Eric Rosenberg, MAAPAR's director of rural areas and forestry. This meeting followed the presence of ESA at last autumn's United Nations Framework on Climate Change Convention Eighth Session of the Parties in New Delhi. This article is from a report at the ESA web-site: www.esa.int.

3.2 News from the EC

3.2.1 Need for closer ESA-EU co-operation on space

On 22 April 2003, at a meeting of the Sky & Space Intergroup of the European Parliament in Brussels, strong converging views emerged between the European Commission (EC), the European and national Parliaments and industry, for the creation of a genuine European space policy. Guest speaker Philippe Busquin, Commissioner for Research, requested a real institutional framework for the space sector in Europe, comparable to the one in the US.

At the meeting, Commissioner Busquin addressed the Green Paper on European Space Policy. The purpose of the Green Paper on Space, to be finalised on 24 June 2003, is to underline the strategic importance of space to the EU, and the necessity for ESA and the EU to convey a common political vision. Commissioner Busquin pointed out that Europe has a strong presence in the space sector, but that it is threatened in the short term, partly due to the current reduction in demand for commercial launches. A consolidated approach between ESA and the European institutions is therefore required. New opportunities for space applications (such as for agricultural or meteorological use) have to be promoted. He welcomed the progress made during the Green Paper consultation phase. A White Paper, including an action plan for a European space policy, will be issued by the end of 2003, in line with the request formulated by the European Parliament at the beginning of 2002. Finally Commissioner Busquin welcomed the support that the European Parliament has given to the Green Paper and looked forward to the report that will be issued on their behalf. He was convinced that, thanks to the progress made by the European Convention, the adoption of the White Paper and the report of the European Parliament would represent a great leap forward towards a genuine European space policy.

A lively debate followed Commissioner Busquin's speech, with a round of questions raised by Members of French, UK and European Parliament, and industry, represented by AECMA (European Association of Aerospace Industries) and EUROSPACE (Association of European Space Industry). Concerns were expressed about the weakness of the institutional space market in Europe, the under-financing of the space sector, and the difficult decision-making process between Member States. In this context the Green Paper was highly welcomed. The set up of a clear space policy and its implementation was stressed as a matter of urgency. Some representatives from industry also noted that, due to space specificity, EU competition rules should not hinder European industry restructuring and the emergence of "space champions". This article is from a report at www.aecma.org/Press/pr0303EurospaceGPSpace.htm.

3.2.2 On-going meetings on EU Space Green Paper

On 20 May 2003, high-level representatives discussed the Commission's Green Paper on a European Space Policy in London, focussing on practical applications for European citizens. Highlighted were telecommunications, Earth observation (EO) and satellite positioning, all of which have a huge impact not only on everyday life in Europe but also on global issues of sustain-

able development, peacekeeping and crisis management.

"The aim of the UK's space policy is to generate wealth for all of our citizens," said British Minister of Science and Technology Lord Sainsbury. "We see space as a source of enabling technologies having a greater and greater impact on ordinary life. The importance of space in telecoms is obvious and the global satellite positioning and navigation market will become enormous in the coming years. We are faced with a serious challenge in this space policy debate. Space is a valuable and cost-effective, and, in many ways, a unique tool, but we are not entitled to automatic funding. We must be convincing and accountable."

Representing the European Parliament, MEP Eryl McNally said: "A space policy is perfect for Europe in terms of added value. European security, sustainable development, energy policy – all are served by space technologies and the applications and services they provide. A space policy meets all the criteria of the Lisbon declaration, which we must repeat again and again – to become the most dynamic and competitive knowledge-based economy in the world. Space is dynamic, it is competitive, it is knowledge-driven, and Europe can be a world leader in the space sector. The industry is in a downturn for the moment, no one can deny that, but it will come back. The European Parliament is eager to see the GALILEO programme get off the ground and we want to see space as a part of the new European Treaty. Our main competitor, the USA, is spending much more than we are on space. Dare I say we need to 'boldly go…'? Let's ask for more support, for more money, with confidence. The Parliament's report on the Space Green Paper will be published soon and we expect to give all of you a positive response."

ESA Director General Antonio Rodotà said: "The strategy of using public funding for development and then transferring applications to the private sector has worked. Space development involves huge risks that the private sector is often unwilling to undertake. There are any number of companies in operation today, providing services based on space technologies and systems, first developed and then handed over by ESA. The public sector must continue to contribute to this process. We now believe that the combination of our 'savoir faire' and the political support of the EU is the way to meet our future challenges in space."

Speaking for the Commission, Research Commissioner Philippe Busquin said: "Space is excellent value for money for European citizens. So many applications are bringing space technologies into the lives of everyday people, from medical techniques and communications technologies to frying pans and potato chip packaging. But there is more: agricultural applications; bringing humanitarian aid to earthquake victims; cleaning up the Prestige oil spill. Recent actions in support of this process in the European Parliament, in the European Council and in the Convention have shown that all now agree this is a critical moment for Europe and space."

According to workshop moderator and rapporteur Giuliano Berretta of the European Satellite Operators' Association, the main applications for space technologies remain telecommunications, including television and internet services, EO, including meteorological services, and global positioning and navigation. Workshop sessions covered each area, with speakers from the space industry, government institutions and organisations exchanging views with panel members and the audience. Common threads included the 'digital divide' – i.e. the lack of communications services in remote areas where conventional ground-based access via cable is not practical. Satellite services are seen as a potential stop-gap giving direct access to communications services in these areas. The question of European defence was also raised repeatedly. Space-based systems, such as GALILEO and GMES, are generally seen as having 'dual-use' capabilities. According to Busquin, these systems will provide information useful for both civil- and security-related applications. Public funding is seen by many as a prerequisite to ongoing applications development. While there is great potential for economic benefit in the provision of space-based services, research and development requires a clear political commitment and

an investment beyond the scope of the private sector.

The Space Generation Advisory Council (SGAC) works in support of the United Nations Programme on Space Applications and is represented or directly involved in a wide range of meetings and conferences in the world space arena, expressing the visions and perspectives of youth with regard to future space activities. The group presented a draft of its response to the Space Green Paper to Philippe Busquin and Antonio Rodotà. According to SGAC co-ordinator William Marshall, the group sees four areas for increased investment in the space sector: common defence programmes; launcher technologies; space law; human space flight. Above all, he said, young people must be inspired by bold programmes, and youth outreach and education initiatives should be an integral part of all European space activities.

The Green Paper process comprises a series of seminars, workshops and hearings currently taking place throughout Europe. Its aim is to foster a wide-ranging debate among national and international organisations, the European space industry, the scientific community and the general public. Individual contributions to the discussion can be posted via the dedicated on-line forum: europa.eu.int/comm/coreservices/forum/index.cfm?forum=space. An exchange that includes all of the relevant stakeholders will help to shape a comprehensive EU Space Policy, to be detailed in a White Paper later this year. The last round of discussions on the EC's Space Green Paper, before the wrap-up in Paris, is set to take place in Prague on 2-3 June 2003. The debate will centre on the "international dimension" and will feature speakers representing traditional as well as newer space players. Opening the event will be Petra Buzkova, Czech Minister of Education, Youth and Sports. This article is from a report at europa.eu.int/comm/space/articles/news/news43_en.html.

3.2.3 3rd GMES Forum in Athens, Greece

On 5-6 June 2003, the 3rd GMES (Global Monitoring for Environment and Security) Forum took place in Athens, Greece, as part of the Greek presidency of the EU. GMES is a joint initiative of ESA and the European Commission (EC), spanning both technical and policy domains. It started in 1988 and aims at benefiting from the European knowledge and experience in the domains of data acquisition and analysis systems, as well as information dissemination. It also aims at contributing to the establishment of a new infrastructure at European level capable of providing operational information and services for the benefit of the end-users working on environmental monitoring and management, as well as the security of European citizens.

GMES Forums 1 and 2, as well as the GMES Forum on the role of ocean-observing systems (held on 3-6 December 2002 in Athens, as part of the 3rd EuroGOOS Conference) were specifically designed to establish the state-of-the-art of the issues facing production of information for European environment and security policies.

GMES Forums 3 and 4 are focussed on the results achieved under the GMES Action Plan and on the actions to be taken to establish the European capacity for GMES.
Based on progress of Cross-cutting Assessment, Thematic Projects and ESA GSE (GMES Services Element), as well as GSC (GMES Steering Committee) Working Groups, Forum 3 presented and discussed: initial technical results; emerging orientations and domains of action for the Implementation Period of the Action Plan. The thematic priorities of the 3rd GMES Forum were: terrestrial and coastal resources; marine resources; atmosphere; security. One plenary and four parallel sessions took place during the Forum. The structure of the Agenda was as follows:

- Plenary 1: Initial period – progress of work.
- Parallel sessions: Results from Thematic Projects and national examples, aiming at the response of end-users at European and international level in defining their requirements in data availability, systems, models, products, services, etc.
- Plenary 2: Preparing the implementation period of the GMES Action Plan.

The results drawn by the meetings will be elaborated by the relevant work groups: (a) gaps in knowledge, technology and tools; (b) adequacy of monitoring networks; (c) data policy; (d) socio-economic and institutional issues; (e) security. Their recommendations will be presented before the GMES Steering Committee in order to be part of the future Action Plan after 2003. Further information is at the web-sites www.gmes.info and earth.esa.int/gmes.

