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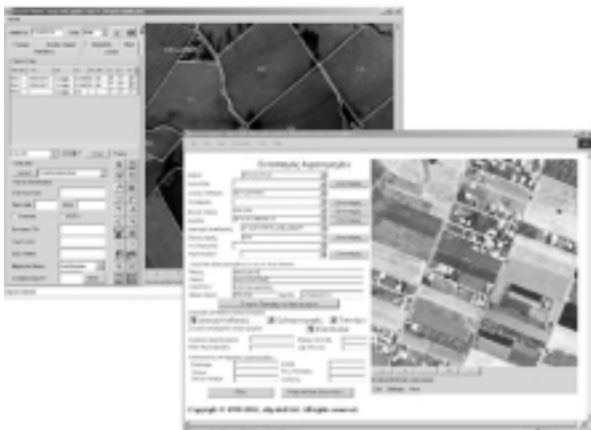
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1 EDITORIAL

One way in which EARSeL fulfils its role as a scientific network to stimulate and promote remote sensing (RS) research and applications, is by providing a forum for the exchange of information on the main current RS activities and "actors" in the different countries. To this end, this month's issue of the EARSeL Newsletter includes, as is customary, the reports by national representatives on RS activities in their countries during the previous year, as presented at the January meeting of the EARSeL Bureau and Council, at the European Space Agency (ESA) headquarters in Paris. This year there are reports from twelve European countries, and also from Canada, which participates in the EU's Research Framework Programmes under the 1995 Canada-EU Agreement on Scientific and Technological Cooperation. By the way, those national reports which did not arrive in time for this issue – e.g. Denmark and Hungary – will be published in the June Newsletter.

The past year has brought mixed fortunes for the international space programme and the RS community. Following the dramatic failure of Europe's Ariane 5 launcher in late 2002 (reported in the December Newsletter), 2003 has seen the tragic loss of the Space Shuttle Columbia and her crew of seven. This Newsletter carries a report (Section 3.1.1) on the implications of the disaster for the International Space Station, and on ESA's scientific and technical input into the ill-fated mission. Not all of the space news is depressing: this Newsletter reports on some notable successes, such as the final mission of Europe's prolific Ariane 4 launcher, and ESA's Artemis (telecommunications) and Envisat (environmental monitoring) satellites.

This Newsletter also features a timely and thought-provoking article by Prof. Håkan Olsson, of the Swedish University of Agricultural Science's Remote Sensing Laboratory (an EARSeL Member Laboratory) highlighting the not-so-favourable outlook for operational land cover (notably forestry) applications of RS. These have traditionally relied on medium-resolution (5-30 metre pixels), wide-area satellite images

such as those from Landsat TM and SPOT. Prof. Olsson points out that it is by no means certain that there will be successors to Landsat and SPOT, capable of ensuring a continued, regular supply of medium-resolution image data.

This is the type of issue which needs to be addressed at the highest echelons by Europe's space policy-makers, and the recent Green Paper on European Space Policy, prepared by the European Commission (EC) in co-operation with ESA, is an encouraging development in this regard. As reported in this Newsletter (Section 3.2.2), the new Green Paper on Space is the first step in a consultation process, which will run until 30 May 2003, on how best to integrate space into European policy. Various consultation events, including a dedicated on-line forum, are taking place. Based on these, a draft White Paper (or Action Plan) will be published by the EC later in the year.

A major element of Europe's future space policy is the Global Monitoring for Environment and Security (GMES) initiative. This Newsletter includes a report by Keith McCloy of the Danish Institute of Agricultural Sciences (also an EARSeL Member Laboratory) on the second of the four planned GMES Forum conferences, which was held in Noordwijk, Holland, on 14-16 January 2003.

With regard to the main global event at the time of writing - the war in Iraq - there is perhaps a small crumb of comfort to be taken from the fact that "civilian" satellites may make a positive contribution (as opposed to the destructive purpose of military satellites), as part of an environmental assessment study recently initiated by the Post Conflict Assessment Unit (PCAU) of UNEP / United Nations Environment Programme (www.unep.org <<http://www.unep.org/>>). One can only imagine what impression these "intelligent" Earth-observing satellites might have of their human creators, as they observe the mayhem and chaos taking place below.

The Editor

2 NEWS FROM THE ASSOCIATION AND ITS MEMBERS

2.1 EARSeL Annual Symposium 2003 (Ghent): news

Preparations are now in full swing for the annual EARSeL meeting – the 23rd EARSeL Symposium, Workshops and General Assembly – which will take place at the Het Pand Conference Centre, which is linked to the University of Ghent, and which is in the heart of the historic centre of Ghent at no. 1 Onderbergen, just behind St. Michiels Church and near the Korenmarkt Square. A former Dominican monastery, the oldest parts of which date from the 13th century, the Het Pand has been completely restored and offers a wide range of possibilities for scientific and cultural events. A large number of abstracts have been received for the symposium and the workshops. The papers have been organised in well-focussed sessions. The preliminary programme can be found on the EARSeL web pages (www.earsel.org).

The Workshop on Coastal Zones has attracted a large number of papers, and it has been no easy task for the Scientific Committee to fit in all the quality papers that have been received. The formula of the Forest Fires Workshop, with invited overview papers and many contributed posters, has once again proved very popular. A selection of the best papers will form a special issue of the journal "Remote Sensing of the Environment".

The social events include a welcome reception at the historic Town Hall, and another reception to mark the opening of the SPOT Art exhibition that the EARSeL organisers have brought to Ghent, and that will remain open for the duration of the Ghent Summer Festival. The symposium and workshop dinners will be held in restaurants steeped in history and renowned for their good food and wine. So we are looking forward to some stimulating science and enjoyable social occasions that are conducive to fruitful contacts and exchanges.

2.2 EARSeL Bureau and Council meetings (Paris): report

The EARSeL Bureau and Council held their regular January meetings on 16-17 January 2003 at the European Space Agency in Paris. Countries represented included Austria, Belgium, Canada, Croatia, Czech Republic, Finland, France, Germany, Hungary, Italy, The Netherlands, Spain, Switzerland and the UK. Mr. Ulf Almroth of the Swedish Society for Photogrammetry and Remote Sensing and Mr. Ian Downey of the Remote Sensing and Photogrammetry Society in the UK, also participated. Dr. Jean-Pierre Mas-sué, representing the Council of Europe, was also present at the Council meeting.

At these January meetings national representatives are invited to present a short report on the remote sensing programmes and activities in their country in the past year and plans for the future. These reports are published below. The activities of the EARSeL Special Interest Groups (SIGs) were also reviewed and plans for workshops drawn up. A new convenor for the SIG on Forestry has been nominated in the person of Professor Hakån Olsson of the Swedish School of Agricultural Sciences in Umeå, Sweden. He will be assisted by Prof. Jouni Pullianen from Helsinki, Finland, and Prof. Werner Schneider from Vienna, Austria. A Workshop about the laser scanning of forests is to be held in Umeå from 2-4 September 2003. The new convenor of the Land Use SIG is Dr. Matthias Braun of the Remote Sensing Centre in Bonn. He is organising the first workshop of the group to be held on 28-29 May 2004 in Dubrovnik following the annual symposium.

Speaking of which, EARSeL has been invited by its Croatian members to hold its 2004 General Assembly and Symposium in Dubrovnik. This medieval, walled city on the Adriatic in the far south of Croatia is a UNESCO cultural heritage centre. The venue is the Inter University Centre, offering all modern equipment for scientific and cultural events. A presentation will be made at the General Assembly in Ghent, and a Call for Papers distributed. The Pro-

ceedings of the 2002 symposium in Prague have now been printed and distributed to participants and all paid-up EARSeL member laboratories. Readers wishing to obtain these Proceedings should contact the Secretariat.

2.3 News from the Special Interest Groups

EARSeL SIG – 3D Remote Sensing:

This group will organise a session during the EARSeL symposium in Ghent, chaired by Dr. Karsten Jacobsen, and will have a joint workshop on "High Resolution Mapping from Space 2003", together with the ISPRS WGs 1/5 and IC WG II/IV and the OEEPE (now to be called EuroSDR), in Hanover from 6-8 October 2003.

EARSeL SIG – Coastal Zones:

It has been necessary to extend the duration of the workshop to be held in Ghent by one day in view of the number of papers received. The group will no doubt organise a session in Dubrovnik and the next full workshop will most likely be held in 2005.

EARSeL SIG – Data Fusion:

This group has discontinued the series of workshops held every two years in January or February, but the group continues to participate in joint meetings with other organisations, including the ISPRS WGs and the series of workshops on remote sensing over urban areas.

EARSeL SIG – Developing Countries:

All papers presented at the Bonn Workshop in September have been received and the CD is in preparation and will be distributed by the time this Newsletter is distributed. These papers will be put on the EARSeL web-site during the next six months. This will also answer the call from many developing countries to have better access to the literature. It was agreed that the best papers presented at the Bonn meeting and the former meeting held in Ghent should be reviewed for presentation on a CD-ROM in the EARSeL e-Proceedings series. In order to facilitate the participation of researchers from developing countries, the next workshop will be organised in the National Research Centre in Cairo, Egypt, in March

2004 with a field excursion to the region NE of Cairo where many environmental problems can be studied.

EARSeL SIG – Forest Fires:

The structure of the workshop planned to be held in parallel with the CZ workshop is that of having a high quality review paper at the beginning of each session and the contributed papers are then presented as posters with ample time in the programme for discussion of these. A selection of the best papers presented will be published in a special issue of the journal 'Remote Sensing of the Environment'.

EARSeL SIG – Forestry:

Prof. Hakån Olsson is the new convenor of this group. He is organising two Workshops on the laser scanning of forests "Scand-Laser" to be held in Umeå, Sweden, 2-4 September 2003. More information can be found at: www-conference.slu.se/scanlaser.

EARSeL SIG – Geological Applications:

This group aims to organise a meeting associated with the Dubrovnik symposium.

EARSeL SIG – Imaging Spectroscopy:

A session chaired by Andreas Müller of DLR will be held in Ghent and the 3rd Workshop organised by this group will be held in Oberpfaffenhofen, near Munich, Germany, from 13-16 May 2003 where some 120 participants are expected. Contributions addressing European airborne imaging spectrometer campaigns such as ProSmart, MINEO, HySens, DAIS LSF and DAISEX are expected.

EARSeL SIG – Land Use:

The new chairman, Dr. Matthias Braun from the Centre for Remote Sensing in Bonn, is organising the first meeting of this newly-formed SIG to be held in Dubrovnik, Croatia, on 28/29 May 2004. The first announcement will be distributed shortly.

EARSeL SIG – Land Ice and Snow:

The papers presented at the workshop held in March 2002 are now ready for publication on CD-ROM. One copy will be distributed to each participant and one to each paid-up EARSeL member laboratory. The papers will also be put on the EARSeL web pages subsequently.

EARSeL SIG – Multilateral Environmental Agreements:

Questionnaires have been distributed to those who have signed up for this group and the first workshop will be held in Istanbul on the occasion of the ISPRS Congress in July 2004. The web-site for the SIG is under construction on the server of MEDIAS FRANCE, supervised by the chairman, Dr. G. Bégni.

EARSeL SIG – Self-Organised Criticality in the Environment (SOCE):

The following is a report on the EARSeL SIG Self-Organized Criticality in the Environment (SOCE), by Prof. Leonid Vasiliev, Institute of Geography Russian Academy of Sciences, Moscow, Russia. Prof. Vasiliev is planning to organise a workshop in Moscow on 25-26 November 2003. All those who are interested should contact him by e-mail at vasiliev@igras.geonet.ru.

In recent years there has been much discussion of the nature of complexity in geo-physical systems with many independently varying degrees of freedom. These ideas have broad applicability, but their use requires care and good judgement. Experiences with complex systems lead us to expect richly structured behaviour with abrupt changes in space and time, and some scaling properties.

Even though spatio-temporal complexity is ubiquitous in the environment, until recently little understanding of its origin has been achieved. Geo-systems evolve through transient states, which are not critical, to a dynamical attractor poised at criticality. In order for self-organisation to occur, these systems must be driven slowly through a succession of meta-stable states to another, by avalanche dynamics. Recently, simple types of models with extremal dynamics that exhibit Self-Organised Criticality (SOC), have been developed, based on "sandpile", "Bak-Sneppen evolution", and "forest fire" theory. After ten years of research and countless papers, the precise significance of self-organised criticality is still controversial. Avalanche dynamics were experimentally observed in a variety of phenomena. SOC ideas simulated a great interest in the environment. Most of

the evidence for SOC behaviour has been numerical. The fundamental mechanism for the self-organisation process, via avalanches, has not been well understood, and requires further effort to be applied to geo-physical processes in order to answer the question whether processes in the environment show a common feature typical for SOC behaviour. What is also apparent is that we do not yet know what conditions would be necessary and sufficient for critical behaviour to exist.

The EARSeL SIG-SOCE was established in 1999 with the objective of generating fundamental knowledge needed for future geo-physical advances that will continue to drive remote sensing (RS) applications. SIG-SOCE provides a structure for bridging the gap between the physical theory of SOC and satellite technology, to develop the knowledge and tools by which it can directly participate and contribute to disaster preparedness and mitigation efforts. SIG-SOCE serves as a catalyst for the delivery of scientific and technical knowledge to the end-users. The primary objective of SIG-SOCE will be: to promote effective means of using SOC theory to assist in the solution of problems of disaster prediction by using RS; to strengthen international cooperation in the development and use of SOC theory and applications for environmental problems.

When a system is at or close to a critical point, anomalies occur in a wide variety of dynamic properties, as well as in the static properties most commonly discussed in the theory of critical phenomena. Over the years a number of theoretical ideas have shaped our understanding of dynamic critical phenomena, in particular: (1) hypotheses of dynamic scaling and universality; (2) re-normalisation group approach to critical dynamics. Dynamic scaling, percolation theory, and the re-normalisation group approach have given a new insight into the properties of global space-time precipitation. To confirm experimentally the signatures of SOC in precipitation, pattern images of one-degree daily global precipitation (1DD) for 1997-2002, made within the Global Precipitation Climatology Project (GPCP), were used.

SOC in the environment addresses the most important issues associated with prediction in the Earth sciences and environmental policy-making. Uncertainties must be clearly articulated by scientists, so users understand their implications. SIG-SOCE acts as a focus for exchange of ideas and information about the broad scope of the predictability the occurrence of phenomena such as precipitation, floods, droughts, earthquakes, forest fires, hurricanes, sand storms, El Nino etc. using RS data. We anticipate many other applications of SOC that would allow us to better judge the potential value of predictive modelling in the environment, and the contribution of RS to this issue.

The EARSel Symposium in Ghent on 2-6 June 2003, specially dedicated to natural disaster and hazards, provides a possibility for the next step in communication among people, that will encourage action on this problem. As one of the preparatory activities for the meeting at the Symposium in Ghent, a set of papers will have to be prepared to provide potential members participating in SIG-SOCE with information of the status and trends in the use of SOC.

In view of the considerable interest in the use of SOC in the modelling and analysis of poorly understood, non-equilibrium processes in the environment, especially with RS techniques we have decided to host an Expert Meeting, at the Institute of Geography Russian Academy of Sciences, Moscow Russia, on 25-26 November 2003. The main aims of this meeting are to reach some conclusions on the potential application and value of SOC with RS.

2.4 Reports from National Representatives

2.4.1 RS activities in 2002: Austria

Dr. Erwin Mondre, Austrian Space Agency (ASA), Vienna

Remote sensing (RS) is one of the major topics of space-oriented research in Austria. For this reason Austria participates in all ESA programmes related to RS and

Earth observation (EO). Starting with ERS-1 and 2 and ENVISAT, the present ESA programmes under development in the framework of the Earth Observation Envelope Programme (EOEP) and Earth Watch, have been signed up for. In addition to the interest of our space industry to develop new instruments and to participate in constructing new satellites, the research community at universities and research institutions is actively involved in analysing satellite data and preparing for the new missions. Operational use is at present mainly in meteorology and weather forecasting, using Meteosat data via our engagement in Eumetsat.