3.3 EUROGI elects new president (2003-2005)

Jean Poulit was elected President of EUROGI (European Umbrella Organisation for Geographic Information), at its 10th General Board meeting in Brussels, on 21 March 2003. His main task, he says, will be to raise EUROGI's profile for European decision-makers. High level lobbying for GI is needed. He emphasises that better use of GI ultimately leads to economic growth and environmental protection. Jean Poulit has many years experience in the operational use of GI for land planning and environment. He is the former General Director of IGN France and President of IGN France International, and was President of CERCO for two years. He is presently a Member of the National Council for Transportation and Planning in the Ministry of Public Work, Transport, Housing, Tourism and Sea as well as an Advisor to the President of the National Space Agency for new applications of space.

During his acceptance speech, Mr. Poulit expressed gratitude to EUROGI members and thanked Ian Masser for the exceptional performance as President of EUROGI over the past four years. He wishes to give attention to the different EC Directorate Generals having an interest in using GI, the Commissioners and the European Parliament. Mr. Poulit strongly believes that special attention should be given to promoting the benefits of GI to society at large. This can be best achieved by showing the several uses of GI in transport, buildings, natural spaces, etc. It is necessary also to enlarge the pledge for GI to other key decision-makers in Europe from the private sector. Mr. Poulit will support the mechanisms necessary in setting up a European spatial data infrastructure and its added value. This will involve all federations in the greater Europe. EUROGI is honoured to welcome Mr. Poulit to its growing list of accomplished Presidents. For further information contact EUROGI Secretariat: Karen Levoleger (phone / fax +31-55-5285532 / 5285032; e-mail eurogi@euronet.nl; web www.eurogi.org).

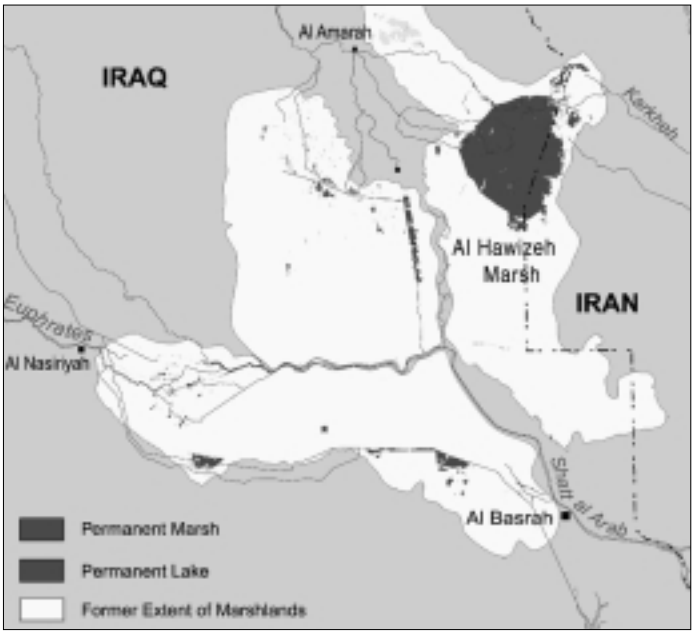
3.4 UNEP maps marshlands loss in Iraq & Iran

The Marshlands of Mesopotamia, considered by some to be the Biblical location of the Garden of Eden, and known as the fertile crescent, are continuing to disappear at an alarming rate. Studies, disclosed on 22nd March 2003 at the 3rd World Water Forum in Kyoto, Japan, indicate that of the 10% of the marshlands left, one third has disappeared in the past two years with many endangered species such as the Sacred Ibis and African darter holding on at a knife's edge.

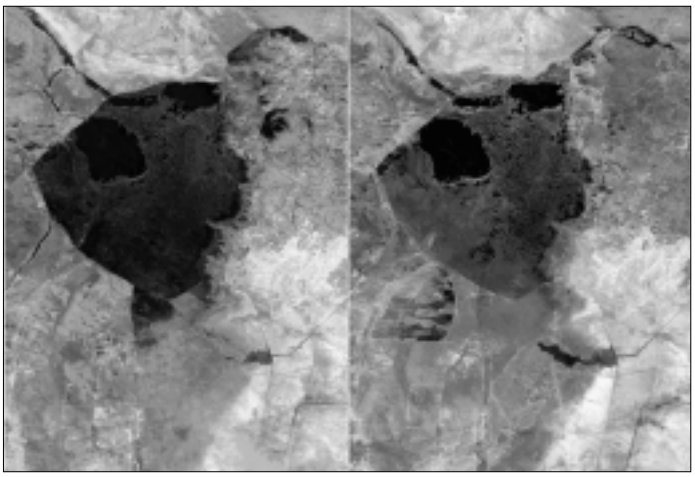
Two years have elapsed since the United Nations Environment Programme (UNEP) drew the world's attention to the plight of the marshlands and its unique culture, the Marsh Arabs, who are the 5,000 year-old heirs of the Babylonians and Sumerians. Satellite-based assessment studies, carried out by UNEP's Division of Early Warning and Assessment (DEWA ~ Europe / GRID – Geneva), and covering a period from the early 1970s to 2000, showed that 90% of the marshlands, also home to rare and unique species and a spawning ground for Gulf fisheries, had disappeared.

The new studies show that a further 325 square kilometres have dried out since 2000, leaving just 7% of the original area. Unless urgent action is taken to reverse the trend and re-habilitate the marshlands, the entire wetland known as the Hawr Al-Hawizeh in Iraq and Hawr Al-Azim in Iran, are likely to have gone in three to five years.

Klaus Toepfer, Executive Director of UNEP, said at the Forum: "As we mark World Water Day 2003, we are reminded again of



Map showing loss of Mesopotamian marshlands: 1973-2000. (Copyright © 2002 UNEP / DEWA / GRID – Geneva)



Landsat ETM+ satellite images of Mesopotamian marshlands: 2000 (left) and 2002 (right). (Images provided courtesy of UNEP / GRID – Sioux Falls and USGS EROS Data Centre)

the dramatic destruction of the Mesopotamian marshlands and their unique culture and wildlife over the past decade. It is an environmental catastrophe for this region and underscores the huge pressures facing wetlands and freshwater ecosystems across the world. We have already lost half of the world's wetlands in the last 100 years, and the continued desiccation of the Mesopotamian marshlands confirms that more decisive and concrete action is needed." Mr. Toepfer said he hoped that the end of hostilities in Iraq and the rehabilitation of the country would include a full assessment and action plan for the restoration of the marshes.

UNEP's Post-Conflict Assessment Unit (web-site: postconflict.unep.ch), which has successfully carried out environmental assessments and drawn up action plans for the Balkans and more recently Afghanistan and the Occupied Palestinian Territories, stood ready to assist in any project to restore the wetlands. Mr. Toepfer said such an assessment needed to address all the issues which are potentially impacting on the marshes. These include extensive, internal drainage, projects and dams upstream including those on the Euphrates and Tigris rivers. UNEP believes there is still a last window of opportunity to reverse wetland desiccation and achieve at least partial restoration. In the short term, an emergency release of water from reservoir dams in Iran and Iraq to simulate the seasonal flood is needed.

Iran reacted positively with a limited release of water to the wetlands in March and April 2002 flooding the northern core part. A long-term recovery plan is however needed. This will require a holistic river basin approach based on the ultimate goal of sustaining river ecology and in which all Tigris-Euphrates riparian countries share the rivers' waters in a co-ordinated and equitable manner. An integrated catchment plan would also give priority to allocating an adequate amount of water to the wetlands, while water releases from existing dams can be timed to mimic natural flow patterns and bring the marshlands back to life.

The Mesopotamian marshlands are an integral part of the Tigris-Euphrates river basin, which is shared by Iran, Iraq, Syria and Turkey. UNEP first drew the world's attention to the demise of the largest wetland ecosystem in the Middle East Mesopotamian marshlands in May 2001 with hard evidence from satellite imagery

capturing the shrinkage of the marshlands' physical extent. The UNEP study revealed that by spring 2000, a one thousand square kilometre vestige straddling the Iran-Iraq border was all that was left of the extensive wetland complex, which originally covered an area of 15,000 - 20,000 square kilometres.

For more information, please contact Eric Falt (eric.falt@unep.org), UNEP Director of the Division of Communications and Public Information or Nick Nuttall (nick.nuttall@unep.org), UNEP Head of Media, or visit the web-site www.grid.unep.ch/activities/sustainable/tigris/marshlands.

4 RS DATA, PRODUCTS & PROJECTS

4.1 Observations

Boudewijn van Leeuwen (leeuwen@itc.nl), ITC (International Institute for Geo-Information Science and Earth Observation), The Netherlands

What was launched?

The decline in the satellite business is now also clearly shown in the field of Earth Observation satellites: in the last three months no new birds were launched and Orbview-3, DMSP-16 and Scisat–1 were delayed to later this summer.

What was in the news?