In 2002 ESA launched two major RS satellites: ENVISAT, the largest EO satellite with ten instruments, and the first model of Meteosat Second Generation (MSG-1), which will be operated by Eumetsat. After ENVISAT's successful launch, six research contracts supported by the Austrian Space Agency (ASA) are now in progress. The evaluation and data interpretation cover activities in: snow melting processes and snow cover detection in Alpine areas; environmental monitoring in Alpine regions using the ASAR and MERIS instruments; geo-scientific application of ENVISAT sensors for agriculture, forestry and hydrology; ice / climate interaction in Antarctica; soil moisture estimates over Mali; atmospheric change analysis using GOMOS, MIPAS and GPS limb sensors.

In support of the preparation of the GMES (Global Monitoring for Environment and Security) initiative of the European Commission (EC) and ESA, projects on RS for land use planning and GIS application, and on the development of methods for monitoring hazards along Alpine traffic routes, have been initiated, financed by the Ministry for Traffic, Innovation and Technology. The ESA Call for Proposals for the first part of the GMES Service Element triggered a number of replies from Austrian institutions, and offers were prepared together with international groups. The tender evaluation is in progress. Further interest and actions are expected in the area of sustainable development, global changes and ecosystems, within the EC's Sixth Framework Programme.

The International Charter on Space and Major Disasters was activated by our authorities after the extensive flooding in summer 2002 at different parts of Austria. Some research contracts have been awarded to support these activities, and to define more efficient and faster ways for data analysis in such catastrophic events.

A national programme for space research and development was approved by the Ministry for Transport, Innovation and Technology, and will be co-ordinated and monitored by ASA. A first call for ideas resulted in more than twenty proposals, some related to EO. Several contracts will be placed within the next weeks. A second call for ideas will be issued soon.

A project supported by ASA has been initiated with the Austrian Research Centre (ARC) in Seibersdorf, and the value-added company Geoville, to analyse data of the Korean satellite KOMPSAT at four selected areas in Austria (close to Vienna). It is planned to develop a rapid semi-automatic updating system of topographic information and urban growth monitoring.

The first Earth Explorer Core Mission GOCE (Gravity and Ocean Circulation Explorer), planned for launched in late 2004, is of great interest to our scientific community. The University Institute for Geodesy in Graz is planning to carry out a major part of the data analysis for this mission. The evolution of the second call for Earth Explorer Opportunity Missions resulted in the selection of three out of twenty-five proposals which will be studied in greater detail and which will finally lead to the definition of the next ESA Opportunity Mission. A joint Austrian / Danish proposal was selected to be one of these three candidates. This mission ACE+ (Atmosphere and Climate Explorer) will be studied during 2003 under ESA contracts by two industrial teams.

Forthcoming RS events in 2003 are: 3rd International Conference on Computer Vision Systems / ICVS03, Graz (1-3 April 2003); Österreichischer Geodätentag "Vermessung und Geo-information – Fundamente der Wirtschaft", Wels (8-10 April 2003); AGIT 2003 – 15 Symposium Ange-

wandte Geographische Informationsverarbeitung, Salzburg (2-4 July 2003).

2.4.2 RS activities in 2002: Belgium

Carine C. Petit, Belgian Federal Office for Scientific, Technical and Cultural affairs (OSTC)

In 2001, following the 15-year TELSAT programme, the Belgian OSTC launched two new satellite EO research programmes for a 5-year period (2001-2006):

- **STEREO (SR):** Support to the Exploitation and Research on Earth Observation Data (10.85 million Euros);
- **VEGETATION (VG):** Scientific Support for the Exploitation of the VEGETATION Instruments on SPOT 4 and 5 (2.7 million Euros).

After the TELSAT programme, an evaluation was performed, showing that too many small and short projects were granted, leading to a disorganised and fragmented expertise in Belgium. Therefore, the aims of the two new programmes are: teaming of researchers into internationally recognised "expertise pools"; preserving and developing the Belgian expertise in EO; fostering innovation and introduction of new technologies; increasing the use of RS imagery in Belgium (by private companies and administrations); developing products and operational services.

The main elements of the new Belgian EO strategy are R&D expertise building ("expertise pools"), market development ("products and operational services"), user support / Eodesk (SR), and evaluation and promotion (SR).

To build the expertise pools (network of teams), two calls for proposals were launched in May-June 2001, on four topics supported by the STEREO and VEGETATION programmes: vegetation and associated parameters at global and local scales; cartography and land management; coastal regions; new technologies and innovations. Six proposals, for 3-5 year projects, were selected. These expertise pools, which have been running for one year, are submitted to an annual evaluation by a Steering Com-

mittee formed by foreign scientific experts, potential users, representatives of other national administrations, and representatives of OSTC as observers. The granted expertise pools are: modelling crop growth based on hydrology and assimilation of RS (SR/00/01); spatial information mining for local and regional authorities on the basis of very high- resolution data (SR/00/02); optical RS of coastal waters (SR/00/03); advanced methods for SAR RS processing (SR/00/04); data analysis in hyperspectral RS (SR/00/05); centre of expertise for monitoring changes in terrestrial ecosystems via EO (VG/00/01). More details on these networks (promoters, objectives, etc.) are available on our web-site (telsat.belspo.be/projects/project.asp).

Regarding market development, two calls for proposals were launched in April-May 2002, to develop products and operational services. Two ways of functioning were proposed to the Belgian EO community: partnerships between OSTC and other Belgian administrations; partnerships between industry and research. In both cases, OSTC finances the research partner(s), and the administration or the private partner, for which the product or the operational service will be developed, co-finances the project for at least 25 % of the total project budget. We are now in the final contracting phase of these calls. Probably, four new partnerships will be supported by the STEREO programme from February 2003: Monitoring the State of Walloon Agriculture by RS (**SAGRIWATEL**) (SR/00/20); Updating Rate Assessment System of Topo-Geographical Data using RS (**ETATS**) (SR/20/21); Flood map (SR/20 /22); Global EO in Support of Climate Change and Environmental Security Studies – the Geo-Success Service Centre (VG/00/11).

In 2002, OSTC also supported a hyperspectral RS flight campaign within the framework of the commitments of Belgium to the development of the ESA imaging spectrometer, APEX. Seven projects were selected and the pilot areas were surveyed in September 2002, both by airborne and field measurements. This campaign was organised in collaboration with VITO (Belgium) and NERC (UK). The images have just been made available to the teams. The selected

hyperspectral projects were: Detection of Contaminants in Solid Matrices and Plants using Hyperspectral CASI2-SWIR Images (SR/00/10); Spatial Information Extraction for Urban Regions based on Hyperspectral Data (SR/00/11); Airborne Hyperspectral Potential for Coastal Biogeochemistry of the Scheldt Estuary and Plume (SR/00/12); RS of the Vitality of Perennials (SR/01/13); Hyperspectral RS of Moisture Gradients – the Influence of Infiltration and Seepage Areas (SR/03/14); Estimation of the Superficial Organic Matter Content of Soils (SR/19/15); Use of Hyperspectral Measurements to Characterise the Vegetation of Permanent Prairies (SR/42/16).

Three forthcoming calls for proposals under the STEREO programme, are: expertise pools (February 2003 / budget to be defined); industry-research (April 2003 / 600,000 Euros); Apex exploitation (2004 / 124,000 Euros). Forthcoming Belgian RS activities include: hyperspectral workshops (launch of second CASI-SWIR flight campaign, supported by PRODEX, March 2003; presentation of results of 2002 campaign, autumn 2003); OSTC / ESA forum on "space and disasters management", Brussels, 26 March 2003 (www.belspo.be/belspo/ostc/agenda/index_uk.stm); annual national STEREO and VEGETATION workshop, May 2003; 23rd EARSel Symposium, Ghent, June 2003.

The OSTC's Department of Space Research and Applications manages the Belgian (public) participation in R&D activities carried out by industry and Belgian scientists in space-related matters. These activities are conducted primarily within the framework of international organisations to which Belgium belongs (e.g. ESA, EUMETSAT), or within the framework of bilateral agreements (e.g. with France on SPOT). This policy is intended to open up new prospects for the scientific, technological, industrial and commercial actors of the Belgian aerospace sector. Belgium also participates in ESA programmes, GMES, DUP, PRODEX, PROBA, Earth Watch, EUMETSAT, World Heritage Program (UNESCO), etc.

OSTC also provided the funding for the recent flight to the International Space Station (ISS) of the Belgian ESA astronaut, Frank De

Winne, and for the related experimental programme. The flight took place in late October 2002, on board a Russian Soyuz taxi vehicle. During the 10-day ISS mission (called ODISSEA), De Winne performed a series of science and technology experiments, the majority of which were led by Belgian scientists. The prime task of the mission was to replace the TM-34 Soyuz vehicle currently attached to the Station with this modernised version. On the ISS, De Winne performed a large experimental programme, including work with one of the key research facilities: the Microgravity Science Glovebox (MSG), an important piece of European hardware which provides an enclosed, sealed environment in which safely to perform experiments on combustion, fluids and biotechnology under conditions of weightlessness. For more information, visit the OSTC web-site (telsat.belspo.be).

2.4.3 RS activities in 2002: Canada

Extracts from the report "Significant Canadian Events and Achievements in the Earth and Environment Field", published by the Canadian Space Agency

2002 marked the 30th anniversary of the creation of the Canadian Centre for Remote Sensing (CCRS). In the same year the US launched ERTS-1 (later renamed Landsat-1), the first RS satellite. Since then, under the tutelage of the Canadian Advisory Committee for RS, representing all key stakeholders from both federal and provincial agencies and the University community, the CCRS and later the Canadian Space Agency (CSA), have developed a dynamic, large-scale programme geared to making EO data an operational tool for resource and environmental managers in Canada. Launched seven years ago, RADARSAT-1 is still providing timely and reliable data for applications in agriculture, mineral exploration and ice detection. RADARSAT-2 is due to be launched in March 2004 and will increase Canada's ability to provide precise imaging to meet the evolving needs of users such as relief agencies and disaster management organisations.

The Canadian Forest Service (CFS), with support from CSA, initiated partnerships

with provinces and territories for the production of a 2000 land cover map of the forested areas of Canada, as part of the Earth Observation for Sustainable Development of Forests initiative (EOSD). CFS and the Canada Centre for RS of Natural Resources Canada (NRCan) have completed a Land Cover map of Canada for 1998, which takes advantage of the improved capabilities of SPOT 4 / VEGETATION.

The International Charter on Space and Major Disasters launched, in January 2002, is an innovative web-site, hosted by CSA, to facilitate the work of rescue teams dealing with the worst disasters. Three CEOS meetings took place in Canada this year. The CCRS also took the chair of the CEOS Working Group on Information Systems and Services (WGISS) in November 2001 for a two-year term. Also in 2002 the 22nd International Geoscience and Remote Sensing Symposium (IGARSS) and the 24th Canadian Symposium on Remote Sensing (CSRS) were held in Toronto.

The Earth Observation Application and Development Programme (EOADP) favours projects that demonstrate the ability to position strategically the Canadian EO industry through the development of commercial activities or applications fulfilling government requirements. The programme is now in its third year and has awarded over 49 contracts that illustrate the need for EO data and the effectiveness of partnerships combining resources and expertise from the public and private sectors. The Government Related Initiatives Program (GRIP) fosters the use of spaceborne RS information by federal government departments to enhance their efficiency and effectiveness and showcase Canadian technology.

CCRS is leading a collaborative pre-competitive research effort to develop new techniques in the processing, visualisation, and analysis of hyperspectral data, by focusing on the development of calibration and data pre-processing methods, procedures for extracting information, and related information products. The Hyperspectral Applications Development Programme at CCRS is strongly focused on issues of concern to the Earth Sciences Sec-

tor: sustainable development of natural resources, Northern development, and a clean environment. More information is at www.ccrs.nrcan.gc.ca/ccrs/misc/issues/hypersp_e.html.

RADARSAT-2's extended capabilities will permit SAR imaging modes with high spatial resolution, with selective co- or cross-polarisation, and with full quadrature polarisation, and will present a challenge to the community as new concepts and methods of analysis and data processing are required. CSA, in collaboration with CCRS, initiated a suite of activities in early 2001 that will continue into the first years of RADARSAT-2 operations. The programme's objectives are to help the Canadian EO community (academia, industry, and government departments) master the concepts, develop the tools, and explore the potential of RADARSAT-2 data. One-day workshops on RADARSAT-2 polarimetry and potential applications were organised by the CCRS at the 23rd Canadian Remote Sensing Symposium in August 2001 and at IGARSS in June 2002.

The Global Observation of Forest Cover and Land Dynamics (GOF-C-GOLD), a coordinated international effort to develop and implement a suite of EO programmes using both space-borne and in-situ data, is designed to help provide information to study global change, related for example to the carbon cycle, as well as for improved natural resources management. GOF-C-GOLD has three core themes: land cover characteristics and changes; fire monitoring and mapping; biophysical processes. The GOF-C-GOLD office was relocated to CFS's Pacific Forestry Centre in April 2002. More information is at www.fao.org/gtos/gold.html.

Forestry is the largest industry in Canada, supporting 373,000 direct jobs and contributing over \$37 billion to the balance of trade. Canada's forests also support a multi-billion dollar recreation and tourism industry. The Earth Observation for Sustainable Development of Forests (EOSD) initiative is working in partnership with the provinces and territories to develop a land cover map of the forested area of Canada. More information is at the new

EOSD web-site (www.pfc.cfs.nrcan.gc.ca/eosd), which was launched in 2002.

One of the main objectives of CRYSYS (Cryosphere System) is to develop capabilities for improved satellite-based measurement, monitoring and understanding of cryospheric variables over a range of spatial and temporal scales. In 2002, twelve research projects were supported in Canadian universities with topics ranging from development of improved automated sea ice classification for RADARSAT data, to modelling of glacier surface melt. A major effort was made in 2002 to expand Canadian cryospheric data at the Canadian Cryosphere Information Network (CCIN) at the University of Waterloo. The other major focus of CCIN was the development of a web-based interactive data display capabilities for near-real-time monitoring of Canadian cryospheric conditions during the winter of 2002-2003.

Canada is one of the fourteen participating countries in the joint EU / ESA Global Monitoring for Environment and Security (GMES) initiative. The first Canada / ESA co-operative agreement was signed in 1979, and was renewed in 2000 for 10 more years. Canada participates in the following ESA programmes: Earth observation (ENVISAT, Earth Observation Preparatory Program / EOEP, GMES); satellite communication (ARTES-1, -3, -5, and ARTEMIS); satellite navigation (GalileoSat Definition Study); planetary exploration (AURORA). Canada also participates in the General Support Technologies Programme (GSTP) and the mandatory General Budget.

2.4.4 RS activities in 2002: Croatia

Croatia was among the first European countries that introduced, developed, and applied RS methods in various fields of pure (academic) and applied research. As usual, first came various aerial photographs (panchromatic, infrared, and colour-infrared) which were used in topographic mapping, various geological research activities, as well as in forestry, pedology, archaeology and other fields. As long as thirty years ago, aero-thermal imaging by means of the multispectral

scanner DS 1250 (Michigan, USA) has been carried out in Croatia for application in petroleum-geologic and geo-thermal research, as well as for registration and monitoring of the submarine springs, which abound all along the Croatian Adriatic coast. When the first satellite images (Landsat-1) became available, they were immediately applied, first in geological, and later in many other areas of research. The results proved to be very useful and so, in 1979, experts from various fields agreed to establish, within the Croatian (ex-Yugoslav) Academy of Science and Arts, the Scientific Council for Remote Sensing and Photo-Interpretation. The main purpose of the Council was to advance, promote, enhance, co-ordinate, and organise scientific and technical research and to collect and edit information and new data that have become abundantly available for remote sensing activities. The Council consists of several commissions and working groups, and the activities of the Commissions have been arranged so as to match the various Special Interest Groups within EARSel. The Council has been a member of EARSel since 1992.

At first, the Council had over 200 personal members from forty-four institutions, which were also members of the Council. Due to the disintegration of Yugoslavia, the number of members (both persons and institutions) decreased, so that nowadays the Council has around thirty institutional and 140 personal members. The activities of the Commissions and Working Groups are regularly reported in the publication of the Council, the "Bilten" (Bulletin). Up to now, sixteen issues of the Bilten have been published, containing a considerable number of scientific and technical papers dealing with various aspects of RS activities and GIS. In addition, the Council has organised numerous symposia, meetings, seminars, talks, round-table discussions, etc., as well as several excursions. Also, members of the Council have authored several books dealing with RS and GIS technologies. Three of these are: V. Donassy, M. Oluić and Z. Tomašegović: *Remote Sensing in Geosciences*, published by the Croatian (then Yugoslav) Academy of Science and Arts in 1983; M. Brukner, M. Oluić and S. Tomanić: *Geographic Information Systems*

– *A Methodological Study*, published by INA-INFO in 1992; M. Oluić: *Earth Imaging and Exploration from Space – Satellites, Sensors, and Applications*, published by the Croatian Academy of Science and Arts in 2001. All the books are written in Croatian, in order to be primarily accessible to local technical population.

Nowadays, RS and GIS methods are part of the undergraduate curricula at several faculties of the Zagreb University (Faculty of Science, Faculty of Geology, Mining and Petroleum Engineering, Faculties of Forestry, Agronomy, and Geodesy). There are also several companies that are actively participating in using RS and GIS. Almost all kinds of satellite images are applied, ranging from spatial resolutions of around 1 km (NOAA, RESURS) to 1 metre (IKONOS, EROS). These are mostly small-scale projects, because large projects, which should be financially supported by government, are unfortunately not feasible, due to severe financial restrictions.

In 2004 Croatia will host the 24th EARSel Symposium in Dubrovnik. For that purpose, a local organising committee, headed by dr. M. Oluić, has been established, in order to carry out all necessary preparations for the symposium.

2.4.5 RS activities in 2002: Czech Republic

Dr. Tomas Benes, UHUL Forest Management Institute

The following actions were carried out in 2002: Czech cadastre map on the web were published at the end of 2002; the second phase of the Unimap base of Czech Republic has been published, called ZABAGED II; regional forest development plans were finished for the whole territory; DEM military model based on 1:10,000 topomaps, were finished; forest inventory using aerial photos was begun in 2002. The following meetings were held / are planned in 2003: GIS Ostrava 2003 / GI-GIT Theory and Practice – Bringing Them Together (27-29 January 2003 / web-site gis.vsb.cz); 9th International Conference "Infosystems in Agriculture and Forestry" in Sec, near Chrudim (11-13

March 2003 / web-site www.ccss.cz/sec); 13th Conference "GIS for State Administration" in Sec near Chrudim (June 2003 / web-site sec.upce.cz); 3rd International Symposium on "Digital Earth – Information Resources for Global Sustainability", in Brno, organised by Milan Konecny and ICA (21-25 September 2003 / web-site digitalearth03.geogr.muni.cz).

2.4.6 RS activities in 2002: Finland

Prof. Dr. M. Hallikainen, Helsinki University of Technology

The main sources of public funding for RS activities in Finland 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 .

The Tekes five-year RS technology programme GLOBE 2000 was aimed at (a) development of operational RS methods having commercial potential or beneficial socio-economic effects, (b) development of sustainable RS industry, and (c) research in areas having high national importance (environment, forests, water, snow, ice). The total volume of Globe 2000 was about 9 M during 1995-2000. The evaluation report of the programme, written by two international experts, was published in November 2001 (www.tekes.fi/eng).

Tekes is preparing a new programme, AVALLI, for the development of space business in the following areas: satellite instrumentation; telecommunications and navigation; RS; satellite services. The goal is to create business outside ESA and EU markets. Consequently, companies are expected to play a major role in the programme, with research institutes and universities transferring their know-how to companies. The programme will start in the spring of 2002 and last until 2005, with a total volume of 15 M . Additionally, Tekes presently provides funding to 18 research units and 12 companies with an annual level of 3 M .

The Academy of Finland and Tekes started in 2001 a joint four-year space technology

programme Antares. Its focus is on space science and environmental RS, and the essential technological areas are development of instruments and observational and analytical methods. An international evaluation board selected a total of eight projects that receive funding since the spring of 2001. The total funding of Tekes is 4.5 M and that of the Academy of Finland 4 M .

Several Finnish research institutes and universities participate in projects funded by EU and ESA. Numerous nationally funded Envisat AO projects are ready to use data from the Envisat satellite when available. Examples of research projects are listed below:

- (1) Updating of the National Forest Inventories using RS Data (www.joensuu.fi/forestry/index.html, www.efi.fi);
- (2) Forest Tree Groupings Database of the EU-15 and Pan-European Area Derived from NOAA-AVHRR Data / European Forest Map II (www.joensuu.fi/forestry/index.html, www.efi.fi);
- (3) New Modelling and Data Analysis Methods for Satellite Based Forest Inventory / MODAFOR (www.vtt.fi/tte/research/tte1/tte14);
- (4) Envisat in Boreal Forest Mapping and LAI Estimation / ENBOR FORMAL (www.vtt.fi/tte/research/tte1/tte14);
- (5) Forest Environmental Monitoring and Management System / FOREMMS (www.space.hut.fi, www.metla.fi);
- (6) Retrieval of Boreal Forest and Surface Characteristics from Envisat Multi-Sensor Data / BOREAL (www.space.hut.fi, www.honeybee.helsinki.fi/mmeko/research.htm, www.foto.fi);
- (7) Forest Information Assessment and Updating / METY (www.metla.fi);
- (8) Scale-Dependent Monitoring of Non-Timber Forest Resources / MNTFR (www.metla.fi);
- (9) CORINE Land Cover 2000 and IMAGE 2000 (www.vyh.fi);
- (10) Assimilation of RS Data to Physical Models in Environmental Monitoring and Forecasting / ASSIMENVI (www.space.hut.fi, www.vyh.fi);
- (11) Mapping of Random Natural Structures: Genes, Trees and Ice (www.fimr.fi);
- (12) Digital Photogrammetry (www.fgi.fi);
- (13) Laser-Scanning (www.fgi.fi);
- (14) Hyperspectral Detection of Geological Objects / HYDO (www.gsf.fi/research.htm);
- (15) Assessing and Monitoring the Environmental Impact of Mining Activities in Europe Using Advanced EO Tech-

niques / MINEO (www.gsf.fi/resactiv.htm); (16) RS Laboratory of the Geological Survey of Finland / GTK-RSLAB (www.gsf.fi/resactiv.htm); (17) Environmental History of the Severely Eroded North-Eastern Icelandic Semi-Desert / LANDIS (www.utu.fi/ml/maantiede/html/engl/html); (18) Development of an Operational Monitoring System of European Glacial Areas / OMEGA (omega.utu.fi); (19) Development of Generic EO-Based Snow Parameter Retrieval Algorithms / EnviSnow (www.space.hut.fi, www.vyh.fi); (20) Integrated Weather, Sea Ice and Ocean Service System / IWICOS (www.fimr.fi); (21) Development of Methods to Measure Complete Precipitation Parameters (including particle size distribution) (cumulus.helsinki.fi/engl.html); (22) Quantitative Estimation of Wet Deposition of Airborne Pollutants by Rain and Snow Using Weather Radar (cumulus.helsinki.fi/engl.html); (23) Ozone Monitoring Instrument / OMI (www.fmi.fi); (24) GOMOS on Envisat (www.fmi.fi); (25) Development of an Airborne Interferometric L-Band Radiometer for RS / HUT-2D (www.space.hut.fi, www.ylinen.fi); (26) MIRAS Demonstrator Pilot Project (www.ylinen.fi, www.space.hut.fi).

2.4.7 RS activities in 2002: France

Gérard Begni (*), ISPRS 2nd Vice-President, Deputy Manager MEDIAS-France, START / MEDCOM Secretary, SFPT Council Member. (* Acknowledgements: Alain Baudoin (CNES), Delphine Fontannaz (MEDIAS-France), Marc Leroy (MEDIAS-France), Frédérique Remy (LEGOS), François Spiero (CNES), Pascale Ultre-Guerard (CNES), Daniel Vidal-Madjar (CNES).

In 2002, Europe as a whole and France in particular has been very active during the World Summit on Sustainable Development (WSSD), supporting developing countries. French activities are led quite systematically within the scope of international co-operation, inspired by CEOS / IGOS-P initiatives, and shared among the programmes designed both by ESA (of which France is a major partner) and those developed according to other scenarios.

Contribution to ESA and EUMETSAT Programmes:

France is a major contributor to the EOEP (Earth Observation Explorer Programme) component of the ESA "Living Planet" programme. Two core missions, GOCE (Gravity Field and Steady-State Ocean Circulation Mission, scheduled for launch in 2006) and ADM-Aeolus (Atmospheric Dynamics Mission) scheduled for launch in late 2007, in co-operation with France and England) have been already planned. A third one should be chosen from: EarthCare (Earth radiation mission, a joint European-Japanese mission); WALES (lidar measuring water vapour concentration); SPECTRA (measurement of directional and spectral properties of Earth radiation), in line with the results of two parallel phase A studies. Moreover, two "Opportunity Missions" are on their way. CryoSat (on which DORIS will be flown) is a three-year radar altimetry mission to be launched mid-2004. The Soil Moisture and Ocean Salinity Mission (SMOS), a joint France / Spain co-operation, is scheduled for launch in 2006. Following a call for proposals in early 2002, three new "opportunity missions" are now under consideration: ACE+, EGPM and SWARM. The first and the third could be merged into a single mission.

In the framework of the "Earth Watch" programme, France is a strong supporter of the GMES initiative. The L-band TERASAR and the FuegoSAT projects will be consolidated. A consortium for the distribution of ENVISAT products has been formed around the SPOT-IMAGE Company. Regarding meteorological observation developed within the joint framework of ESA and EUMETSAT, the major event to be underlined is the successful launch of Meteosat Second Generation (MSG). CNES is also developing the IASI sounder in partnership with EUMETSAT and other European countries, to be flown onboard the METOP satellites.

SPOT and VEGETATION Programmes:

The present SPOT constellation includes three satellites (2, 4, 5). SPOT 2 and 4 observe the Earth surface in panchromatic mode with 10-metre resolution, and in multispectral mode with 20 m resolution, including the short wave infrared wave-

length for SPOT 4. SPOT 5, successfully launched on 4 May 2002, offers improved performances. The two high resolution HRG instruments offer panchromatic mode with 2.5 m resolution, 10 m multispectral mode, a 60x60 km swath and an image absolute location accuracy of 50 m without Ground Control Points (GCPs). In addition, the High Resolution Stereoscopic (HRS) instrument is dedicated to the operational collection of along-track stereoscopic couples (5x10 m), to produce DEM with accuracy better than 15 m without GCPs on flat areas (slopes less than 15%). Its innovative technical characteristics open new perspectives in the domain of high resolution spatial imagery and stereoscopy. This instrument, partly funded by private investments, meets a strongly increasing market demand. Setting up a coherent DEM database for the most demanding areas of the world is under development by SPOT IMAGE and IGN. Note that the International Society for Photogrammetry and Remote Sensing (ISPRS) recently set up a dedicated "HRS study team". An ad hoc programme allowed a careful preparation of scientific and commercial applications of SPOT 5. Among others, natural hazards prevention and monitoring, humanitarian operations, epidemiology (France presented a topic on this at WSSD), and precision farming applications are under strong development.

CNES is now studying a new multi-sensor programme based on small satellites, Pléiades, which should succeed SPOT and be progressively operational by 2005. It would include optical satellites and radar satellites with 1 m resolution, made possible by innovative technologies. It should also enable the continuity of wide-field observations after SPOT 5, and observations by "super-spectral" satellites with a typical daily revisit period. Pléiades includes data from French and non-French systems. An agreement was signed with Italy in January 2001 to co-ordinate with the Italian COSMO-SKYMED project, the so-called "ORFEO" dual system, which includes a high resolution optical component under French responsibility (Pléiades Haute Résolution), a SAR component under Italian responsibility (Cosmo Skymed) and a jointly developed ground segment. The joint

Pleiades HR / Cosmo Skymed programme could in particular bring a major contribution to the European GMES programme, mainly in the field of security.

CNES has established a procedure to supply SPOT products at marginal costs for European researchers. In 2002, this so-called ISIS programme delivered about 500 high resolution products to this community. On the operational side, following the UNISPACE Conference in July 1999, CNES, ESA, CSA, NOAA and ISRO have signed the "Space and Major Disasters" international charter, to supply operational users with urgent information in case of natural hazards.

Solid Earth, Ocean, Atmosphere and Coupled Systems:

Over the last two years, a new generation of DORIS positioning instrument has been launched on board three satellites (JASON, ENVISAT, SPOT 5). This new configuration enables 1 cm accuracy for satellite location and a few millimetres per year accuracy for the motion of the 54 ground-based DORIS stations. French researchers are also active in analysing EO data for geo-physical applications (tectonic, vulcanology, seismology, landslides, etc.). In other domains, like spatial measurements of the Earth magnetic and gravity fields, France co-operated respectively with Denmark for the OERSTED mission (launched in February 1999 and still in operation) by providing a scalar magnetometer, and with Germany for the CHAMP mission (launched in July 2000 and still in operation) by providing a micro-accelerometer. France is also involved in the preparation of the ESA projects SWARM and GOCE.

The Franco-American TOPEX-POSEIDON system and its successor, the JASON-1 mini-satellite, have enabled to determine the ocean level with a precision of a centimetre, and to study its dynamics. The need for the continuation of precise non-sun-synchronous orbit altimetry data has been clearly expressed by the ocean user community, in particular the Global Ocean Data Assimilation Experiment (GODAE), the Integrated Global Observing Strategy Partnership (IGOS-P) and the European Global Ocean Observing System (Euro-

GOOS). So, CNES (France), NASA and NOAA (USA) and EUMETSAT have agreed to work towards the joint implementation of the follow-on Jason-2 satellite, to be launched in late 2005. Together with complementary ERS and ENVISAT data, it will be a key component of the Oceanographic Surface Topography Mission (OSTM), EUMETSAT's first optional programme.

A major event in the meteorological domain is the successful launch of the geostationary MSG satellite. The SEVIRI radiometer allows an enhanced observation of the Earth surface and clouds, through twelve channels from visible to thermal infrared. The nadir resolution of the visible channel is 1 km, and the sampling period is 15 minutes. In addition, the GERB instrument allows the study of the Earth's energy balance. PUMA, one of the priorities of the GMES European programme, was developed to allow African countries to receive MSG data in a homogeneous way. The AMESD (African Monitoring for Environment and Sustainable Development) programme is under development to take advantage of PUMA and other initiatives.

France is also developing IASI, a wide field infrared interferometer, on the polar meteorological satellite METOP. This allows atmospheric profiling of temperature (1°K accuracy) and humidity (10% accuracy), with a kilometric vertical resolution. Data from POLDER-1, a wide field imaging optical radiometer, launched on the Japanese ADEOS satellite, have led to innovative studies and results on aerosols (clouds / aerosols interactions, radiative forcing, RS, modelling), clouds (properties, radiation budget, climate models), solid ground (monitoring of vegetation, carbon cycle, climate models), ocean colour (primary production, carbon cycle). The follow-on POLDER-2 was implemented on-board ADEOS-II (MIDORI), successfully launched on 14 December 2002, and with two core sensors: AMSR for the observation of various physical parameters concerning water cycle regardless of day and night, and GLI for the high accuracy observation of ocean, land and clouds. In addition, other instruments such as Seawinds

(NASA / JPL), DCS (CNES), ILAS-II (EA) have been implemented, and ADEOS-II is expected to acquire the data necessary to better understand the circulation of water, energy and carbon in order to contribute to study the global environment changes and its mechanisms. POLDER is also planned to be flown on PARASOL, a micro-satellite intended for a joint CALIPSO / CLOUDSAT mission.