Midori-II
The first data from the five instruments on board of Midori–II (also known as ADEOS-II) were published by the NASDA, JPL and CNES in January and February. Now the validation period for most instruments has started. During this period some preliminary data are already made available for scientific purposes. Regular sciences operations for the SeaWinds instrument are scheduled for October. All GLI and AMSR products will be available at the end of 2003, and the distribution of Level 2 and 3 POLDER data will start in 2004. Web-sites: winds.jpl.nasa.gov; smsc.cnes.fr/POLDER; sharaku.eorc.nasda.go.jp/ADEOS2; www-ilas2.nies.go.jp/en.

ALSAT-1
The first images of the Algerian EO satellite, ALSAT-1 were released on 2 April 2003. This micro-satellite, launched in November 2002, provides 32-metre multispectral imagery of large areas (maximum swath 600x600 km). It is the first satellite of the international Disaster Monitoring Constellation (DMC). Three more DMC satellites, NigeriaSat-1, UK-DMC and BILSAT-1, are scheduled for launch in July 2003. Web-site: www.sstl.co.uk/

SRTM
During the last three months, NASA / JPL released two major Shuttle Radar Topography Mission C-band data sets. In March 2003, the 30-metre digital elevation model of North America was released. Two months later this set was joined by the 90-metre DEM of South America. The data can be downloaded or ordered at seamless.usgs.gov/viewer.htm.

Coming up soon:

On 1 June 2003, the launch of OrbImage's 1-metre resolution satellite Orbview-3 was postponed again. At this moment, mid-June is the most likely schedule that is mentioned. Orbview-3 will be launched by an Orbital Sciences air-launched Pegasus XL rocket from Vandenberg Air Force Base. Web-site: www.orbimage.com

Also, the launch of the defence meteorological satellite DMSP-16 was delayed again. DSMP-16 was originally scheduled for launch in January 2001. The launch has been postponed over and over again for the last 2.5 years due to various problems with the satellite. It is now scheduled for 19 July 2003. Web-site: dmsp.ngdc.noaa.gov/dmsp.html

One week later, on 26 July 2003, the Canadian scientific satellite SciSat–1 is sched-

uled for air launch by a Pegasus XL from Vandenberg Air Force Base. Detailed information about this mission can be found at www.space.gc.ca/asc/eng/csa_sectors/space_science/atmospheric/scisat/scisat.asp

4.2 Rescue package for European launch industry

Russian Soyuz rockets could soon be launching from the European spaceport at Kourou in French Guyana. The proposal is part of a package of measures designed to re-structure the European launch business and rescue it from its current parlous financial state. On 27 May 2003, ministers from the Member States of the European Space Agency (ESA) considered the plans and decided whether they are worth the requested extra investment from tax-payers and industry of about one billion Euros.

The Soyuz vehicles would have their own pad built at Kourou, with the first flight likely to lift off in 2006. "Soyuz would give us the full range of vehicles to get into orbit," ESA Director-General Antonio Rodota told BBC News Online. "Smaller payloads will eventually travel on the Vega rocket; the larger satellites will be lifted by the Ariane 5. "The low-cost Soyuz can lift medium payloads into low-Earth orbit and geo-stationary orbit. It would also give Europe a manned spaceflight option."

But it is imperative that space ministers first put in place measures to strengthen the market position of Europe's main launch vehicle, the Ariane 5. A beefed-up version of the rocket, the 10-tonne Ariane 5, exploded four minutes into its maiden flight in December 2002, dumping two satellites worth 600 million euros in the Atlantic. The cooling system on the rocket's new Vulcan 2 engine failed, and it must be re-designed and flown on two qualification flights before payload opportunities can again be offered to customers. This recovery programme alone will cost Europe 0.25 billion Euros. The first qualification flight, carrying a dummy payload, is envisaged for March 2004. The second flight, in September 2004, would undertake an altogether more onerous task – that of launching the first Automated Transfer Vehicle (ATV). This new "cargo truck" is intended to ferry supplies to astronauts living on the International Space Station.

There is a shake-up also for the way the whole launch operation is managed. Arianespace, the company charged under a convention with ESA to operate Europe's rockets, is asked to concentrate more on the marketing side of the business. In future, development and manufacture will be the sole responsibility of aerospace giant EADS. Arianespace would essentially just purchase rockets – Ariane 5s, Vegas, and Soyuz vehicles from the Russian company Starsem – and launch them for customers.

All the changes, together with substantial new funds for Arianespace after a recapitalisation of the company, are intended to carry the European launch industry through its current slump. Worldwide, there are too many rockets chasing a small pool of satellite contracts. The current state of affairs has seen the two major players in the US, Boeing and Lockheed Martin, discuss a joint venture.

Commenting on the upcoming ministerial meeting, Philippe Camus, president of the Association of French Aeronautic and Space Industries (GIFAS), said: "The space industry expects that France and all the other European states are going to take measures and decisions that safeguard the public and private investments that have been made over the past 40 years." Mr Camus told La Tribune that industry was prepared to do its bit to safeguard the future of Europe's independent launch capability but that the ESA Member States had to share the burden. Story from BBC News web-site: news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/2933606.stm.

4.3 Landsat 7 instrument anomaly (31 May 2003)

It was reported on 6 June 2003 that an instrument anomaly has been discovered with Landsat 7, which appears to have started on May 31, 2003. Investigators are working to resolve this problem and its effects. All Landsat 7 scenes that were acquired from 31 May 2003 to present (i.e. at

the time of going to press of the EARSeL Newsletter) are designated "unorderable" at this time, and therefore will not appear on the search and order interfaces. Standard data acquisitions and scheduling are suspended until this problem has been resolved. Details and updates on the anomaly investigation will be provided, as they become available, on the web-site landsat7.usgs.gov/updates.php. For current multispectral imagery, please be aware that Landsat 5 TM, EO-1 Advanced Land Imager (ALI), and ASTER may provide useful data alternatives. For questions regarding this issue, please contact us via our contact form (landsat7.usgs.gov/contact.php). This news item is from a report at landsat7.usgs.gov/programnews.html.

4.4 EC awards framework contract to Eurimage

On 5 May 2003 the European Commission (EC) and Eurimage signed a new Framework Contract for "Supply of Satellite Remote Sensing Data to European Institutes Services". The Invitation to Tender came from the Joint Research Centre's Institute for the Protection and Security of the Citizen / IPSC (web-site: ipsc.jrc.cec.eu.int) in Ispra, Italy. Under the terms of the contract, which will have an initial duration of two years with an option to renew for a further year, Eurimage will be the exclusive provider to all EC Institutes of QuickBird and Landsat world-wide satellite data.

ISPC-JRC provides research-based, systems-oriented support to EU policies in the areas of cyber-security and new technologies for combating fraud, monitoring agriculture with remote sensing, technological and economic risk management, humanitarian security, and non-proliferation and nuclear safeguards. Eurimage has a long history of service to the EC, through Framework Contracts dating back to 1996, and has contributed to the success of many Community initiatives, in particular the "Control with Remote Sensing" programme carried out by the MARS unit of IPSC-JRC. The new contract, in addition to renewing the existing agreement covering Landsat data, will allow EC institutes for the first time to order very high resolution imagery from the DigitalGlobe™ QuickBird mission. QuickBird data, with its maximum 61 cm resolution, is the best-quality data available from any commercial Earth observation satellite. More information is at www.eurimage.com.

4.5 Return of International Space Station crew

On 4 May 2003, the crew of Expedition 6 to the International Space Station (ISS), US astronauts Kenneth Bowersox and Donald Pettit and Russian cosmonaut Nikolai Budarin, returned to Earth after spending 162 days on board. Expedition 6 left the ISS in the TMA-1 spacecraft that had flown ESA astronaut Frank De Winne to the Station on 1 November 2002. Initially the Expedition 6 crew was to have been relieved in March 2003 by a new crew arriving on Space Shuttle flight STS 114. After the Columbia accident, ESA agreed to a six-month postponement of Pedro Duque's mission to the Station, initially scheduled for April, making the Soyuz flight available for relieving the Expedition 6 crew. The Expedition 7 crew, US astronaut Ed Lu and Russian cosmonaut Yuri Malenchenko, arrived at the Station on a TMA-2 spacecraft on 28 April 2003.

The Soyuz capsule's re-entry did not take place in the nominal automatic controlled mode, in which the trajectory of the capsule is actively controlled by using aerodynamic lifting forces when rolling the capsule to the left or right. This mode provides minimum gravity loads to the astronauts during re-entry and accurate landing, which in the case of Expedition 6 should have occurred 88 kilometres north of Arkalyk. For as yet unknown reasons the re-entry took place in ballistic mode, in which the capsule behaves like a spherical object. For greater stability the capsule spins around its trajectory axis. The ballistic mode leads to a steeper trajectory, increased gravity loads for astronauts, and less precision in reaching the landing site. It is a contingency mode, which had occurred twice before in the history of Soyuz capsule re-entries. The Expedition 6 crew experienced about 8 times the force of gravity during re-entry and the landing

took place 150 kilometres north of Baikonur, about 440 kilometres short of the planned target area.

The recovery teams therefore had to be redirected and it took them longer than usual to locate and retrieve the capsule. The crew had established radio communications with the recovery teams and the Mission Control Centre near Moscow. After the arrival of the recovery teams, the crew were flown by helicopter to Baikonur, from where they returned to the Chalkovsky military airfield near the Gagarin Cosmonaut Training Centre in Star City, north of Moscow. All three were in good physical shape. At the Gagarin Cosmonaut Training Centre they started debriefings and physical rehabilitation.