CNES and ISRO (Indian Space Agency) have signed a Phase B MoU to lead together the MEGHA TROPQUES project, planned for 2006. This mini-satellite is dedicated to the observation of seasonal variations in the water cycle and energy exchanges within the atmosphere-ocean-earth system in the tropical areas. It will carry a hyper-frequency radiometer (MADRAS), the ScaRaB radiometer measuring the Earth radiation budget, and a hyper-frequency humidity sounder, for depicting the meso-scale structure of water vapour profiles (SAPHIR).

NASA and CNES also agreed to co-develop the CALIPSO project. This mini-satellite, to be launched in 2004, will study the radiative forcing due to clouds and aerosols by coupling lidar backscattering measurements with passive radiometry measurements (visible and infrared imaging and spectrometry in the near infrared). France will supply an infrared imaging radiometer with micro-bolometers, as well as the PROTEUS platform and satellite control centre

The Thematic Ground Segments Programme:

This major initiative aims to provide scientists with relevant products and information, minimising data handling and pre-processing, providing advanced retrieval algorithms, and validating and improving its outputs. Of specific interest is GEOLAND, a joint Belgium-France initiative, in line with GMES priorities and objectives. GEOLAND is in its early phase, jointly defined and initiated by VITO and MEDIAS France in 2002. It aims to derive several biophysical parameters related to terrestrial surfaces from wide field satellites. Using several space systems allows to minimise instrumental biases linked to

specific viewing modes, by taking advantage of the wide spectrum of observations now available. GEOLAND will provide the scientific and industrial community with products duly labelled in terms of description and accuracy.

The PNTS Programme:

PNTS (French National Programme for Space Remote Sensing) aims to develop methodologies for the use of space data by the scientific community, by promoting the implementation of operational methods and the assessment and assimilation of space data into complex models. PNTS includes many themes: Solid Earth, Ocean, Biosphere, Snow and Ice, Ground and Water, Atmosphere, Human and Social Sciences. PNTS has backed the following existing space programmes: POLDER, SeaWiFS, SPOT, VEGETATION, MERIS / ENVISAT in the solar spectrum; ERS (altimeter, windscatterometer, SAR), ENVISAT, TOPEX / Poseidon and JASON in the microwave field. It also helped in exploiting new gravity missions such as CHAMP, GRACE, and GOCE. It supported scheduled missions such as IASI, Lidar WIND, MSG, CALIPSO and SMOS, belonging to new technologies of space measurements. PNTS also provided important support for research on radar image processing (GDR / ISIS) and SAR interferometry (GDR / InSAR or GDR / StrainSAR), as well as the development of instruments such as the radar in the P-band (RAMSES). PNTS will continue to support the methodological developments of future missions (ESA Earth Explorer), through studies which use new concepts such as very high spatial and temporal resolution, as well as new measurement techniques: RAMSES, fluorescence in Fraunhofer lines, polarimetry of ENVISAT or RADARSAT SAR, bistatic or radar interferometry (GPS, "ALOS wheel"), hyperspectral data (CHRIS) or directionality in the thermal field.

2.4.8 RS activities in 2002: Germany

Prof. (em.) Dr. Gottfried Konecny, University of Hannover, Germany

Space and RS activities are financed in Germany mainly by the Federal Ministry of

Education and Research (BMBF), which controls the country's space programme. These are conducted and co-ordinated with Europe's space agencies (ESA, CNES, ASI) and in partnership with the wider international space community (NASA, NASDA). This includes participation in launch facilities, sensor developments and the operation of space tools by industrial partners, governmental laboratories and the German scientific community. The activities of the German EARSel laboratories depend on this governmental funding.

DLR:

The major RS laboratory is the German Centre for Space and Aero-Science (DLR). The RS activities of DLR in Oberpfaffenhofen include data processing for various European sensors. After ESA Envisat's successful launch on 1 March 2002, the DLR will start delivery of Sciamachy level 0 data in March 2003. Data from the ASAR, MIPAS and SCIA sensors will be transferred from the reception station and archived at the D-PAC, starting in May 2003. In September 2003 data will be delivered to the CAL / VAL users and in December 2003 to the public. For the ESA Earth Explorer satellite GRACE, 3000 passes have so far been processed.

The NASA / NIMA-DLR Shuttle Radar Topographic Mission SRTM, with its X-band radar provided by DLR and ASI, foresees processing of X-band radar data at DLR. The products, of excellent quality, have been nominally completed over Europe, Africa and Central America. A commercial distributor is being selected. For the anticipated mission Terra SAR-X, the project plan has been signed, the split antenna mode has been decided upon and the ground segment design is completed. The vegetation sensor MOS is still operating successfully in its seventh year on the Indian IRS satellites. The small satellite BIRD, built by DLR-Adlershof, was successfully launched on 22 October 2001 with a thermal camera. During 2002, Australian fires, the Etna eruption and the China coal fires have been monitored. Data are available on a non-commercial basis via the DLR-DFD. For the Champ and BIRD satellites, 8000 passages have been recorded at the Spitzbergen station. The data were trans-

ferred to Germany. An X-band antenna for receiving IKONOS data has been established in Neustrelitz. An agreement has been signed with European Space Imaging (EUSI), whereby IKONOS data may be obtained for scientific users under special conditions.

On 2 December 2002, DLR-DFD was officially named as "ICSU World Data Centre for Remote Sensing of the Atmosphere". It supports the International Charter for Major Disasters, and was active during the Elbe / Danube floods in 2002, when an area of 700 km² was mapped. For the German military, DEMs have been processed for 200,000 km² from MOMS data. Projects for the monitoring of mangrove forests (MADAM III) and Lake Aral have been approved. DLR-DFD has supplied the following products to users during 2002: SAR products (ERS-1 and 2) on CDs (2800); GOME products on CDs (6800); MOMS and X-SAR products on CDs (100); NOAA images online (7200); Landsat images online (3000); SAR products (ERS-2) online (100).

DLR-Adlershof, besides its activities with BIRD, is preparing for the Mars-Express mission to be launched in 2003. The comet satellite ROSETTA has unfortunately been postponed until the fall of this year. On 7-9 April 2003, the IAA Symposium on Small Satellites will be held at the Berlin Hilton Hotel, organised by DLR.

Governmental Laboratories (BKG):

Among the government laboratories, the Federal Institute for Cartography and Geodesy (BKG) in Frankfurt is engaged in knowledge-based methods for extracting changes in the German GIS data base ATKIS by means of digitised aerial photographs, and in extracting the high waterline from satellite images during the Elbe flood. Other governmental laboratories, and former EARSel members, such as the Federal Institute for Geosciences (BGR) in Hanover and the Federal Institute for Land Use planning in Bonn may continue their RS activities, but due to personnel changes have terminated their reporting.

GAF:

GAF is the largest value-added RS company in Germany. It operates the receiving

station for IRS data in Neustrelitz and is a distributor of Landsat, SPOT and IRS images. While the direct sale of data remained small (600,000 euros for Landsat ETM data and 300,000 euros for SPOT and IRS data), the total volume of value-added business is approximately 3M euros per year.

Research Laboratories at German Universities:

These draw their funding mainly from the EU or the German Research Foundation (DFG), Bonn.

Institute for Meteorology, Free University of Berlin: This Institute conducts operational reception, processing and archiving of weather satellite images from NOAA-15 AMSU (6 orbits / day) and NOAA-16 AVHRR, TOVS and AMSU (8 orbits / day) in full resolution, as well as Meteosat 7 PDUS every 30 minutes. These are operationally processed in all five or six channels and transformed into mosaics, twice daily. For Meteosat, the Atlantic-Europe area is produced in stereographic projection every 30 minutes in two channels. These data have served to produce a normalised and homogenised data set of reflectivity and the vegetation index with 1 m resolution for Central Europe and the Mediterranean since 1989, in co-operation with the universities in Karlsruhe, Florence, Wageningen and Valencia. Also derived is the ground radiation balance from satellite data, with Greek, Swiss and NASA partners. Furthermore, AMSU microwave data are used for the determination of hydrological parameters, such as precipitation intensity, snow cover and soil moisture. Also a monthly coverage of the ice-covered area between Greenland and Novaja Semlya is used for observation of long term trends since 1966. See www.sat40.met.fu-berlin.de.

Humboldt University Berlin, Division of Geoinformatics and Cartography: This unit concentrates on environmental issues in European urban areas (Berlin) in the regional context (Brandenburg) and in transformation countries (land degradation).

Technical University Berlin, Division of Photogrammetry and Cartography: This unit concentrates on processing software for the "Mars Express" mission scheduled for June

2003. The intention is to prepare an image map of Mars at the scale of 1:200,000. Furthermore, polarimetric SAR tomography is investigated as a new RS technique, extending 2D SAR into three dimensions. An additional synthetic aperture in elevation is created by several coherent parallel flight tracks to resolve the scattering ambiguity for volume structures. For OEEPE, data fusion experiments combining SAR with optical images are carried out for updates of topographic objects.

University of Bonn, Centre for RS of Land Surface and RS Research Group: This Centre, with a staff of 15, hosted the EARSel Workshop on RS for Developing Countries in September 2002, and is preparing for the next workshop in May 2004 in Dubrovnik. The prime research is on land use changes, both in the State of North Rhine – Westfalia, as well as in developing countries (Project GLOWA-Volta, East Africa, Ghana and Benin, Morocco and Namibia) using a variety of satellite sensors (Landsat 7, SRTM, Envisat). A number of research proposals have been submitted (glacier movement on the Antarctic peninsula via InSAR and digital photogrammetry; GMES participation in northern areas, UNESCO Uzbekistan project). The Centre organises graduate courses in aspects of RS in the English language.

Technical University of Dresden, Institute of Cartography: The Institute engages in land use mapping updates in comparison to the project of 1994 for the State of Saxony. In addition a mountain map of the highest Chilean volcano (6893 m) is compiled at the scale of 1:100,000 using Aster data and SRTM. Similar mountain maps have been produced in the Tianshan (Chan Tengji 6995 m and Pik Pobly 7436 m). For Siberian glacier and forest changes in the Altai region, recent satellite images were compared with Corona images.

University of Freiburg, Division of RS and Land Information Systems: The division engages in a number of EC- and DLR-funded projects: 3D pattern recognition models based on airborne laser scanners; a forest cadastre for the State of Thuringia from multispectral satellite images; storm damages in forests of Baden-Würthtemberg;

coastal rain forest monitoring on the Brazilian Atlantic coast; biodiversity assessment in Europe via satellite images, aerial photos and laser scans; eco-tourism GIS development. A number of forestry related European RS projects have been completed during 1999-2002.

University of Freiburg, Institute of Physical Geography: The Institute concentrates on global land ice measurements from space, and acts as regional centre for the Antarctic Peninsula in co-operation with the USGS. It uses Aster, Landsat, Modis, ERS, Radar and Envisat data to retrieve glacier surface parameters, and is creating a glacier inventory for that region. For King George Island in Antarctica, a GIS for multi-disciplinary applications is being created. Another project is on the glaciers of Patagonia to study the impact of global climate changes. Land use changes of Araucaria forests in Argentina are also studied. Another project in Chad concerns the study of land cover and the detection of nomadic migration routes.

University of Göttingen, Department of Cartography, GIS and RS: The department participates in the DFG-sponsored project Antarctica, investigating ice changes in the Otto-von-Gruber range, for which old aerial photographs of 1938/39 exist. Russian and Norwegian campaigns have been carried out in the 1950s and 1960s and recent BGK images are available from 1996. A project for glacier floe monitoring in Alaska has been applied for. Another project is on the parameterisation of land use changes in tropical agro-forested areas.

University of Hannover, Institute for Photogrammetry and Geoinformation: The Institute investigates the geometric accuracy and topographic mapping capability from high-resolution satellite images. Regarding IKONOS-2, several software products have been developed to evaluate mono-scopic and stereo-scopic Carterra images of 1 m pixels. An affine transformation of the images to four or more GCPs yielded RMS values of 4.3 m (X) and 0.9 m (Y). This is about the same accuracy as achieved by Space Imaging-supplied rational functions with only one GCP. If both methods are combined and elevation and azimuth control is included, the X-RMS values can be reduced

to 1.2 m. IKONOS stereo images can be used to derive building heights. Stereo-scopic 15 m ASTER data gave residuals of 10 m in position and 15 m in height. SPOT 10 m pixel stereo data with a height-base ratio of 1.5, yielded accuracies of 14 m in position and 10 m in height. For Corona images with a height-base ratio of 1.8, a relative elevation accuracy of 2 m was achieved.

Technical University of Munich, Chair for Forest Growth, and Limnological Station: The Chair for Forest Growth develops mathematical models for the growth of single trees depending on time, location and disturbing factors. RS give base information for initialising the models. In particular, laser scanner data and multi-frequency / multi-polarisation data are used. The Limnological station studies the ecological relations of structure, content and energy of inland waters including ground water. RS serves as a data pool, together with expert knowledge in a GIS.

Activities of other German EARSel laboratories:

The activities of other German EARSel laboratories can be extracted from their web pages: (a) BGR, Hanover / www.bgr.de (technical co-operation); (b) University of Trier, Department of Geography / www.feut.uni-trier.de (groundwater formation); (c) University of Munich, Department for Geo- and Environmental Sciences / www.uni-muenchen.de (hydrological parameters); (d) University of Oldenburg, Department of Physics / www.physik.uni-oldenburg.de (laser scanning of the sea); (e) University of Stuttgart, Institute of Navigation / www.nav.uni-stuttgart.de (radar interferometry, SRTM, laser-scanning); (f) Max-Planck Institute for Meteorology / www.mpimet.mpg.de (biochemical and physical processes of the Earth system); (g) Optimare / www.optimare.de (marine remote sensing).

2.4.9 RS activities in 2002: Italy

Mario A. Gomasasca, Italian Remote Sensing Association (www.asita.it/ait)

The activities in the last year in Italy concerning RS were extremely active. The large reduction of the Research budget ap-

proved by the Parliament in the Financial law of 2002, was very negative also for the Italian RS Community. Several but not all of the RS activities are reported below.

In 2002 the Italian Government appointed Sergio Vetrella, for several years EARSel chairman, as president of ASI / Italian Space Agency (www.asi.it). ASI, on the basis of Italian Government Directives, has already started joint activities with ESA programmes and other international space agencies (e.g. NASA, CNES, DLR, CONAE). Italy has a fundamental role in the following projects: Vega (strategic ESA small-medium launcher), Galileo (Europe's own global navigation satellite system), COSMO-SkyMed (first dual satellites constellation for high resolution EO).

The Italian Space Programme / Piano Spaziale Nazionale (2003-2005) is the first that derives from guidelines of the Instruction and Research Ministry's National Research Programme. The central focus is application-oriented, whereby research and innovation are used to reach well defined product objectives. There are five main thematic areas: EO, Telecommunication, Navigation, Medicine and Bio-Technology, Astronomy and Astrophysics. Concerning EO, a strong focus has been on four main themes: oil spill, landslides, floods, and forest fires. EO is a top priority in ASI's Strategic Plan. Besides ESA programmes, ASI is promoting and funding several Earth Science researches and demonstrative / operative national programmes. COSMO-SkyMed is an end-to-end EO System dedicated to Earth RS and data exploitation, in collaboration with CNES's Pleiades programme. Since early 2000 Pleiades has become a co-operative programme, with a co-ordinated development with the Italian Cosmo-SkyMed radar programme, under the name of ORFEO. ORFEO aims to set up a Dual Use EO system (i.e. a system usable by both civilian and military users. Besides specific defence needs and constraints, the Dual System is specified to fulfil a broad spectrum of applications, addressing scientific, institutional and commercial users. Risk management and the monitoring of coastal zones and sea pollution are also considered important.