This was the first re-entry by the enhanced TMA-1. It was also the first time that US astronauts had returned from space in a Soyuz spacecraft. The Expedition 7 crew flew TMA-2, the second enhanced Soyuz spacecraft, to the ISS, where it will stay until October / November 2003. It will then be used to bring the Expedition 7 crew and the European astronaut Pedro Duque back to Earth. Rosaviakosmos (Russian Space Agency) Director General Yuri Koptev has set up a State Commission to investigate why the Soyuz re-entry occurred in ballistic mode. This article is from a report on the ESA web-site: www.esa.int.

4.6 NASA's aqua satellite marks one year of EO

NASA Aqua satellite's first year has revealed impressive views of our planet's volatile surface, capturing dramatic events such as fires in Australia and the USA, snowstorms in the Arctic, typhoons in the East China Sea, a volcanic eruption on the island of Sicily, and dust storms in the Middle East, all with data from its six unique instruments. "We've collected high-quality data from all of our instruments, and these data should eventually lead to a better understanding of Earth's water cycle and the role it plays in our changing climate," stated Claire Parkinson, Aqua Project Scientist at NASA's Goddard Space Flight Centre, Greenbelt, Maryland.

Aqua was launched on 4 May 2002, and soon after began providing valuable information from its massive data flow, approximately 89 gigabytes a day, allowing scientists to analyse and generate dozens of data products. The Aqua Science Team convened at Goddard on 28-29 May 2003 to present their insights, first-year results, and plans for their future research using Aqua data.

The Atmospheric Infrared Sounder (AIRS), the Advanced Microwave Sounding Unit (AMSU) and the Humidity Sounder for Brazil (HSB) combine to form a trio of instruments that capture an ongoing, detailed picture of Earth's atmosphere that will eventually lead to improved short-term weather predictions, improved tracking of severe weather events like hurricanes, and advances in climate studies. Arctic snowstorms were successfully tracked using data from AMSU and HSB, the latter provided by the Brazilian National Institute for Space Research. In the past, tracking snowstorms in the Arctic from satellites was particularly difficult because of the underlying ice and snow surfaces. Successful tracking with Aqua data was accomplished by using channels of AMSU and HSB that do not see through to the surface. The European Centre for Medium Range Weather Forecasting has shown a positive impact on its weather forecasts and plans to incorporate AIRS and AMSU data in their operational forecast models by the end of summer 2003.

AIRS data already available to scientists include the most accurate, highest spectral resolution space measurements ever taken of the infrared brightness (radiance) of Earth's atmosphere. This information can be used to make more accurate predictions of weather and climate. More advanced data products are expected to become available later this year. The data will include atmospheric temperature and humidity profiles as well as additional environmental measurements on various types of clouds, particularly the thin veil of cirrus clouds that covers Earth. Further new data are expected on concentrations of greenhouse gases, such as CO^2, methane, CO and volcanic SO^2.

Aqua imagery has captured numerous dramatic events of the past year. On 24 June 2003, the day that Aqua's Moderate Resolution Imaging Spectroradiometer (MODIS) was turned on, its data were used to produce MODIS imagery of fires in Australia. MODIS also captured extensive flooding of three major river systems along the Gulf of Mexico resulting from heavy rains, dust storms in the Middle East and Mediterranean, the October 2002 eruption of Mount Etna (also captured by the AIRS data), and the Biscuit fires in Oregon and California in August 2002. In early June 2002, the Advanced Microwave Scanning Radiometer for the EO System (AMSR-E) produced Aqua's first global map of sea surface temperatures. AMSR-E also recorded images of Typhoon Rammasun in the East China Sea on 4 July 2002, and Typhoon Higos approaching Japan on 1 October 2002. This instrument was provided by the National Space Development Agency of Japan.

The Clouds and Earth's Radiant Energy System (CERES) detects the amount of outgoing heat and reflected sunlight leaving the planet, providing critical information about the Earth's radiation budget. An understanding of this budget and how clouds affect it is essential for understanding changes in our climate. In addition to the information the CERES instruments (Aqua has two) are providing about the radiation budget as a whole, CERES also reveals information about how various features, such as Hurricane Lili on 1 October 2002, affect outgoing short- and long-wave radiation. For more information see www.gsfc.nasa.gov/topstory/2003/0528aqua.html.

4.7 GPS satellites used for earthquake studies

On 14 May 2003 it was reported that a serendipitous discovery by a team led by Colorado University (CU) at Boulder, has shown for the first time that satellite signals from the Global Positioning System (GPS) are a valuable new tool for studying earthquakes. *Editor's note: "Serendipity" = the faculty of making happy and unexpected discoveries by accident*. ☺ CU-Boulder Associate Professor Kristine Larson, of Aerospace Engineering Sciences, said seismic waves from a 7.9 magnitude earthquake in Alaska's Denali National Park in November 2002, were detected using GPS receivers as far away as 3760 kilometres from the event. The quake also was picked up by scores of GPS receivers in Canada and the USA.

GPS is a constellation of satellites originally designed by the US military to provide precise positions of ships, tanks, airplanes, other military equipment and even people. Currently there are 27 GPS satellites orbiting Earth at roughly 20,000 kilometres above the planet. "This is the first time GPS has been used to track seismic waves," Larson said. "The signals were large enough to be recorded by GPS receivers as far away as Colorado Springs, Colorado." A paper on the subject was published electronically by Science magazine on Science Express, on 15 May. In addition to Larson, co-authors include Paul Bodin from the University of Memphis and Joan Gomberg from the U.S. Geological Survey's Memphis office.

"The nice thing about GPS is it's great versatility," said Larson. "In this study we were able to track seismic waves that travelled from Alaska through Canada to Washington, Montana and Colorado." GPS has a number of other scientific uses, like measuring ice sheet movements, the inflation of magma under volcanoes and plate tectonics, Larson said. More practical uses of GPS include navigating aircraft, boats and cars, as well as helping lost hikers find their way to safety. GPS users – like hikers, boaters and car drivers – decide how frequently their position determination is needed. For measuring seismic waves from Denali, Larson's team used GPS receivers that were set to measure positions once each second, or 1 Hertz. Ordinarily, she said, scientists study earthquakes with seismometers, but these often are set for a particular sensitivity range. Because the earthquake in Alaska was so big, however, many seismometers in the US and Canada were not able to measure it. "But GPS researchers love very big signals," Larson said. "The bigger the better for us."

The Denali quake ruptured almost 320 kilometres, causing surface displacements of more than 8 metres in some places, she

said. "This is permanent deformation. The deformations we observed with GPS in the lower 48 states also were large, but were caused by the seismic waves and did not cause permanent displacement." For a sense of how big the seismic waves were, a GPS receiver in eastern Washington moved 23 centimetres horizontally in just 10 seconds, even though it was 2,400 kilometres from the Denali earthquake. There are many continuously operating GPS receivers in the US, she said, and scientists use them primarily to monitor small motions on faults. Roughly 250 GPS receivers are operating in Los Angeles County, for example, installed in response to the 6.7 magnitude Northridge earthquake in 1994.

The National Science Foundation recently funded the Earthscope research project to study the structure and evolution of the North American continent, Larson said. Earthscope also is designed to decipher what causes earthquakes and volcanic eruptions and as part of that effort, Earthscope engineers will soon be installing 800 additional GPS receivers in the western US. This article is based on a report at www.colorado.edu/PublicRelations/NewsReleases/ 2003/2336.html.

4.8 New NASA models for forecasting earthquakes

On 22 May 2003 it was reported that advanced computer simulation tools now being developed by NASA and university researchers may soon give scientists new insights into the complex and mysterious physics of earthquakes and enable vastly improved earthquake forecasting. Scientists at NASA's Jet Propulsion Laboratory, Pasadena, California, together with NASA's Goddard Space Flight Centre, Greenbelt, Maryland, Ames Research Centre, Mountain View, California, and several universities, are developing an advanced earthquake modelling system called QuakeSim. When completed in late 2004, QuakeSim's simulation tools will help scientists learn more about what makes earthquakes happen.

The tools are based upon the latest technologies. For example, one uses finite element analysis, which solves complex computer modelling problems by breaking them into small pieces. For QuakeSim, the finite elements are tens to hundreds of thousands of measurements of how Earth's crust deforms in response to movement of the giant tectonic plates Earth's landmasses ride upon. The measurements are gathered through both ground and space-based techniques. The latter include global positioning system and interferometric synthetic aperture radar (SAR), which measure the "quiet" (non-earthquake) motions associated with plate tectonics and the quake cycle.

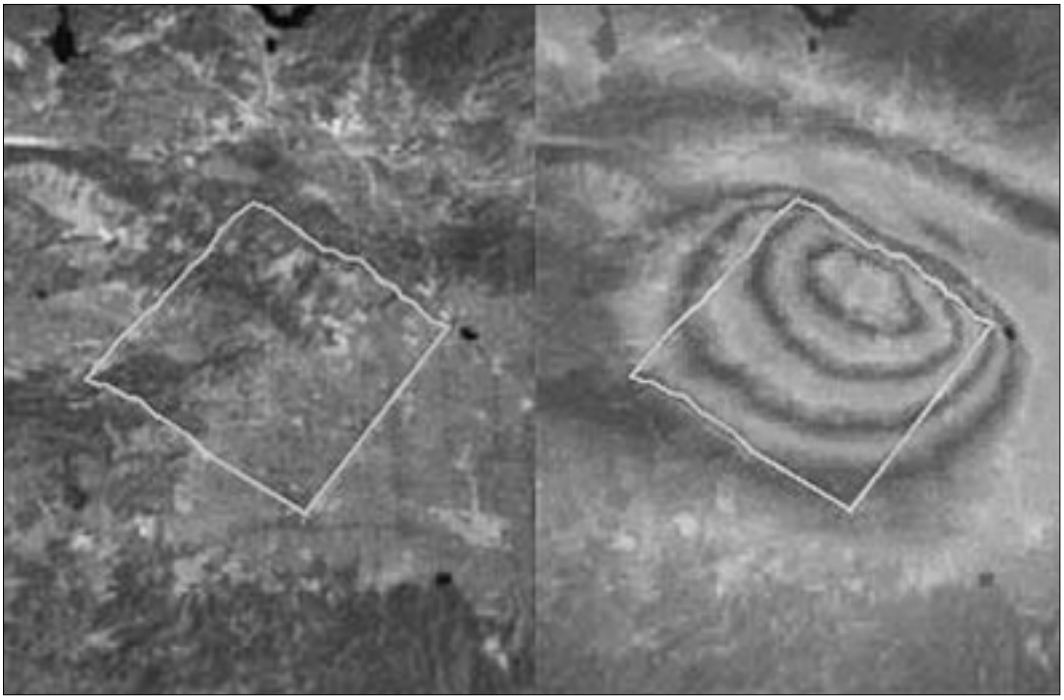
QuakeSim Principal Investigator Dr. Andrea Donnellan of JPL calls QuakeSim a vital step toward eventual earthquake forecasting: "The deformation of Earth's crust and the interaction between quake faults is a complex 3-D process happening on timescales of minutes to thousands of years. Studying it requires sophisticated simulation models and high-performance supercomputers. The availability of space-based data and our current limited understanding of quake processes make this an ideal time to develop a system for studying deformation processes such as tectonics, quakes and volcanoes. New quake models developed under QuakeSim are expected to yield future earthquake forecasts that will be used by a variety of federal and state agencies to develop decision support tools that will help mitigate losses from future large earthquakes."

QuakeSim's three major simulation tools are Park, Virtual California and the Geophysical Finite Element Simulation Tool (Geofest). Park simulates the evolution of a quake on a single, unstable fault over time. It is based upon current knowledge of the rate of movement (or "slip") and friction on a well-studied section of the San Andreas Fault in Parkfield, California, but is applicable to any fault or collection of faults. Park will be the tool of choice for researchers seeking to determine the nature and detectability of quake warning signals. It will determine how stress is distributed over a fault and how it is re-distributed by quakes or "quiet" seismic motion. It can also be used to compute the history of slip, slip speed and stress on a fault. Up to 1,024 computer processors will be used in parallel to demonstrate Park's capability.

Virtual California simulates how California's hundreds of independent fault segments interact and allows scientists to determine correlated patterns of activity that can be used to forecast seismic hazard, especially for quakes of magnitude 6 or greater. Patterns from the simulated data are compared to patterns in real data to strengthen understanding of the quake process. The approach's potential is already being demonstrated. Under a joint NASA / Department of Energy study lead by Dr. John Rundle, director of the Centre for Computational Science and Engineering at the University of California at Davis, Virtual California was used to identify regions of the state with elevated probabilities of quakes over the next decade. Since the study was completed in 2000, all of California's five largest quakes of magnitude 5 or greater have occurred within 11 km of these sites. The probability of this occurring randomly is about one in 100,000. The last three of these quakes occurred after the forecast map was published in the Proceedings of the National Academy of Sciences in February 2002.

Geofest creates 2-D and 3-D models of stress and strain in Earth's crust and upper mantle in a complex geologic region with many interacting fault systems. It shows how the ground will deform in response to a quake, how deformation changes over time following a quake, and the net effects to the ground from a series of quakes. The entire Southern California system of interacting faults will be analysed, covering a portion of the crust approximately 1,000 km on a side. The simulation will require millions of equations and hundreds of computer processors. In addition to JPL, the QuakeSim team includes the Davis and Irvine campuses of the University of California; Brown University, Providence, R.I.; Indiana University; and the University of Southern California. An independent review board provides oversight. Codes will be run on supercomputers at NASA's Goddard, Ames and JPL facilities and other institutions. The California Institute of Technology in Pasadena manages JPL for NASA.

NASA's Earth Science Enterprise is dedicated to understanding Earth as an integrated system and applying Earth system science to improve prediction of climate, weather and natural hazards using the unique vantage point of space. A primary goal of NASA's solid Earth science pro-



Simulation of deformation of the Earth's surface following the 1994 Northridge, California earthquake, generated by Geofest, one of the QuakeSim simulation tools under development. The Northridge fault is located within the white rectangle

gram is assessment and mitigation of natural hazards. QuakeSim supports the Enterprise's goal of developing predictive capabilities for quake hazards. This article is from a report at www.jpl.nasa.gov/releases/2003/74.cfm.

4.9 NASA, USDA cooperate on EO in agriculture

On 4 June 2003 it was reported that US Department of Agriculture (USDA) Secretary Ann M. Veneman and NASA Administrator Sean O'Keefe had launched a partnership that will use Earth Science technologies to enhance the competitiveness of American farmers and ranchers and help protect the environment. O'Keefe and Veneman signed a Memorandum of Understanding (MOU) that enables USDA to draw on the best scientific and technical information available from NASA research in Earth observation (EO) and systems engineering. The primary purpose of this new co-operative effort is to help increase the production efficiency of farmers while continuing to reduce the cost of production. EO technologies provide insights into climate and precipitation patterns, crop health, airborne particles, and water availability.

"Precision agriculture practices are helping farmers improve productivity while protecting our natural resources," said Secretary Veneman. "This partnership with NASA will make available remote sensing (RS) technologies that will advance precision agriculture." This joint endeavour also spawns information that contributes to inter-agency co-operation on climate change through the Climate Change Research Programme, to develop a scientific understanding of the Earth's response to natural or human-induced changes. Veneman said that such technology would also be highlighted at the Ministerial and Expo on Agricultural Science and Technology in Sacramento, California, on June 23-25. Ministers from over 180 countries will discuss and share science and technological innovation in agriculture at the conference.

"NASA is pleased to be part of this worthwhile effort, which will benefit all Americans," said Administrator O'Keefe. "NASA's unique ability to view the Earth from space enhances our ability to anticipate climate change, understand weather and natural hazards, as well as to mitigate and assess the effects of natural and human-induced disasters. The information we provide will allow our partners to make critical, accurate and timely decisions." An immediate outcome of the new partnership is a $1 million, three-year programme to establish Geospatial Extension Programmes at land grant universities. Geospatial Extension specialists work closely with NASA and USDA to address Earth Science applications and the RS needs of the agricultural community.

The MOU focuses on five areas: carbon sequestration for carbon management; environmental models for biological invasive species; water cycle science for water management; conservation weather and climate prediction research for agricultural competitiveness; regional, national, and international atmospheric predictions for air quality management. This article is from a report at www.spacedaily.com/news/farm-03f.html.

4.10 Ferry to monitor ocean colour in Irish Sea

European funding from the Welsh European Funding Office (WEFO) under the INTERREG IIIA programme has enabled the Centre for Applied Oceanography, part of the University of Wales, Bangor, and the National University of Ireland, Galway, to team up with Irish Ferries in order to carry out a water quality study in the Irish Sea. The project will be investigating the use of above-water radiometers deployed from ships of opportunity for the retrieval of water quality parameters from ocean colour information. The ultimate aim of this project is to improve current capabilities for the long term autonomous monitoring of water quality in the Irish Sea.

In September 2003, optical sensors measuring ocean colour from above the sea surface will be placed on the Irish Ferries' Ulysses, crossing between Holyhead and Dublin. Work is currently underway to establish

measurement protocols and develop water quality algorithms during sea trials of the RAMSES radiance and Irradiance sensors (TriOS Optical Sensors – www.trios.de) on board the University research vessels the Prince Madog and Celtic Voyager. The instruments will enable the detection of small changes in the colour of surface waters of the Irish Sea during twice daily crossings, which will provide an indication of water quality. Variations in ocean colour will provide valuable information on water clarity, sediment loading, frequency and magnitude of phytoplankton blooms (including nuisance algae). It is expected that the Irish Sea waters will appear browner and carry more sediment during the winter months, appear greener in spring as the plankton or algae in the water blooms and will clear during the summer months to give a deep blue colour. The detectors will also pick up any immediate changes due to pollutants such as oil.