ASITA / Federation of the Scientific Societies for Geographic and Environmental Information (www.asita.it) is based on the collaboration of four Scientific Associations concerning different aspects of geomatics: SIFET (Società Italiana di Topografia e Fotogrammetria), representing Italy in ISPRS; AIC (Associazione Italiana di Cartografia), representing Italy in ICA (International Cartography Association); AIT (Italian Remote Sensing Association), associate member of ISPRS; AM / FM / GIS (Automated Mapping / Facilities Management / GIS) Italia, representing Italy in EUROGI (European Umbrella for Geographical Information). The 6th National Conference was held in Perugia on 5-8 November 2002. About 1,200 registered at the Conference, 380 papers were presented, and more than 50 exhibitors presented their technical solutions in the field of the GI.

AIT / Italian RS Association has a new Steering Committee for the next 3 years. The new President is Dr. Ruggero Casacchia (casacchia@ntserver.iaa.mlib.cnr.it), CNR-IIA, Roma. With the past president, Prof. Giovanni Lechi (1997-2002), AIT increased its number of members to 450, and founded ASITA. AIT has published three issues per year of the Italian-reviewed RS Journal (Rivista Italiana di Telerilevamento). AIT coordinated a research team of Italian laboratories for the definition of quality in RS products, a project founded by ASI.

The Working Group on "Earth Observation" / OT (www.iroe.fi.cnr.it/ot) was established in March 2000. Founders of the Group are several Institutes of the National Research Council of Italy concerned with EO. The main aim is to promote relationships among EO entities in Italy.

The aim of CNR-IREA / Institute for the Electromagnetic Detection of the Environment (www.irea.cnr.it), in Milan, is to develop studies in the optical and radar spectral ranges with environmental applications. CNR-IIA, Rome (www.iaa-cnr.it) manages the hyperspectral airborne MIVIS (Multispectral Infrared / Visible Imaging Spectrometer) over the Italian territory in co-operation with CGR, Parma. MIVIS performances were checked and a substantial improvement was achieved by radiometric

calibration of the instrument. Relevant environmental issues were studied using MIVIS: in particular, surveys were conducted in several Italian regions to collect information on vegetated areas, and in urban areas to detect asbestos and to monitor impact of waste disposal. MIVIS data were also acquired during the Etna eruption in July-August 2002, thus providing valuable data for volcanologic research, and to support ASTER data validation.

During the summer of 2002, ENEA-CLIM / Ente per le Nuove Tecnologie, l'Energia e l'Ambiente - Progetto Speciale Clima Globale (clima.casaccia.enea.it) successfully tested a new balloon-borne micro-lidar, during two stratospheric balloon flights in Europe. The instrument is a very light (<10 kg), small (<60 dm³) and low-consumption (< 10 W) optical radar performing, every 30 seconds, night-time profiles of aerosols plus molecular scattering and depolarisation at 532 nm, from the balloon level downward to the Earth surface, with a vertical resolution of 30 m. The main goal of the experiment is the study of tropical cirrus clouds in the framework of the Hibiscus EU project.

At the Department of Electronics and Information (DEI) of POLIMI / Politecnico of Milano (www.elet.polimi.it), the Permanent Scatterers Technique (PST) applied to ERS SAR data for monitoring ground deformation, has become fully operational. This is now offered as a service through Telerilevamento Europa (T.R.E.) a small spin-off company of POLIMI, established in March 2000. Recently, PST has been successfully applied to RADARSAT SAR data, and research on its applicability to ENVISAT (continuing ERS archives) is currently in progress at POLIMI. More than 2,800 ERS scenes have been processed for many international users. Ground-based parasitic SAR studies are currently in progress at POLIMI. A second prototypal receiving station has been almost completed. It consists of two synchronised satellite digital TV receivers that cross-correlate the direct TV signal with that backscattered by the terrain. The system will generate X-band SAR images of the observed area every twelve hours. They will be exploited to analyse X-band backscattering and inter-

ferometric possibilities, in order to evaluate atmospheric effects and availability of PS. A study on the optimisation of ENVISAT-SAR parameters has been carried out at POLIMI for ESA-ESTEC. The obtained parameter-setting has been actually adopted for the final ENVISAT configuration. Moreover a phase-preserving interferometric processor for ENVISAT ScanSAR data has been designed and implemented for ESA-ESTEC.

IAO / Istituto Agronomico per l'Oltremare – Natural Resources (www.iao.florence.it) in Florence has developed several bi-lateral development co-operation projects and contracts with international agencies. The most important concern the "Africover" project, which is the first phase of building a digital land cover database (1:200,000) for the Democratic Republic of Congo. The main training activities continue with the Professional Master on "Geomatics and Natural Resources Evaluation". During 2002 the 22nd edition was completed, with field work carried out in Morocco, and the 23rd edition was started, with participants from several Mediterranean and Sahelian Countries.

The activities of CNR-IFAC (www.ifac.cnr.it) in Florence, concern mainly ENVISAT projects, and verification and validation of some of the instruments on ENVISAT. Two aircraft campaigns on the M-55 Geophysica were carried out in July and October 2002, with the aim of validating the products of the chemistry instruments MIPAS, GOMOS and SCIAMACHY. Other measurements were carried out with the SAFIRE-A Far Infrared Fourier Transform spectrometer. In July 2002 a stratospheric balloon was launched from Trapani, with instruments for measuring the stratospheric composition (15-38 km) in order to validate MIPAS on ENVISAT. These experiments were carried out within the framework of an ASI project and ESABC activities (ENVISAT Stratospheric Aircraft and Balloon Campaigns). A European project (Envisnow), started in early 2002, mainly focuses on the use of ENVISAT ASAR, and the development and validation of algorithms for retrieving cryosphere (snow, glacier) parameters and soil moisture for use in global climate

study and hydrology. An experiment took place in the Italian Alps in spring with a set of microwave radiometers for the study of snow melting / re-freezing cycles within the framework of both Envisnow and ASI projects. A new lidar sensor, the FLIDAR-N, was developed for water column profiling in the marine environment from ships. A multivariate method for characterising different litho-types, and a user-friendly interface for the analysis of RS laser-induced fluorescence images of historic monuments, were also implemented.

The operational aerosol lidar system at CNR-IMAA / Istituto di Metodologie per l'Analisi Ambientale (www.iiia-cnr.it), in Tito Scalo, Potenza (Southern Italy), is able to provide independent measurements of aerosol extinction and backscatter at 355 nm, and backscatter at 532 nm. The aerosol backscatter coefficient is related to size, shape and chemical composition of particles, and measurements at two wavelengths are useful in order to retrieve a dimensional size characterisation of the aerosol layer. Further information on the optical properties of the atmospheric aerosol can be obtained from simultaneous and independent measurements of aerosol extinction and backscatter at the same wavelength. The resulting extinction-to-backscatter ratio (lidar ratio), is in fact strongly dependent on particle size distribution and chemical composition of aerosols. This lidar system is part of the EARLINET project: the first European network of twenty advanced lidar stations operating to provide a quantitative climatological database of the horizontal, vertical and temporal distribution of aerosols over Europe. In addition to the routine measurements, further observations are devoted to monitor special events such as Etna volcano eruptions.

IPRS / Image Processing and Pattern Recognition for RS Laboratory (spt.dibe.unige.it/IPRS) at the University of Genoa is involved in the development of image analysis and pattern recognition methodologies for several EO applications. In recent years, IPRS has contributed to several projects for ASI, the Italian Ministry of University and Scientific Research, and the EU. This year the activity deals mainly with:

multi-temporal classification using spectral / contextual fusion; multi-source fusion, involving also textural information; feature selection in hyperspectral and multi-dimensional data; water quality analysis; supervised and semi-supervised classification and change detection based on Markov Random Fields; coastline extraction from satellite SAR images, based on the fusion of intensity and coherence information extracted from an Interferometric couple.

2.4.10 RS activities in 2002: Netherlands

Prof. Dr. Freek van der Meer, ITC / Delft University of Technology, The Netherlands

Space research in the Netherlands is concentrated on astrophysics, microgravity research and EO. The astrophysics community participates, as sole European partner, in the main space telescopes currently or formerly operational (Hubble, Gamma Ray Observatory, Infrared Space Observatory, XMM-Newton and Chandra). This field is also involved, through the Institute for Space-Oriented Research (SRON) of the National Science Foundation (NWO), in the ESA mission FIRST (it is planned to participate in the XEUS and IRSI / Darwin missions). The microgravity research community is preparing experiments in outer space using the International Space Station, focusing on life sciences, mainly molecular and cell biology, and physical material sciences. The EO community plays an important role in ESA, with core competence in atmospheric chemistry and composition, meteorology, ocean currents, climate research and global change, gravity field and geoid research and geokinematics, and a minor role in land degradation and erosion, geological, water quality, and hydrological studies. Dutch researchers are involved in several ESA Earth Explorer Missions (core type). The GOCE and ADM missions have been selected, and the Netherlands is also involved in pre-phase-A studies for ACE, EarthCARE and SPECTRA.

The core missions of SRON are atmospheric chemistry and the Earth gravity field.

SRON developed the ENVISAT instrument SCIAMACHY (in collaboration with German partners), the Global Ozone Monitoring Experiment (GOME), and supports the Ozone Monitoring Instrument (OMI). In addition, SRON is involved in the preparation of various future ESA missions (e.g. SFINX and ACE). The Gravity Field and Steady-State Ocean Circulation explorer (GOCE) is part of SRON. The Vening Meinesz research school of geo-dynamics (at Utrecht University), hosting the Delft Institute for Earth-Oriented Space Research (DEOS), form the core of the Netherlands scientific infrastructure in gravity field research linked to geo-dynamics. The Institute for Marine and Atmospheric Research / IMAU based at Utrecht University, is involved in many international studies in atmospheric chemistry and ocean current research. Studies on land degradation and land cover / use are pursued at Wageningen University (WUR). Hydrology is a competence of the IVM of the Free University Amsterdam, and WUR. Laser altimetry and imaging spectrometry studies are carried out at the Technical University of Delft.

The Dutch Meteorological Institute / KNMI is the prime institute for atmospheric chemistry, and processes research and meteorology. The Centre for Climate Research focuses on global change issues. The Institute for Public Health and Environment / RIVM specialises in environmental monitoring. The Survey department of "Rijkswaterstaat" exploits airborne RS techniques for vegetation studies, water quality assessment, and preparing and maintaining the actual DEM of the Netherlands. The Institute for Coastal areas and Sea / RIKZ is involved in EO for coastal processes. The International Institute for Geo-Information Science and EO / ITC is one of the largest institutes devoted to EO in the Netherlands, whose mission is knowledge transfer in the field of geo-information to students mainly from developing countries. This is done through a PM, M.Sc. and Ph.D. programmes, based on a strong EO research programme.

Private companies in the EO sector – trends and developments:

There is strong cohesion in the Netherlands

in EO between research groups and industry, linking fundamental and application-oriented research, leading to a strong position in the operational use of EO. Many private companies and smaller consulting firms (e.g. Geodan, Argoss, Wageningen Radar surveys) demonstrate this, as does the operational use of EO in governmental institutes (e.g. the Survey Department). On the technology side, TNO Space, Fokker Space, and the Dutch Space Agency / NLR play an important role, with fundamental research centres at the Delft University of Technology. An important development is the establishment of the Geomatics Business Park, a business and science park near NLR, Marknesse, Flevoland. This provides offices and facilities to high-tech companies in RS and associated technologies, along with several research laboratories.

R&D funding status and development:

For fifteen years, the Netherlands Remote Sensing Board (BCRS) was the funding organisation for many RS projects. The BCRS has ceased to exist, but the programmes continue in a different format. The Netherlands National Science Foundation (NWO) supports fundamental research (through SRON) in EO, and is founder of SRON.

National platforms:

Two important national platforms have been established: the national user platform, under the chairmanship of Prof. Karel Wakker and under the auspices of NIVR, will co-ordinate communication between government and the Dutch EO user-community. The GMES National Forum co-ordinates the Dutch input in the ESA-EU GMES initiative.

Geodesy education stopped!

Due to financial constraints and the relatively low number of students, the course on Geodesy at the Delft University of Technology has been stopped. Geodesy is one of the oldest studies at the university and its research programme is of excellent international quality and standing. This decision is regrettable for our profession. Part of the research, and groups, on space geodesy and cadastral geodetic applications will be grouped under the Faculty of Aerospace Engineering. Within the new BAMA

structure, a M.Sc. programme in EO is planned for 2003. The GIS-related expertise will move to the OTB research institute.

GIN.nl – the new EO society:

The professional society for EO in the Netherlands is the Netherlands Society for EO and Geo-Information (NSEOG), with 700 members and three sections: RS, GIS, and photogrammetry. From 1 January 2003, a new society, "Geoinformatie Nederland (GIN)", has been established, which amalgamates about nine professional societies in the field of geo-informatics and EO, the NSEOG being one of these. GIN will have a board and a number of sections / departments of which EO is one and GIS another. In total, the GIN society will have 3500 members and around 500 institutional members. Specific activities of GIN include a yearly congress, the former Geodesia congress, seminars and workshops organised by the various sections and other exchange of information. The society will offer a number of scientific journals and periodicals that were previously published by the participating societies, and will publish a new journal and newsletter. Details can be found at www.geo-info.nl.

2.4.11 RS activities in 2002: Poland

Major RS research / application activities in Poland were carried out in the following centres / institutions: RS Department, Institute of Geodesy and Cartography, Warsaw; RS of Environment Laboratory, Faculty of Geography and Regional Studies, University of Warsaw; Satellite Research Department, Institute of Meteorology and Water Management, Cracow; Space Research Centre, Polish Academy of Sciences, Warsaw; Geosystems Polska, Warsaw.

Activities at the **RS Department, Institute of Geodesy and Cartography** in Warsaw concentrated on land applications of satellite data, with special emphasis on further development and operational use of RS-based system for crop condition assessment and yield forecasting. Extensive studies on the application of multi-sensor data for analysis of soil moisture / vegeta-

tion conditions within wetlands areas were also conducted. The major works carried out in 2002 are mentioned below.

Development of crop condition assessment system for drought monitoring and yield forecast: About 200 daily NOAA / AVHRR satellite data of Poland were acquired for all of 2002, and an archive database, covering 1992-2002, was created for the whole country. Information packages on crop condition assessment, containing maps and images derived from comparative analysis of NOAA / AVHRR data, were delivered operationally to the Central Statistical Office throughout the whole vegetation period (April-September). The INFOSAT database, containing vegetation and temperature indices derived from NOAA / AVHRR data, was developed for 1992-2002.

Development of methods for soil moisture assessment and classification of wetland areas by synergistic use of optical and microwave satellite data: A method of soil moisture assessment for wetlands, using microwave satellite data, was created. In parallel, a methodology for studying ecological changes within wetlands, through multi-source optical / microwave satellite data, was prepared. The combined approach, aimed at analysis of vegetation parameters with the use of microwave ERS and JERS images was also applied.

Production of land use maps on the basis of high-resolution satellite images: Research within this project resulted in a hybrid method for producing satellite-derived land use / cover maps. The method is based on high-resolution pan-sharpened IRS LISS III satellite images, and their analogue interpretation. As a result, a 1:50,000 detailed land use map, comprising land use / cover categories corresponding to Level 4 of the CORINE nomenclature, was prepared.

Multi-media geo-information for e-communities in rural areas with eco-tourism: The aim of this 5th Framework Programme IST project is to develop an improved tourist information system for promoting rural development. The ReGeo system will be based on a virtual geo-multimedia data-

base to serve different applications, and will be accessible both off- and on-line, as well as through interfaces to other e-platforms. Advanced multi-media presentations will be prepared with the project. The project will benefit tourism development, enterprise marketing, local administration, decision-making, planning and presentation of regions.