The information from the sensors on board the ferry will provide a unique, continuous and potentially long term record of the water quality of the central Irish Sea, which would not be possible through current monitoring techniques. Such a record would be invaluable for marine environmental monitoring and protection of the region. The specific project objectives are: to calibrate measurements from autonomous optical instruments against water quality parameters (including algal blooms, sediment loading and water clarity) at sea from research vessels; to install and commission the optical instruments on the Irish Ferry, Ulysses, which crosses the Irish Sea between Holyhead and Dublin on a daily basis; to acquire a long time series of ocean colour data and, therefore, water quality parameters, between Holyhead and Dublin from these instruments; to ascertain the feasibility of using these methods for long term water quality monitoring in Irish Sea waters. This article is from a report at www.cao.bangor.ac.uk/research/ulysses/ferry.htm.

4.11 Satellites spot "black water" off Florida

On 17 April 2003 it was reported that a research study, funded by NASA, the US Environmental Protection Agency and the National Oceanic and Atmospheric Administration (NOAA), has revealed that a patch of "black water", almost 100 kilometres in diameter had formed off southwestern Florida in early 2002, and contributed to severe coral reef stress and death in the Florida Keys. The "black water" contained a high abundance of toxic and non-toxic microscopic plants.

Chuanmin Hu and other colleagues at the Institute for Marine Remote Sensing of the University of South Florida (USF), St. Petersburg, Florida, and colleagues from the Florida Fish and Wildlife Conservation Commission (FFWCC) and the University of Georgia, co-authored an article on this phenomenon that appeared as the cover story of a recent issue of the American Geophysical Union's Geophysical Research Letters. "The water appeared black in satellite imagery because the concentrations of microscopic plants and other dissolved matters were high," Hu said. Because plants and dissolved matter absorb sunlight, they reduce the amount of light normally reflected from the ocean. When a red-tide bloom occurs the water takes on various hues of red or brown. While not all microscopic plants contribute to red tides, the darker hue created by both the plankton and the harmful algal blooms made the water appear black when seen from the satellite.

When Hu and his colleagues examined the data collected by divers from the dark water area in the Florida Keys, they discovered a 70% decrease in stony coral cover, a 40% reduction of coral species, and a near-elimination of sponge colonies at two reef sites after the dark water passed. By examining satellite images and field survey data, the authors concluded that the coral reef ecosystem was stressed by microscopic organisms and toxins contained in the dark water.

The "black water" event caused alarm among local fishermen, divers, and the public, as the colour of the water was unusual and fish seemed to avoid this large area of dark water. Satellite instruments such as the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) on Orbimage's

SeaStar satellite and the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra and Aqua satellites, provide information on ocean colour that allows scientists to monitor the health of the water and the shallow "benthic" (ocean bottom) environment. The SeaWiFS and MODIS measurements of the dark water led to a number of investigations to help clarify the issues and to provide answers to the public's concerns. During January 2002, SeaWiFS detected the dark-coloured water in the Florida Bight, just southwest of the Everglades. In fall 2001, the SeaWiFS images showed an extensive red tide off Florida's central west coast, near Charlotte Harbor. Red tides occur every year off Florida and are known to cause fish kills, coral stress and mortality, and skin and respiratory problems in humans. They are caused by high concentration of microscopic plants called dino-flagellates. Other micro-organisms called cyano-bacteria can also cause harmful algal blooms. The waters containing this red tide migrated to the south along the coast.

Winter storms caused large amounts of fresh water to drain from the Everglades into Florida Bight (the curve in the shoreline from the Keys north to Everglades National Park on the mainland), carrying high levels of nutrients such as silicate, phosphorus, and nitrogen to the sea. These caused a bloom of the microscopic marine plants known as diatoms in the same patch. The bloom turned the water dark and the "black water" patch re-circulated for several months in a slow clockwise motion off southwest Florida in the Florida Bight. Slowly, the dark water drifted farther south and toward the Florida Keys. By May 2002, the "black water" had moved through passages in the Florida Keys, dispersing into the Atlantic and the Gulf Stream. This article is from a report at www.gsfc.nasa.gov/topstory/2003/0423blackwater.html.

4.12 Future space missions to be "entangled"?

Albert Einstein might be astonished to learn that NASA physicists have applied his relativity theory to a concept he introduced but later disliked, namely that two particles that interact could maintain a connection even if separated by a vast distance. Researchers often refer to this connection as "entanglement." On 2 April 2003 it was reported that researchers at NASA's Jet Propulsion Laboratory, Pasadena, California, have discovered that this entanglement is relative, depending on how fast an observer moves with respect to the particles, and that entanglement can be created or destroyed just by relative motion. This might change the way entanglement is used on future spacecraft that move with respect to Earth or each other. "Imagine a particle on Earth entangled with a particle light years away," said Dr. Christoph Adami, principal scientist in the Quantum Computing Technologies Group at JPL. "Whatever happens to particle A on Earth happens to particle B, even if it is on another planet. Einstein referred to this connection as 'spooky'."

Einstein thought this connection violated the relativity rule that information can't travel faster than the speed of light. Adami and Dr. Robert Gingrich, also of JPL, are the first to apply Einstein's relativity theory to quantum entanglement between particles. They compared the amount of entanglement when the particles were at rest to when they were given a boost. Their findings show that while speeding up ordinary entangled pairs would lead to a loss of the precious entanglement, certain special pairs can be created whose entanglement is increased instead. This increases the connection between them. Understanding how some of the characteristics of a

Artist's concept of "entanglement"

particle can become entangled through relative motion alone, when they seemed to be unentangled when at rest, could have many applications. For example, entangled particles could be used to synchronise atomic clocks, which are essential for navigating spacecraft in deep space.

"One of the amazing things about entanglement is that it connects objects over arbitrary distances, so that in principle the two clocks could be started and stopped simply by acting on only one of them," said Adami. "However, no workable protocol has been found to date to achieve that." Because the creation of entanglement in the laboratory is usually a delicate matter, discovering new ways to create entanglement is always a goal of the quantum technology community. "If you can create entanglement just by moving with respect to what you're measuring, then seemingly you've created something from nothing," said Gingrich.

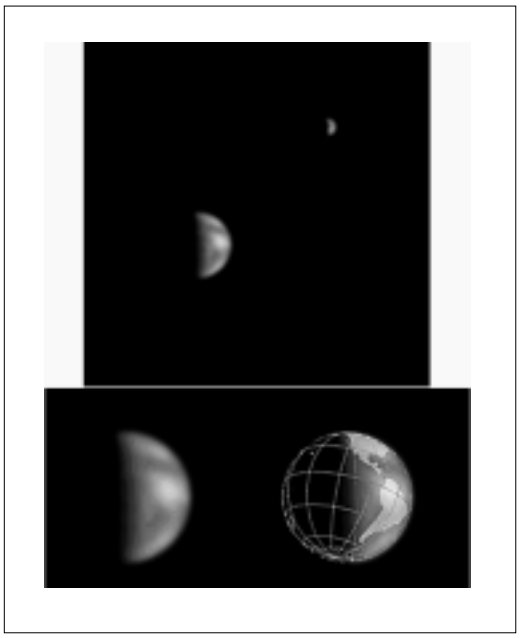
Another possible application of entanglement is quantum teleportation: the ability to transfer the precise quantum state of one microscopic object to another, while using only traditional communications, such as a phone line. This technique, which has been demonstrated experimentally, requires that the sender and receiver share pairs of entangled particles. But until now nobody knew what would happen to these pairs if the sender and receiver move with respect to each other, or if an observer moves with respect to them. This new theory gives researchers a whole new outlook on what happens to particle pairs when you apply the relativity theory. The research also has ramifications for ongoing work in the area of quantum computation, which seeks to use the subtle effects of quantum mechanics to build faster and more efficient computers. "Whenever new ground is treaded by theory, new applications are sure to follow." said Adami.

Gingrich and Adami's findings appeared in a paper they co-authored titled, "Quantum Entanglement of Moving Bodies," which appeared in the December 2002 issue of the journal Physical Review Letters. The Quantum Computing Technologies Group at JPL investigates the design and capabilities of hypothetical computing and measurement devices that use delicate quantum effects for enhanced power and accuracy for future space missions. This article is from a report at www.jpl.nasa.gov/releases/2003/47.cfm.

4.13 Remote sensing of Earth from Mars!

Have you ever wondered what you would see if you were on Mars looking at Earth through a small telescope? Now you can find out, thanks to a unique view of our world recently captured by NASA's Mars Global Surveyor spacecraft currently orbiting the red planet. This first-ever image of its kind not only shows Mother Earth as a tiny alien world in the vast darkness of space, but also includes a view of the giant planet Jupiter and some of its larger moons. The camera aboard Mars Global Surveyor photographed both planets in an alignment, as seen in the evening sky of Mars, at 06.00 hours Pacific Time (15.00 hours CET), on 8 May 2003.

"From our Mars orbital-camera perspective, we've spent the last six-and-a-half



Top: Earth and the Moon (in background), seen from Mars. (Image taken by NASA's Mars Global Surveyor). Bottom: Globe diagram illustrates the Earth's orientation as viewed from Mars (North and South America were in view)

years staring at Mars right in front of us," said Dr. Michael Malin, president and chief scientist of Malin Space Science Systems, of San Diego, who operates the camera aboard Mars Global Surveyor. "Taking this picture allowed us to look up from that work of exploring Mars and take in a more panoramic view. This image gives us a new perspective on that neighborhood, one in which we can see our own planet as one among many."