The **RS of Environment Laboratory, University of Warsaw** was mainly involved in the application of multi-source satellite data and aerial images for assessment of environmental changes in Poland, apart from its educational function within the Faculty of Geography and Regional Studies. In particular the projects related to monitoring of abiotic conditions of the anthropogenic pressure on the vegetation of the Narew River National Park, as well as assessment of socio-economic changes in Carpathian Mountains, were conducted. Work on geo-morphological large-scale mapping using GIS, RS data and terrain analysis were continued. Research on artificial neural networks in land cover classifications was started. In co-operation with DLR, work on application of hyperspectral data for analysing and monitoring mountainous ecosystems, including heavy metal contaminated vegetation, was started.

In 2002 the **Satellite Research Department, Institute of Meteorology and Water Management** conducted work on meteorological applications of RS. In particular, operational acquisition of METEOSAT and NOAA data for meteorology was continued, and a database of meteorological satellite images for 2002 was extended. Estimation of surface radiation using METEOSAT data, and forecasting of UV-B radiation on the Earth's surface, were continued. The Department was deeply involved in EUMETSAT activities, which Poland joined in December 1999.

In 2002 the **Space Research Centre, Polish Academy of Sciences** continued its research works related to the construction and application of several RS instruments. In particular, activity was concentrated on constructing a soil sounder for measuring heat fluxes and a microwave sounder for soil moisture measurements. A radiometer

for measuring aerosol content in the atmosphere, which can support activities related to atmospheric corrections of satellite data, was also constructed.

GEOSYSTEMS Polska is an RS / photogrammetry and LIS / GIS laboratory involved in various types of geographic data processing, spatial analysis and geo-visualisation, including satellite image mapping, thematic mapping, land use / cover classification, and creation of digital terrain models. In 2002 the Laboratory prepared the concept of a GIS for the Tatra National Park, including RS-derived information. It also continued the preparation of ecological layers for a digital map of Poland. In particular, ortho-photomaps of national parks, nature reserves and protected areas, based on satellite images, were produced.

In September 2002, the international conference on **GIS and RS in Mountain Environments** (EnviroMount), in Zakopane, Poland, attracted over eighty geo-matics professionals from fourteen countries. The emphasis in most presentations was on mountain forests and vegetation.

2.4.12 RS activities in 2002: Spain

Prof. Dr. José-Luis Casanova, University of Valladolid, Spain

The most important themes among Spanish researchers are on oceanography and environmental protection. During 2002, the work of Spanish groups participating in the studies of scientific definition of the SMOS mission of ESA (mainly ICM-CSIC, Polytechnic University of Cataluña, University of Valencia), have continued under the direction of Dr. Jordi Font, on the analysis of data from the 2001 campaigns (EuroSTARRS airborne and WISE). In November 2002, the ESA organised a meeting in Toulouse, where the latest results were presented.

There has also been an important participation of Spanish groups (ICM-CSIC, IEEC-CSIC, University Iles Balears) in in situ measurements for calibration of the ENVISAT altimeter. Several mareographs and radiometers have been displayed and

important campaigns have been carried out for the determination of sea-level below the satellite's path, through GPS-equipped buoys.

Doñana Biological Station has participated as end-users in the ESA-financed TESEO (Treaty Enforcement Support using Earth Observation) project, within the RAMSAR agreement on the protection of humid zones, under the direction of Dr. Ricardo Díaz-Delgado, where the Natural Park of Doñana has been used as a pilot zone. The project, which has been developed during a one-year period, aimed at using RS data in an effort to support the definite establishment of different international agreements on nature protection. These are MARPOL (sea pollution), RAMSAR (wetlands), KYOTO (climate change) and DESERTIFICATION from the UN.

In summary, extensive consulting was carried out with all those involved in the pilot area, in order to collect the most urgent requirements. The two firms managing the project (ATLANTIS, Cádiz and SISTEM, Barcelona) have been later identifying the RS possibilities for these requirements. They have also been defining a final product to help users within the RAMSAR agreement, as well as developing a prototype which is now being validated. Thus, a map of changes in flood levels during 2002 has been created for Doñana, by photo-interpretation of RADARSAT images, as well as a map of land use and cover changes during 1973-2002, with LANDSAT MSS and ETM+. Validation was done by an ad hoc aerial survey of flooded surfaces. This project also intends to gather all the organisations involved in these international agreements, in order to continue with the same objectives in the medium-term, and to plan a new project in which these preliminary results can be given new shape and consistency, providing a regular product to end-users.

In the region of Valencia, the team led by Dr. Ernesto López-Baeza has installed an Achor Station site that has recently been installed in the Utiel-Requena Plateau, near Valencia (Spain). It has the main objective of developing and providing a Calibration / Validation (Cal / Val) test area principally dedicated to large-scale low spatial resolution RS mis-

sions. In this station, representing a large 50x50 km area, different meteorological magnitudes are measured: wind speed and orientation, ground temperature at different levels, humidity, etc, as well as the ascendant and descendant radio-active fluxes.

Two Congresses have been held, one at national and the other at international levels. The former was the 10th Congress on Quantitative Methods, Geographic Information and RS Systems, "Science and Technology of Geographic Information in a Globalized World", in Valladolid on 17-20 September 2002. It was organised by the Group of Quantitative Methods, Geographic Information and RS Systems, the Association of Spanish Geographers and the Geography Department of the University of Valladolid. It was organised by Dr Jose Luis García Cuesta and had 200 attendees. The international meeting was "Recent Advances in Quantitative RS", in Torrente (Valencia) on 16-20 September, organised by the Global Change Unit of the University of Valencia under the direction of Dr. José Antonio Sobrino. Around 150 papers were given, which have been published in the Proceedings by the Publishing Service of this university, with almost 1000 pages.

Within the activities of exchange and co-operation with Latin-America, two courses can be mentioned. The first, held in Tandil (Argentina) was directed by Dr. Vicente Caselles. The second, addressed to RS experts, was held in Cartagena de Indias (Colombia), under the direction of Dr. Federico González-Alonso. The Spanish Remote Sensing Association has published the two yearly numbers of its "Revista de Teledetección", in Spanish, and has carried out its usual activities: seminars, news dissemination and so on. Apart from these tasks, the different groups working in RS, as well as the companies linked to the distribution of images and technological development, have continued with their customary research, development and innovation tasks.

2.4.13 RS activities in 2002: UK

Mr. Ian Downey, Chairman, Remote Sensing and Photogrammetry Society and Dr. Robin Vaughan, University of Dundee, UK

At the annual meeting of the Society held in October 2002, Lord Hesketh stood down after six years as President. His successor is Prof. David Rhind, currently Vice-Chancellor of City University, London and previously Director General and Chief Executive of the Ordnance Survey of Great Britain. The Photogrammetric Record and the RSP-Soc Newsletter continue to be published regularly and the International Journal of RS is to be published with 24 issues per year, with members still enjoying preferential subscription rates. The 2003 annual meeting of the Society will be held on 10-12 September in Nottingham, with the theme "Scales and Dynamics in Observing the Environment". For more information contact rspsoc03@geog.nottingham.ac.uk.

In July 2002, a consultation process began towards producing a new UK Space Strategy aimed at promoting an innovative and competitive space sector and at ensuring that UK citizens, scientists and enterprises will have access to advanced space-based systems and services. A draft for public consultation is expected in early 2003. More information can be found on the British National Space Centre (BNSC) website: www.bnsc.gov.uk.

A new funding structure for UK space activities was set up in September 2002, making the Natural Environment Research Council (NERC) responsible, from April 2003, for the whole ESA EO science budget for optional programmes, such as the Earth Observation Envelope Programme. NERC has established six EO Centres of Excellence in order to stimulate the exploitation of EO data in environmental science. A workshop will be held at the University of Wales, Swansea, on 31 March – 1 April 2003, for an exchange of information between participants in these Centres, open to the entire UK EO community. The centres and principal investigators are: Centre of Observation of Air-Sea Interactions and Fluxes (Prof. Jim Aiken and Prof. Ian Robinson); Climate and Land Surface Systems Interaction Centre / CLASSIC (Prof. Mike Barnsley, University of Wales); Centre for Terrestrial Carbon Dynamics (Prof. Shaun Quegan, Sheffield Centre for Earth Observation Science); Centre for Observation and Modelling of Earthquakes and

Tectonics (Dr. B. E. Parsons, University of Oxford); Data Assimilation Research Centre (Dr. William Lahoz and Prof. A. O'Neill, University of Reading); Centre for Polar Observation and Modelling (Prof. D. J. Wingham, University College London). More details are at www.nerc.ac.uk/funding/earthobs/EO_Prog.shtml.

A millennium map of the UK, based on aerial photography has been completed for England. Wales and Scotland are being completed. The Ordnance Survey has announced that it will include an imagery layer within the new National Digital Framework (NDF). A pan-government agreement is making this digital map and image data available across all UK government departments to stimulate coherent service provision via e-government. This is galvanising private sector airborne image and mapping operators to form the Geographical Industry Forum as a means to develop these services profitably.

A new low-cost UK instrument, CHRIS (Compact High Resolution Imaging Spectrometer), on board the ESA technical demonstrator satellite PROBA-1, continues to operate well. This new space-borne instrument technology will observe the Earth from an orbit of 800 km, providing UK and European scientists with new measurements of the atmosphere, vegetation and minerals. CHRIS is a hyperspectral instrument with a spatial resolution of about 20 metres, flown as the main payload on a European satellite managed by ESA and built by Verhaert (Belgium) with the contribution of European and Canadian Industry, as part of ESA's Project for On-Board Autonomy (PROBA). This programme sets out to demonstrate new on-board technologies in the design of a small, flexible and versatile satellite missions.

Other missions launched during 2002 with important UK contributions include Envisat (ASAR, AATSR) and MSG-1 (GERB). In December 2002, Surrey Satellite Technology Limited (SSTL) successfully launched the first satellite (ALSAT-1) of the Disaster Monitoring Constellation (DMC). Current EO satellites offer infrequent images and often delivery of critical images may take months due to periodic cloud cover and

tasking conflict. They are also very expensive and designed to be general-purpose instruments to meet many wide-ranging user requirements with spectral imaging characteristics not ideally suited to disaster monitoring functions. SSTL and its partners propose a network of affordable micro-satellites providing imaging on a daily basis as an affordable solution to the problem of disaster assessment and monitoring from space. The first Opportunity Mission of ESA's Earth Explorer Programme, CRYOSAT, is led by Duncan Wingham of University College, London, and is scheduled for launch in 2004.

2.5 Need for post-Landsat, SPOT data continuity

The need for an operational supply of post-Landsat and SPOT, medium-resolution remote sensing satellite data for forestry and land cover monitoring

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Medium-resolution data like Landsat TM and SPOT are used operationally by forest authorities in some countries. The Finnish National Forest Inventory has since 1991 improved their statistics by combining National Forest Inventory (NFI) plots with Landsat data. Similar methods are also being introduced in Sweden and tested in several other countries as well. Another example is that of the Swedish Forest Administration which buys a yearly coverage of TM or SPOT data over Sweden for updating of clear-felled areas. For the above mentioned forestry needs, pixels in the order of 5-30 metres are sufficient, but it is important that scenes cover large areas, preferably on the order of 200x200 km. Large scenes enable a sufficient number of field plots per scene, and a good chance to obtain cloud-free images. A few spectral bands in the visible to mid-infrared wavelength regions are sufficient, with the mid-infrared as the most important for forestry purposes.

Medium-resolution satellite data have also become operationally used for land cover

mapping, such as in the CORINE programme. There is also an anticipated need for satellite data in land cover change mapping between 1990 and 2008 for reporting of carbon budgets. There are also efforts, for example, within the framework of the ESA / EU GMES programme, for making remote sensing (RS) even more operational. However, before new users are willing to adopt RS as part of large-scale operational routines, there must be a reliable future data supply. For medium-resolution data, the combination of three systems – SPOT, Landsat and IRS – formed just such a secure flow of data. It is therefore a bit worrisome that both the present SPOT and Landsat are the last satellites of their kind, and that currently there are no existing officially disclosed plans for a future operational supply of medium-resolution data over Europe.

The present Landsat 7, which has a design lifetime until around 2006, will as a result of political decisions not be followed by a US government-owned "Landsat 8". NASA has instead a request for proposal, issued on 6 January 2003 (prod.nais.nasa.gov/cgi-bin/eps/sol.cgi?acqid=102577), which specifies the requirements for a Landsat Data Continuity Mission (LDCM). The plans are that an industry-owned satellite in 2007-2013 shall deliver 250 "Landsat-like" scenes per day from all over the world to the US government. This is half the current receiving capacity for Landsat data in the USA. It can be anticipated that the image acquisition capacity for scenes exceeding the initial 250 will be commercially operated, and the implications of this for the data supply in Europe are presently unknown. The LDCM project is further described at ldcm.usgs.gov and ldcm.nasa.gov.

The present SPOT 5, with an expected lifetime until around 2007, will be replaced with the Pléiades series of satellites. However, at least the first two Pléiades satellites, to be launched in 2005 and 2006, are high-resolution satellites with 0.7-2.8 metre pixels, and have only 21 km wide scenes. Fortunately, an option mentioned for future Pleiades missions includes sensors for larger scenes (up to 300 km wide) with medium-resolution pixels (Kramer, 2002).

The commercial market for medium-resolution satellite data appears to be weak, as indicated by the following citation: "market research by NASA and the USGS clearly determined that there was no existing source of data that could provide continuity to the nearly 30 years of Landsat data archived by USGS. It also proved that the market for moderate-resolution data was insufficient to make it profitable for a private firm to design, build, launch and operate a Landsat-like mission solely through commercial funding and revenue streams" (ldcm.usgs.gov/rfpfaq.html). One of the very few officially disclosed commercial initiatives in this segment is the German company, Rapid Eye (www.rapideye.net), which in 2004 plans to send up a constellation of four satellites with 6.5 m pixels and 79 km wide scenes. However, forestry is at present not named among the considered application areas.

For high-resolution satellite data, with pixel sizes of around 1 metre, there is an emerging and probably sustainable market, which is backed by military needs and orders. For low-resolution data, with pixels of 400-1000 metres, there is and will continue to be a secured supply of data through the institutional world-wide cooperation of weather services. The operational supply of medium-resolution optical data, with pixels of 5-30 metres, seems to be an intermediate "no-man's-land" at the moment, where both market and institutional structures are weak. Operational needs for data do exist, especially within government administration, but the pioneer authorities can hardly bear the costs for the systems alone. A large additional value of the data is the documentation of landscape changes that they could provide for future generations. A basic regular supply of medium-resolution data should therefore preferably be regarded as society infrastructure.

The undertakings to be made are not huge. It would be sufficient that EU / ESA, possibly in partnership with industry, would support having one or a few operational satellites producing SPOT- or Landsat-like images, in space at any one point in time. Ideally, the needed redundancy in the data flow could be obtained by establishing a

co-operation with one or a few other space nations that are willing to do the same, for example Japan, India or USA. One opportunity to express the needs in the above indicated direction is, before the end of May, to give a response to the EU / ESA Green paper on European Space Policy (www.esa.int/export/esaCP/SEMERO1A6BD_Benefits_0.html).

- Kramer, H. J. 2002. "Observation of the Earth and its Environment – Survey of Missions and Sensors". 4th edition. Springer Verlag. 1514 pages. ISBN: 3-540-42388-5.

2.6 25 years of China-Europe co-operation on EO

During February and March of 2003, Prof. Dr. John van Genderen of the International Institute for Geo-Information Science and Earth Observation (ITC) in Enschede, the Netherlands, will celebrate the Silver Jubilee of scientific co-operation between Europe and China, with a lecture tour to various cities in China. It all started in 1977, when a senior delegation of officials and scientists from the Chinese Academy of Sciences (CAS), visited Europe to discuss establishing scientific co-operation between European and Chinese researchers. This visit was hosted by the Royal Society in London, UK. As one field in which China wished to establish joint research activities was remote sensing (RS), Prof. van Genderen was invited to join these discussions in London. As a follow-up, he was invited by CAS to visit China in the spring of 1978.