The image of Earth (see accompanying graphic) actually shows our home as a planetary disc, in a "half-Earth" phase. The image has been specially processed to allow both Earth and the much darker Moon to be visible together. The bright area at the top of the image of Earth is cloud cover over central and eastern North America. Below that, a darker area includes Central America and the Gulf of Mexico. The bright feature near the centre-right of the crescent Earth consists of clouds over northern South America. The image also shows the Earth-facing hemisphere of the Moon, since the Moon was on the far side of Earth as viewed from Mars. The slightly lighter tone of the lower portion of the image of the Moon results from the large and conspicuous ray system associated with the crater Tycho. The image also shows Jupiter and three of its four Galilean moons: Callisto, Ganymede, and Europa. At the time, Jupiter's giant red spot had rotated out of view, and the other so-called Galilean satellite, Io, was behind Jupiter as seen from Mars. This image has been specially processed to show both Jupiter and its satellites, since Jupiter was much brighter than the three satellites.

Mars Global Surveyor, one of the most successful missions to Mars ever undertaken, has been orbiting the red planet since September 1997. The mission has examined the entire Martian surface and provided a wealth of information, including some stunning high-resolution imagery, about the planet's atmosphere and interior. Evaluation of landing sites for NASA's two Mars Exploration Rover missions and the British Beagle 2 lander mission has relied heavily on mineral mapping, detailed imagery and topographic measurements by Mars Global Surveyor. NASA's Mars Exploration Rovers, and ESA's Mars Express mission, carrying the Beagle 2 mission, are due to launch this Summer and arrive at Mars in late December 2003 and January 2004. More information about Mars Global Surveyor is available at mars.jpl.nasa.gov/mgs. This article is from a report at www.jpl.nasa.gov/releases/2003/75.cfm.

4.14 US & European landers heading for Mars

On 10 June 2003, NASA successfully launched the first of two rovers to explore the surface of Mars. A Delta II rocket carrying the Spirit vehicle left the Cape Canaveral Air Force Station in Florida. Spirit is identical to the Opportunity rover which will follow it into space, probably on the 25 June. The American Mars Exploration Rover (MER) missions follow quickly behind that of Europe's Mars Express / Beagle 2 expedition to the Red Planet, which left the Russian cosmodrome in Baikonur, Kazakhstan on 5 June 2003. Over the next few months Mars and Earth will be closer than at any time in recorded history, cutting the journey to less than seven months.

The US rovers are going to Mars to study its geology, seeking chemical signatures that would confirm that abundant water once existed on the planet's surface. "The instrumentation on board these rovers, combined with their great mobility, will offer a totally new view of Mars, including a microscopic view inside rocks for the first time," said Ed Weiler, NASA headquarters associate administrator for space science.

Spirit is due to arrive on the Red Planet in the New Year, a few days after the British-built Beagle 2, a tiny space lander the size of a barbecue. It will be joined by the sec-

A scene from Mars in December 2003 / January 2004?

ond NASA rover at the end of January 2004. If all goes well, the rovers will head for two places that appear to have once been flooded by water. Like Beagle 2, NASA's rovers will bounce to airbag-cushioned landings at sites offering a balance of favourable conditions for safe landings and interesting science.

5 REVIEWS, PUBLICATIONS & REPORTS

5.1 Review: Satellites - Orbites et Missions

Michel Capderou. 2003. Satellites: Orbites et Missions. (In French). Springer-Verlag, Heidelberg & Paris. 486 p. ISBN 2-287-59772-7. EUR 35.80.

Reviewed by Dr. Lucien Wald, Ecole des Mines de Paris, Sophia Antipolis, France

This book describes the physical laws driving the orbit of a satellite and shows why an orbit was selected for a given mission. It includes eleven chapters and a CD-ROM. The eleven chapters are divided into four parts. The first part (chapters 1-3) deals with the fundamentals in celestial mechanics, and describes the forces acting on a satellite, including the perturbations by other planets. The equations are well-known and have been published many times. This part forms the basis for a better understanding of the following. The problem is treated in great details with many equations. The author paid great attention to recall all the necessary mathematical fundamentals in this work, so that the content is self-describing: there is no need to consult a maths book to follow the reasoning and the solutions. In these chapters as well as the others, there are several examples to illustrate the content. The author is also fond of astronomers of ancient times, as well as the Greek language. There are plenty of notes that divert the reader from the aridity of equations, though others think that equations are beautiful, expressing in a concentrated form the beauty of the universe.

The second part is original (chapters 4-7). It presents tools that were developed for a better presentation of orbits for inexperienced readers. The author defines a few parameters that are then used to describe the orbits of several space missions. Chapter 4 provides equations about the apparent movement of the Sun, a problem that often appears in remote sensing (RS) – e.g. when computing the zenith angle for computing reflectances. This chapter describes the case of geo-stationary satellites with numerous examples, including Meteosat and the computation of the movement of Meteosat-5 from 10° W to 63° E over the Indian Ocean. This chapter goes on with helio-synchronism and discusses the drift of a satellite and the means to counter it. Chapter 5 deals with orbit and traces of satellite, a point on which practitioners in RS are highly sensitive. After the equations, a wealth of examples is given that illustrates the use of these equations. An important portion (47 pages) is devoted to the description of many missions classified by type: geophysics, Earth observation (EO), oceanography, navigation, communications, astronomy, fundamental physics, technology, military missions and habited missions. There is a wealth of very interesting details about the missions and I found some in EO I was unaware of. There is some confusion in the referencing of the figures. Chapter 6 focuses on the helio-synchronous satellites. It shows the necessary trade-off between the mission objectives, the satellite properties and its payload. Chapter 7 deals with the phasing which characterises the coverage of a geographical area. Several cases are studied: SPOT, MetOp, IRS, TOPEX. This part clearly shows why an orbit was selected for a given mission and can be understood without plunging into the mathematics.

Part 3 (chapters 8-9) focuses on EO satellites and considers what is "seen" by the payload. Chapter 8 discusses the swath of the instrument, the deformation of the pixel

size due to the viewing angle and Earth curvature for several types of orbit. Chapter 9 deals with the temporal and angular sampling rates of the instrument. Part 4 describes satellites around the planet Mars (Chapter 10) and satellites (artificial or not) around another planet (Chapter 11). These are generalisations of the first chapters.

This book offers a deep understanding of the problems that are posed by the precise determination of orbits of satellites. The complexity of the subject is attenuated by a wealth of examples, tables and figures that are very helpful and finally make the book very readable to many. The equations have been coded into software that is available on a CD-ROM. Thus, the reader may compute some orbits very easily. The CD-ROM contains also a large number of maps of orbits for many space missions. I have appreciated the numerous notes in the book that either recall historical facts or add interesting details. This book is definitely one to have in the library for students or researchers. Its cost (35.97 Euro) is fairly low for such a high quality book.

5.2 European Forest Information System (EFIS)

A demonstrator CD of a prototype European Forest Information System (EFIS) has just been released by the Institute for Environment and Sustainability (IES) of the European Commission's Joint Research Centre in Ispra, Italy. EFIS is a fully operational prototype of a reliable forest information system, which directly contributes to EEC Regulation No. 1615/89, established to set up a European Forest Information and Communication System (EFICS) to address the need for sound forestry information at the European level (web-site: europa.eu.int/scadplus/leg/en/lvb/l28054.htm). EFIS is a simple but effective system, providing a comprehensive catalogue of meta-data standards and a visual toolkit for the compilation, processing, analysis and dissemination of available forestry information, from a variety of sources at international, national and regional levels. The challenge for EFIS lies within the creation of an information system that allows flexible analysis options addressing diverse user needs, access restrictions and rights, and adequate technological possibilities of presentation.

The EFIS project was awarded by the EURO-Landscape project (web-site: eurolandscape.jrc.it) of JRC-IES's Land Management Unit, to a consortium made up of the following partners: European Forest Institute; Fraunhofer Institut für Autonome Intelligente Systeme; Dresden University of Technology - Forest Biometrics and Computer Sciences; UNEP - World Conservation Monitoring Centre. For further information, and to obtain a free copy of the EFIS prototype, contact: Dr. Sten Folving, Land Management Unit, JRC-IES, European Commission, I-21020 Ispra (VA), Italy (phone / fax: +39-0332-785009 / 789469; e-mail: sten.folving@jrc.it).

5.3 Applied-GIS-RS list: summary table updated

Alexandre Leroux (Ing. Stag., MSc), MIR Télédétection Inc (www.mirteledetection.com)

The remote sensing summary table on the Applied Remote Sensing and GIS web-site (www.matox.com/agisrs/arsist) is now greatly improved. I consider it usable and not preliminary anymore. It has shrunk to half the original size. Many previously anticipated satellites never found their way to the stars. It's usable now, but there is vast room for improvement. Amongst welcomed additions are more pertinent links (e.g. free data repositories). Two pdf formats are now available: 1 and 4 8x11 pages. Eventually, large coverage sensors and airborne sensors might be incorporated in the table. Thanks for all the AGISRS members that contributed or will contribute. Of course, I did this list primarily for myself and because it was fun, but it's available to all, and helping improve this list will help our entire community. Do not hesitate to send any feedback (to arsist@matox.com)! Take a look at the revamped list. If you like it or believe it can be useful, share the link with your friends!