On his first visit to China, during April and May of 1978, he gave several lectures and held meetings with Chinese scientists to discuss the setting up of an Institute for Remote Sensing. He was the first European RS scientist to visit China. This was still in the time before Deng Xiaoping became President of China and started the "Open Door" policy. The president during Prof. van Genderen's first visit was Guo Hua Feng. With typical Chinese organisational efficiency, CAS established its Institute for Remote Sensing Applications (CAS-IRSA), which commenced work in 1980, with Academician Prof. Cheng Shu Peng as its first

Director. Since then, there has been a long and strong relationship between CAS-IRSA and ITC, and other European RS organisations. In 2000, Prof. van Genderen was one of the guests at the 20th anniversary Celebrations of CAS-IRSA. As a result of his first visit, Dr. He Changchui, a young physics graduate at the time and who acted as his interpreter and guide during that trip, came to ITC to study the following year. Also several other ITC staff members were invited to China for follow-up later on. Many of the more than 300 Chinese who have studied geo-information and Earth observation (EO) at ITC since then have obtained senior positions back in China. Over the past 25 years, Prof. van Genderen has visited China over 100 times. During this long period of co-operation with Chinese organisations he has carried out numerous research and consulting projects in China.

In 1986, ITC received a large grant from the Netherlands government to set up a sister institute in Wuhan, in Central China. This Educational Centre for Urban and Rural Planning and Management (ECURSPAM) was affiliated with the then Wuhan Technical University of Surveying and Mapping (recently merged with Wuhan University). The EU awarded several research projects under the 3rd, 4th and 5th Framework Programmes. For the Asian Development Bank, Prof. van Genderen was Team Leader for a major Technical Assistance Project on "Monitoring and Management of Fragile Ecosystems in Shanxi-Shaanxi-Inner Mongolia". He has given numerous training courses and research seminars on EO throughout China, funded by organisations such as the UN, ESA, Radarsat International, and others. In 1994, he attended, on behalf of the Netherlands Government, the 1st Ministerial Conference on Space Applications in the Asian Pacific Region, held in Beijing, as well as attending many other international conferences in China over the past quarter of a century, such as the Asian Conference on Remote Sensing, the International Geological Congress, the first International Symposium on Digital Earth.

Prof. van Genderen is probably best known for his research into the problem of under-

ground coal fires in north-west China. Since 1987 he and his team of RS researchers at ITC have carried out numerous projects in this field in Xinjiang, Gansu, Ningxia, Shaanxi, Inner Mongolia, resulting in many scientific publications in internationally refereed journals, wide coverage in the media, and several Achievement Awards by the Chinese government. In 1987 he was appointed Honorary Professor in RS at the Xi'an University of Science and Technology, and in 1996 he also became Honorary Professor at the Wuhan University. He has often been referred to as the

Dutch "Marco Polo", building a bridge between China and Europe, and contributing both to knowledge transfer and joint Sino-European co-operation. The many Post-Doctoral scientists, visiting scholars, PhD and MSc students that he has assisted, are now ensuring that China is becoming a leading actor on the international EO scene. By personally leading many Chinese delegations on European study tours to visit RS companies, research institutes and government organisations throughout Europe, he has fostered further co-operation between China and Europe in EO.

3 NEWS FROM ESA, THE EC AND INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 Loss of Space Shuttle Columbia: news update

On 21 February 2003 it was reported that the Columbia Accident Investigation Board (CAIB), chaired by retired Admiral Harold Gehman, with support from a number of boards and expert groups, had taken over full responsibility for the investigation of the Space Shuttle Columbia disaster on 1 February 2003.

Regarding the implications for the International Space Station (ISS), meetings have taken place between NASA and Rosavakosmos (Russian Aviation and Space Agency) on overall re-supply and crew exchange strategies, and between NASA and ESA on the potential rearrangement of taxi flights with ESA astronauts within this situation; these discussions have not yet reached conclusions and will be pursued. Meanwhile the crew that was meant to fly on the next Shuttle flight are still in training, and in parallel a crew for the next Soyuz flight (in April 2003) are being trained in case they have to become the next Expedition crew.

STS-107 (Shuttle Transportation System – Flight 107) was a multi-disciplinary mission dedicated to scientific and commercial

research under microgravity conditions and to technological experimentation in space. The STS-107 mission, with its team of seven astronauts, had a duration of sixteen days, during which more than 100 new experiments on science, technology, applications and research had been performed. The STS-107 mission ended in disaster on Saturday 1 February 2003, when the Space Shuttle Columbia disintegrated during re-entry into the Earth's atmosphere, killing all seven astronauts.

Seven experiment facilities for the STS-107 mission had either been developed by ESA, or their utilisation was co-ordinated and financed by ESA. These were: Advanced Protein Crystallisation Facility (APCF); Advanced Respiratory Monitoring System (ARMS); Biobox; Biopack; Combined 2 Phase Loop Experiment (Com2PLEX); European Research in Space and Terrestrial Osteoporosis (ERISTO); Facility for Adsorption and Surface Tension (FAST). APCF, Biobox, Biopack and FAST flew as part of an agreement between ESA and NASA, the so-called "Super-Guppy ESA/NASA Barter Agreement", by which Europe provided a Super-Guppy transport aircraft to NASA, that was formerly used for the transport of Airbus parts in Europe, and in exchange NASA granted ESA the right to fly up to 1000 kg of experiment hardware on the two Space Shuttle / Spacehab missions STS-95 and STS-107.

ARMS, ERISTO and COM2PLEX flew as part of a contractual agreement between ESA and Spacehab Inc., through Spacehab's commercial agent in Europe, the company Intospace, located at Hanover, Germany.

ESA also played a role in the mission through the fact that the Spacehab Double Research Module which, carried in Space Shuttle Discovery's cargo bay, accommodated most of the experiments, is directly derived by American and European industry from the technology and know-how gained from the European space laboratory programme SPACELAB, that was developed, built and operated for Europe under ESA contract. For more information, visit the ESA web-sites www.esa.int and www.spaceflight.esa.int, or the joint website for the space shuttle and the International Space Station (spaceflight.nasa.gov).

3.1.2 Ariane 4 blasts into history

On Saturday 15 February 2003, the final mission for Europe's Ariane 4 series of rockets was successfully carried out, with the placing in orbit of a telecommunications satellite (Intelsat 907). The early morning launch marked the final flight of an Ariane 4, and the 116th mission of this launcher version (the 159th overall), which entered service on 15 June 1988, and successfully orbited 158 primary payloads (plus 24 auxiliary passengers) with a combined mass of well over 400 metric tons. The Ariane 4, which has well over 100 safe launches to its credit, is being replaced by the much larger Ariane 5 rocket, which is capable of carrying bigger payloads into space. Ariane 5 has been in commercial use since 1999, but has a troubled record for operator Arianespace. It blew up on its maiden flight in 1996, and in December 2002 a heavier version of it had to be destroyed shortly after take-off because it developed problems.

The Ariane 4 launch on 15 February (Flight 159) had been delayed three times because of strong winds at high altitudes over the launch-pad in Kourou, French Guyana. Flight 159 was to be a triumphant event but the loss of the space shuttle Columbia and

problems with the new launch vehicle have cast a shadow over space exploration. Out of fourteen launches of the successor Ariane 5 so far, two rockets have exploded and two have put satellites into the wrong orbits.

After the final Ariane 4 launch on 15 February, Arianespace president Jean-Yves Le Gall told journalists that the Ariane 5 loss in December 2002 would cost the European space programme 300 million euros. Arianespace is planning to re-launch a basic version of the Ariane 5 after the end of March 2003, carrying two telecommunications satellites. Also in prospect is the launch early in 2005 of a 4.7 ton satellite to provide high-speed internet access throughout the Americas. Ariane 4 is being eased out of service because of market pressure to put bigger commercial satellites into orbit more cheaply. It took ESA ten years and \$7bn to produce the Ariane 5, a rocket intended to give Europe dominance in the commercial space business. This article is based on a report at news.bbc.co.uk/2/low/science/nature/2765657.stm.

3.1.3 Artemis finally reaches geo-stationary orbit

On 31 January 2003, it was reported that Artemis, the most advanced ESA telecommunications satellite ever commissioned, had finally reached geo-stationary orbit, some 36000 km above the Earth, at 21.5°E. This announcement would, if all had gone to plan, have been made just a few days after lift-off on 12 July 2001. Now, eighteen months and some serious brainstorming further on, Artemis is on station, ready to play its part in the development of new telecommunications services.

It will be remembered that Artemis (Advanced Relay and Technology Mission) was left in a lower than intended orbit when the Ariane 5 upper stage malfunctioned. It was even feared at the time that the entire mission might be lost. But thanks to creative thinking, often under severe time pressure, by engineering and other specialists from ESA, from prime contractor Alenia Spazio, from Astrium, which designed the ionic propulsion system, and from Telespazio, responsible for satellite operations at the Fuci-

no control centre, satellite and mission have now been recovered. Novel, unplanned use of the ion propulsion technology built into Artemis was the key to this success. Initially provided on an experimental basis to correct orbit drift once Artemis was on station, the ion propulsion system was used to raise the satellite's orbit from 31000 km to 36000 km. This is a much slower process than using a conventional apogee boost motor – a bit like using an outboard motor to drive an ocean liner – but here it was a case of better late than never!

Artemis has now taken up its operational station in Earth orbit and its instruments, placed in hibernation throughout the recovery campaign, have been reactivated. But while its real job is only just beginning, Artemis already has a world first to its credit, earned when its communications payloads were checked out from the ground while preparations for the orbit-raising operations proceeded. The highlight of those checks came when a link was established between the CNES SPOT-4 Earth observation satellite and Artemis (see ESA press release no. 75/2001); imaging data from SPOT-4 was transmitted by laser to Artemis and from there by radio waves to the Spot Image processing centre in Toulouse. An unprecedented link-up between satellites in space! Once all systems are fully active Artemis will be ready to embark on what may prove to be a ten-year operational career, barely less than the service life that had been planned before these celestial gymnastics became necessary – and which have in the end provided a wealth of information and experience for future missions. This article is based on a report at www.esa.int/export/esaCP/SEMQUEK1A6BD_index_0.html.

3.1.4 Envisat celebrates 1st anniversary in space

One year ago, on 28 February 2002, the largest and most sophisticated Earth observation (EO) satellite ever built blazed a fiery trail into the night skies above French Guiana and became another bright star in the constellation of spacecraft in ESA's Earth observation programme. The spacecraft, dubbed Envisat for Environmental satellite, carried with it a suite of ten ad-

vanced sensors designed to provide scientists on the ground with the most comprehensive look ever offered by a remote sensing (RS) satellite of the Earth's oceans, land, atmosphere and ice caps. Borne aloft by an Ariane-5 launcher, the picture-perfect launch of Envisat from the Europe's spaceport in Kourou was followed by a flawless insertion into a sun-synchronous polar orbit. Since reaching its final orbital position on 3 April 2002, Envisat has circled the globe approximately 5000 times in an endless circle that allows it to fly over the same area on Earth every 35 days.

Following the successful launch and insertion into orbit of Envisat, the proudest accomplishment of the Envisat team is that all ten instruments are operating as planned. This assessment came after a long and complex commissioning phase of the satellite. This task was complicated by multiple operating modes for many of the sensors. For example, the imaging radar, ASAR, works in five different modes and thirty-seven different sub-modes. As part of this process, the instruments also need to be calibrated, with the measurements and other observations recorded by Envisat's sensors matched against the results from other satellite, airborne and ground-based instruments. A calibration review in September 2002 confirmed that the satellite and instruments were operating nominally, with stable performances seen from all of them.

The late arrival of Artemis to its proper orbital slot forced Envisat to rely exclusively on the earth station in Kiruna, Sweden. This produced an extremely high workload, and slowed the pre-processing and distribution of Envisat data. To compensate, at least partially, ad hoc transmit and receive equipment was installed in November 2002 at another earth station at Svalbard, the Norwegian archipelago close to the North Pole. This improved the performance of the ground segment while the Envisat team has started the testing activities with Artemis that are now underway and expected to be completed in spring 2003. ESA technicians encountered a related difficulty with Envisat's Payload Data Segment (PDS), the ground data delivery network for data. A number of corrective actions were taken, which allowed the gradual opening of the

Envisat data services to users during the fourth quarter of 2002.

Throughout the past year Envisat has captured people's imaginations and media headlines all over the world by returning striking images and valuable scientific data of the events, both natural and man-made, that have helped to shape our world. Furthermore, the combination of data from various Envisat sensors is allowing scientists to gain new insights into natural phenomena that were difficult to obtain before. Data from three Envisat sensors – radar altimeter, microwave radiometer, and the DORIS tracking instrument – have been combined to produce a global chart of the current El Niño that affects weather patterns in many parts of the world. The combined sensor data also allows scientists a simultaneous look at different parts of events taking place below the satellite. A combined ASAR / MERIS image of Hurricane Isidore that passed through the Gulf of Mexico in September 2002 afforded a rare opportunity for researchers to view, literally, the top and bottom of a hurricane for a clearer understanding of the principle dynamics of this type of storm. A similar merged image of a weather front off the Italian coast allowed the clouds patterns observed by the MERIS instrument to be correlated with the front's structure captured in a simultaneous ASAR radar image. The synergies among the Envisat sensors and their potential to unlock further secrets of our world have only begun to be explored. As ESA commemorates the first anniversary of Envisat, however, it is evident that the spacecraft's suite of sensors offers both exciting research possibilities and practical contributions to solving our most pressing human problems. This article is based on a report at www.esa.int/export/esaCP/SEMBYF2A6BD_in dex_2.htm.

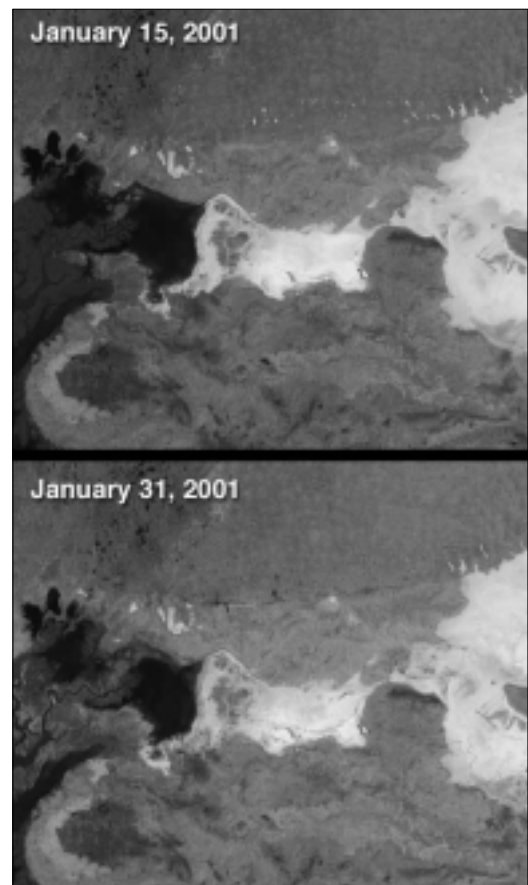
3.2 News from the EC

3.2.1 JRC study on earthquake surface effects

Research at the Joint Research Centre (JRC) of the European Commission (EC) has re-

vealed the effects of a major earthquake in remote regions of the Indian subcontinent, thus providing vital reference material to analyse other earthquakes in the future. The results of this study were published on 4 February 2003. Using data provided by the Multi-angle Imaging SpectroRadiometer (MISR) instrument on board the NASA Terra satellite platform, JRC, US, French and German scientists analysed the earthquake that struck the Gujarat province of India, close to the Pakistan border, on 26 January 2001. The study shows that large areas around the epicentre were affected, including regions that could not be visited by survey teams.