6 FORTHCOMING MEETINGS AND COURSES

6.1 Land use / cover change conference, Turkey

Dr.Garik Gutman, NASA, USA & Prof.Dr. Derya Maktav, ITU, Turkey

You are cordially invited to join the International Colloquium Series on Land Use / Cover Change Science and Applications, at its conference "Studying Land Use Effects in Coastal Zones with Remote Sensing and GIS", on 13-16 August 2003 in Antalya / Kemer, Turkey.

The NASA Land Cover Land Use Change (LCLUC) Programme and the Land Use / Cover Change Project (LUCC) of the International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme (IHDP), announce the start of the new annual international colloquium series on the issues of changes in global land cover and land use, with the emphasis on RS capabilities and interactions between humans and ecosystems. The colloquium series will cover various topics, including deforestation in tropical regions, boreal zone processes, land cover and land use in mountainous regions, land cover / land use and water resources in arid regions, and forest fires. The first conference of this series is devoted to the issues of changes in coastal zones, related to land use. The topics of future conferences will be announced later.

The coastal zone is the interface between land and water bodies, where interactions between various natural processes and human activity are most active. This area is subject to considerable natural variability, and growing socio-economic pressures pose a major challenge for proper management of natural resources. Satellites offer an important but as of yet under-utilised set of tools to manage the transition towards sustainable coastal zone uses.

This international conference aims at linking people, pixels, and ecosystems. It focuses specifically on the application of RS and advanced information technologies such as GIS to the social and physical studies of the coastal zone. As examples, the conference will examine: (a) satellite and airborne imagery combined with social science surveys and published census data for coastal land use monitoring and planning, and (b) anthropogenic effects caused by human populations and land use change on water quality and biological resources in lakes, rivers, estuaries, and other coastal zones, including wetland ecosystems.

6.2 TIWRS 2003 on Elba Island, Italy

The "Tyrrhenian International Workshop on Remote Sensing", which will be held on 15-18 September 2003 on Elba Island, Italy, and organised by the Italian National Consortium for Telecommunications (CNIT) will focus on recent advanced techniques and models for new applications in the field of RS. The single-track workshop programme will be structured in technical sessions organised by leading researchers in the field of RS, which will accommodate invited and regular papers selected on an open-call basis. The list of topics to be covered by the workshop includes: electromagnetic modelling in SAR imagery; sea RS; fractals in RS; urban RS; multi-temporal data analysis; multi-spectral data analysis; multi-dimensional array processing; data fusion; SAR interferometry; sub-surface RS; atmospheric RS; vegetation RS. For more information, contact m.martorella@iet.unipi.it or e.dallemese@iet.unipi.it.

6.3 From OEEPE to EuroSDR: Seminar of Honour

The 50th Anniversary Seminar of Honour, "From OEEPE to EuroSDR – 50 Years of European Spatial Data Research and Beyond", will be held at Bayerisches Landesvermessungsamt / Bavarian State Mapping Agency (BLVA), Alexandrastrasse 4, Munich, Germany, on 16 October 2003. The Seminar will focus on the transition from OEEPE to EuroSDR, reviewing 50 years of spatial data research, but mainly looking into its future in terms of what spatial in-

formation is needed in the framework of the European Information Society, and what type of technology is required to provide it. As space in the Seminar room is limited, we appreciate that anyone interested should register with BLVA by e-mail (barbara.klumpp@blva.bayern.de) before 15 September 2003. The Seminar Proceedings will be published in the Official EuroSDR publication series.

6.4 Advances in RS techniques workshop, USA

The IEEE Workshop "Advances in Techniques for Analysis of Remotely Sensed Data" will be held at NASA Goddard Visitor Centre, Washington DC, USA, on 27-28 October 2003. The aim of the workshop is to celebrate the work of Prof. David A. Landgrebe, to create an open forum for critical evaluation of the evolution of methodological approaches over the past decades, and to discuss fruitful directions for future work through lively interaction. Two distinguished speakers, Prof. David A. Landgrebe and Prof. John A. Richards, have been invited to address both the progress of RS data analysis during recent years and provide perspective on the most critical needs for future methodological advances. Major emphasis will be given to open discussions at the workshop. The workshop programme will include invited lectures and papers accepted for oral presentation. Accepted papers will appear in the workshop proceedings.

The list of topics at the workshop includes: statistical parameter estimation; small sample size problems; feature extraction and selection; multispectral image classification; non-gaussian classification problems; contextual classification; multitemporal image classification; multisource classification; hyperspectral data analysis; RS system modelling; multi-classifier systems. More information will soon be available at the workshop web-site: ewh.ieee.org/soc/ grss

6.5 Microrad 2004, Rome, Italy

The 8th Specialist Meeting on Microwave Radiometry and Remote Sensing Applications will be held at the University "La Sapienza" in Rome, Italy, on 24-27 February 2004. This meeting is the last of a series focusing on Microwave Radiometry and RS of the Environment. The very first one dates back to March 1983, when it was organised and supported by the University "La Sapienza" of Rome, Italy. Since then, several other meetings were held alternately in the USA and Italy. The 2004 Edition of the Meeting will be supported, among others, by IEEE and URSI. Hosted by the Faculty of Engineering of the University "La Sapienza" of Rome, it will be organised by the Department of Electronic Engineering. It is an open invitation to convene again in Rome, twenty years after the previous opportunity.

The objective is to set up a common forum to report and discuss recent advances in the specific field of microwave radiometry, thus gathering all parties belonging to the research and industrial community, active in projects and studies in microwave radiometry of land, ocean and atmosphere. Contributions on topics of primary interest are expected. These include: ground-based RS of the atmosphere and ocean; satellite- and aircraft-based RS of the atmosphere, ocean, land surface and vegetation; radiometric polarimetry, interferometry, imaging radiometer calibration; advanced instrument techniques; special campaigns and field experiments; modelling of scattering, emission and radiative transfer; present and future space missions / instruments; integration with data from radar or other sensors. Detailed information is available from the meeting web-site: www.microrad04.org. Abstract submission deadline: 30 September 2003. Pre-registration deadline: 15 January, 2004.

6.6 Calendar of forthcoming meetings

16-18 July 2003
Ispra, Italy
MultiTemp-2003: Second International Workshop on the Analysis of Multi-Temporal Remote Sensing Images
Contact: multitemp-2003@jrc.it. Web: www.multitemp.org

21-25 July 2003
Cambridge, UK
Cambridge Conference for National Mapping Organisations
Contact: cambridge2003@ordsvy.gov.uk. Web: www.ordnancesurvey.co.uk/cambridge

21-25 July 2003
Toulouse, France
IEEE / IGARSS (International Geoscience and Remote Sensing Symposium) 2003: "Learning from Earth's Shapes and Colours"
Web: www.igarss03.com

13-16 August 2003
Antalya / Kemer, Turkey
International Colloquium Series on Land Use / Cover Change Science and Applications: "Studying Land Use Effects in Coastal Zones with Remote Sensing & GIS"
Contact: Prof. Derya Maktav (dmaktav@ins.itu.edu.tr), Istanbul Technical University (ITU), Turkey.
Web: www.ins.itu.edu.tr/rslucoast1/invitation.htm

10-12 September 2003
Nottingham, UK
RSPSoc Annual Conference: "Scales and Dynamics in Observing the Environment"
Contact: Dr. Paul Aplin (paul.aplin@nottingham.ac.uk).

15-18 Sept. 2003
Elba Island, Italy
TIWRS (Tyrrhenian International Workshop on Remote Sensing) 2003
Organised by: Italian Consortium for Telecommunications (CNIT).
Web: www.incordgmp.it/TIWRS2003

21-28 Sept. 2003
Quebec, Canada
XII World Forestry Congress: Forests, Source of Life
Contact: sec-gen@wfc2003.org. Web: www.wfc2003.org

30 Sept. – 4 October 2003
Antalya, Turkey
XIX Symposium CIPA: New Perspectives to Save the Cultural Heritage
Prof. Dr. M. Orhan Altan, Symposium Director
Information: www.cipa2003-antalya.org

NEW
16 Oct. 2003
Munich, Germany
50th Anniversary Seminar of Honour: From OEEPE to EuroSDR – 50 Years of European Spatial Data Research & Beyond
Contact: barbara.klumpp@blva.bayern.de

NEW
27-28 Oct. 2003
Washington DC, USA
IEEE Workshop: Advances in Techniques for Analysis of Remotely Sensed Data
Web: ewh.ieee.org/soc/grss

29-31 Oct. 2003
Bucharest, Romania
International Scientific Conference: Scientific Research for Sustainable Forest Management
Organised by: Forest Research and Management Institute (ICAS), Bucharest, Romania
Contact: Claudia Morar, ICAS, Bucharest. Phone / fax: +4021-2406845. E-mail: claudia@tma.ro. Web: www.icas.ro

NEW
24-27 Feb. 2004
Rome, Italy
Microrad 2004: 8th Specialist Meeting on Microwave Radiometry and Remote Sensing Applications
Web: www.microrad04.org

NEW
12-23 July 2004
Istanbul, Turkey
20th ISPRS Congress: Geo-Imagery – Bridging Continents
Web: www.isprs2004-istanbul.com