"This is key information, especially when considering the humanitarian and econom-



MISR images before and after the Gujarat earthquake. Data from the red band of MISR's most obliquely backward and forward-viewing cameras, and from the near-infrared band of MISR's vertically-downward viewing (nadir) camera, were used in the identification of surface water, in the Rann of Kutch and along the Nagar-Parkar fault near the Indo-Pakistan border. Each image covers 215x156 km. Credit: NASA / GSFC / LaRC / JPL, MISR Team

ic impacts of such disasters," said European Research Commissioner Philippe Busquin. "Advanced space technology has helped to monitor various surface effects of earthquakes accurately and efficiently. The successful collaboration at EU and international level illustrates the benefits that can be expected from co-ordinated approaches such as under the Global Monitoring for Environment and Security (GMES) initiative. Europe is a major player in space. We are currently building, in cooperation with ESA and national space agencies, a space policy for the EU so that space-based intelligence can be put at the service of our different policy objectives."

Scientific knowledge gained in the Gujarat survey will help in validating earthquake models and documenting relationships between the magnitude of earthquakes and how far their impact extends. The 2001 Gujarat earthquake was devastating, with a magnitude of 7.7 on the Richter scale, causing the death of nearly 20,000 people, leaving over 600,000 homeless and affecting 16 million individuals. Many monuments were damaged, as well as agricultural land and infrastructure. The earthquake also triggered the sudden release of ground water and sediments over large areas, reactivating ancient riverbeds and forming shallow lakes. This "de-watering" phenomenon included liquefaction – a process that causes sediments to behave more like liquids than solids when severe shaking occurs and can lead to severe damage to buildings.

This collaborative research uses measurements provided by the MISR instrument on board the NASA Terra satellite launched in December 1999. The unique capability offered by MISR to view the sunlit face of the Earth at nine different angles and at four spectral bands was fully exploited using a new method to detect and monitor the sudden appearance of surface water over a wide region around the earthquake's epicentre. Such applications were not anticipated when MISR was initially designed. Yet, exploratory research was able to take advantage of the advanced capabilities of the MISR instrument to propose new ways to look at land surface processes on Earth.

The EC's interest in MISR derives from its unique combination of multi-angular and multi-spectral capabilities, allowing extensive analysis of land surfaces and the overlying atmosphere with pole-to-pole coverage. The EC has been particularly involved in the exploitation of MISR data to detect and characterise the properties of atmospheric aerosols over land, and to estimate key land surface properties from their spectral and directional signatures. EU researchers participating in the activities of the MISR Science Team aim to develop original algorithms to provide new information about the status of land surfaces. Together with the NASA team, they have carried out advanced research for the joint retrieval of aerosol and surface properties over land, which is a particularly difficult problem. EU scientists participating in the project have been awarded the 2001 NASA Group Achievement Award for their contribution to the success of the MISR initiative. The experience gained from being part of the MISR Science Team has led to beneficial feedback for European space agencies and will be further exploited as part of the GMES initiative.

The study was published on 4 February 2003 in the American Geophysical Union's journal, "EOS Transactions", in the following paper:

- Pinty, B., N. Gobron, M. Verstraete, F. Melin, J.L. Widlowski, Y. Govaerts, D.J. Diner, E. Fielding, D.L. Nelson, R. Madariaga, and M.P. Tuttle. 2003. "Observing Earthquake-Related Dewatering using MISR / TERRA Satellite Data". EOS, Vol. 84, No. 5, 4 February 2003. Pages 37-48.

This article is from a report at europa.eu.int/comm/research/press_en.html. See also: www.gsfc.nasa.gov/topstory/2003/0115gujarat.html.

3.2.2 EC's new Green Paper on EU Space Policy

The aim of the European Commission's much anticipated Green Paper on European Space Policy (COM(2003) 17 final), which was launched on 21 January 2003 by European Research Commissioner Philippe Busquin, is to initiate a debate on the future

use of space. To this extent the inaugural conference, held in Brussels on 6 March 2003, left no doubt that it has already been a major success. Representatives listened to top-level presentations and exchanged views on the range of space issues currently facing Europe in the first of a series of consultation events set to take place over the coming months. In his introductory remarks, European Commissioner for Research Philippe Busquin said, "2003 will be remembered as a historic year when Europe made major decisions with respect to its role in space. The main European players have already agreed that space must have a place in the next European Treaty. We are at a turning point, a moment of great potential but also great vulnerability. Ambition is crucial."

Europe's history of success in space is noteworthy, but the space industry is currently in crisis and the importance of the integration of space into European policy as we look to the future has become clear. Europe does possess a solid industrial base to support continued activities in space and the list of potential space-related applications grows longer every day, but an overarching strategic policy is still missing. According to European Space Agency (ESA) Director General, Antonio Rodotà, "We are witnessing a revolution in our way of thinking about space. We must not allow the current crisis to interfere with our strategic view. As we look to the future, we can see the need for closer links between our European institutions. That means the Commission, ESA and the national space agencies working together towards common goals."

Joining the opening panel was Jean-Luc Dehaene, former Belgian Prime Minister and current Vice President of the European Convention, the body charged with overseeing the drafting of the next European Constitutional Treaty. "It is very important," he said, "that space be recognised at the highest level, that it be included explicitly in the next Treaty. The Treaty gives Europe a legal framework under which it can carry out its policies and we would like to bring space out from behind the more global Science Policy where it is currently hidden, to stand on its own. This would reflect the true importance of space, which I believe we are all coming to recognise." Opening remarks

were completed by Gilles Savary, Vice Chairman of the European Parliament's Committee for Transport, Regional Policy and Tourism and President of the Sky and Space Intergroup.

The Green Paper process will entail a series of consultation events, each focussed on a specific issue of critical importance in the space debate. The conference in Brussels included discussion panels aimed at introducing several of these issues. They included: space science; access to space; space applications; security; industrial issues; human spaceflight; and institutional issues. Carl Bildt, the forward-thinking former Swedish Prime Minister, closed the panel discussions with a stimulating and widely appreciated presentation on institutional issues. Among Bildt's provocative suggestions was the establishment of a "EU Space Agency". "By this I don't mean to suggest that we need to deconstruct ESA," he said, "but perhaps we need ESA working to implement the goals of the EU. But there must be a policy to implement and this has to come from the very top. If we take the example of the USA, we can see that in fact they have no space policy. What they have is a defence policy and a competitiveness policy and a transport policy, etc., with space as an integral part within each one."

Members of the audience agreed that high-level leadership is now the key to getting Europe moving in the space arena. The Commission's Luc Tytgat closed the conference by thanking the participants and inviting everyone to attend the upcoming Green Paper consultation events, the next of which is scheduled to take place in Madrid on 25 March 2003, on the subject of industrial issues. Readers can also contribute their views directly via the online forum: europa.eu.int/comm/coreservices/forum/index.cfm?forum=space. More information, including the full text of the Green Paper, is at the web-site europa.eu.int/comm/space.

3.3 Global Monitoring for Environment, Security

Report on the second GMES Forum, held at ESA, Noordwijk, Holland, on 14-16 January 2003

Keith R. McCloy (e-mail: Keith.mccloy@agrsci.dk), Senior Scientist, Remote Sensing, Danish Institute of Agricultural Sciences, Post Box 50, 8830 – Tjele, Denmark.

The second GMES (Global Monitoring for Environment and Security) Forum, which was held at ESA, Noordwijk, Holland, on 14-16 January 2003, followed the first GMES Forum in Brussels, on 15-17 July 2002. Each Forum was attended by about 250 people. Towards the end of this second Forum, noting that there was only one user agency present, I made a comment to this effect and suggested that there should be a major effort to involve other user agencies before the next forum. In making this comment I was specifically thinking of DG Agriculture, already a major user of satellite image data as well as other international and regional resource management groups. This comment was immediately followed by one from another participant, that GMES was not about operational implementation of satellite image data at all, but rather about improving the research effort in Remote Sensing (RS). This confusion, possibly arising from the high profile of GMES in the EU 6th Research Framework Programme, is of concern.

The goal of GMES is stated in the first paragraph of the report from the first Forum: "to establish by 2008 a European capacity for monitoring of environment and security". Whilst this sounds precise, it is in fact rather leaky. It is meant to set the goal of making satellite RS operational, but it can be misconstrued. Operational use of RS is already occurring in the EU through DG Agriculture and the Control of Area Based Subsidies (CABS) Programme, and in the European Environment Agency (EEA) through the Corine land cover mapping. So, if it is about operational implementation in the EU, then what are the specific problems that need to be addressed and to which RS can contribute, but which are not being adequately addressed now? If it is broader than the EU, then what are the other areas of operational implementation that are envisaged? My problem here is with the different interpretations that can be made of the goal, with the target(s) for this goal and with its implementation.

The lack of users at the two Forums and the lack of focus on end-user needs, suggest to me that there seems to be a perception that you can just build nice glossy Mercedes, and the users will come streaming in the door to buy them. The EU is, in my opinion, the most successful government in actually implementing satellite RS in an operational way, and with good reason given their inability to derive independent information on relevant issues of concern within Europe from more conventional approaches. The problem is not really one of building bigger and better Mercedes, but rather of constructing a better road system, and methods of use of that system. At present the EU seems to have built a highway between the suppliers of image data and the JRC, but most other connections are over rough dirt tracks, many of which are difficult even to identify as such.

So, the key question remains, "Will GMES be successful and if so, how successful?" The research and development programmes of both Australia and Canada in RS for at least the last 30 years have had a sub-agendum of operational implementation of the technology. In renewable resources this has achieved very modest goals in both countries although it has been instrumental in fostering other significant achievements. So, by what reason shall Europe be successful where others have not achieved this goal? A major issue, I believe, is that the real problem is not really understood, which is how we currently manage rural resources, how we should manage them and why are managers sticking with the former rather than adopting the latter. To deal with this matter, I need to digress into a discussion on the nature of resource management.

We can split the management of resources into three levels: strategic, regional and local. Strategic management deals with establishing long-term policies and programmes. It is the prerogative of the EU, national governments and major business groups. It uses statistical data as a satisfactory tool for defining the policies, and then monitoring their implementation; hence the focus in the EU on indicators. Local management, by farmers, forest managers, etc., is concerned with productivity, within

the constraints imposed by regional governments. For this the farmer or other manager needs very specific information on the unit of management. In between these we find the regional manager who is concerned with converting strategic policies and programmes into implementation programmes, with addressing the conflicts between sustainability on the one hand and productivity on the other, and with optimising regional productivity. Such managers include regional and local government, agricultural advisory services and large agri-business groups. It is not difficult to see that regional managers need predictive potential in their information systems, and that these need to have information down to the unit of management, so that they can talk realistically to local managers, and up to the regional level so as to link it to the strategic information of policy makers. Regional management is the natural focus of satellite RS, even though both other levels of management can benefit from it. So, the question then becomes, "why does this level of management not create the demand that would justify the building of these Mercedes?"

Part of the answer to this question comes out of the GMES Forums, where there are four major areas of focus: gaps in knowledge, technology and tools; adequacy of monitoring networks and data quality; data policy and socio-economic and institutional issues. One of the main topics in the first of these has to do with the inadequacy of current models. For regional managers concerned with creating "What-if" scenarios, implementation of models within a decision support environment is crucial. Whilst there has, and continues to be, much effort put into modelling, there are few models that operate in a routine way in a GIS environment, and exploit the spatial information contained in that environment.

Of course, all managers operate within quite different conditions, but by analysing the decisions that are made, one soon comes to appreciate that the information used by most managers has many common features and a few unique features. What is also unique is how these sets of information are combined to derive

management information. However regional managers usually operate within tight financial constraints, with little financial incentive for innovation, although there may be other incentives. For them there are significant risks attached to adopting a new technology, even if the demands placed on them to implement new or expand old programmes do not easily fit into established methods or systems. The way the EU Water Directive is being implemented is very illustrative of the inadequacy of existing methods and systems, at least in Denmark.

So, there is great potential in the collection of the basic datasets that are of use to most managers. There is also a need to work with regional resource managers to identify which common datasets they need, and how they should be combined with their unique data to give them management information. Once these managers appreciate the additional information that they get from such systems, then it is very possible that the demand for Mercedes may outstrip supply.

3.4 ESRI & AGILE collaborate on GIS education

ESRI and the Association of Geographic Information Laboratories of Europe (AGILE) signed an agreement on November 20, 2002, to combine efforts for geographic information system (GIS) education in Europe. The agreement provides several benefits for both organisations. Through the agreement, ESRI will provide internships at its headquarters in Redlands, California, to students who are AGILE members, and AGILE laboratories will receive ESRI Press books. There will also be special ESRI awards for posters and presentations at the annual AGILE conference, which will take place on 24-26 April 2003, in Lyon, France.

"We think that AGILE members will enjoy the opportunity to get to know the informative ESRI Press books that contain wonderful material for educational purposes," says Mauro Salvemini, president of AGILE. "Students who are selected for an internship in California will have the opportunity to see the day-to-day business of a GIS vendor and be part of the production

process, which can be of invaluable importance for the future of their careers." ESRI is equally enthusiastic about the possibilities created by the agreement. "The AGILE labs are the most prestigious GIS academic and research organisations in Europe, and ESRI appreciates that it will now have a more direct connection with these institutes. It will provide students with other education materials in addition to software," says Dr. Michael Phoenix, ESRI education manager. "Students will be able to subscribe to many

of ESRI's Virtual Campus courses for free, and they will have access to the complete library of ESRI Press books. ESRI Press is the leading publisher of GIS books, with more than 40 books published," adds Phoenix. For more information about AGILE or ESRI education programmes, visit the web-sites www.agile-online.org and www.esri.com/university, respectively. This article is from a report at www.esri.com/news/releases/03_1qtr/agile.html.

4 RS DATA, PRODUCTS AND PROJECTS

4.1 Observations

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What was launched?

ADEOS-II

On 14 December 2002, a Japanese H-IIA F4 launch vehicle successfully placed ADEOS-II into an 803 km sun-synchronous orbit. ADEOS-II, the Advanced Earth Observing Satellite (also known as Midori-II) is a 5-year mission carried out by the National Space Development Agency of Japan. The main objective of the mission is to gather data to study global environmental change. To do so the satellite has five instruments: Advanced Microwave Scanning Radiometer (AMSR), Global Imager (GLI), Improved Limb Atmospheric Spectrometer-II (ILAS-II), SeaWinds, Polarisation and Directionality of the Earth's Reflectances (POLDER). NASDA Earth Observation Centre will be responsible for the data distribution. The first image was acquired by the GLI on 25 January 2003 but normal operations will start in mid-April 2003. The H-IIA F4 launcher was also loaded with three piggyback payloads: WEOS, the Whale Ecology Observation Satellite from the Japanese Chiba Institute of Technology, to capture data sent by probes attached to whales to study their behavior; the Australian FedSAT, a science mission to test

new technologies in satellite computing and communications; the μ -LabSat (Micro-LabSat) which is a short term technology testing mission from NASDA. More information on ADEOS-II: eos.nasda.go.jp/ADEOS2/default_e.htm.

Coriolis

On 6 January 2003, after several delays due to unfavourable weather conditions and technical problems, a Titan 2 launched the Coriolis satellite into an 830 km sun-synchronous circular orbit from the Vandenberg Air Force base. Coriolis is a test mission that carries two US Defence Department payloads: WindSat, a Navy microwave radiometer experiment to passively measure ocean surface wind vectors; and a US Air Force Research Laboratory Solar Mass Ejection Imager (SMEI) to monitor solar activity, with the goal of more accurately predicting geo-magnetic disturbances to orbiting satellites. The instruments will collect data continuously during the three-year mission. More information: www.spectrumastro.com/www.pxi.com/windsat/main.html.

ICESat

On 13 January 2003, a Delta 2 launcher lifted off from Vandenberg Air Force base to place the ICESat and CHIPSat satellites in a 590 km orbit. CHIPSat will study the formation of stars. ICESat (Ice, Cloud, and land Elevation Satellite) is part of NASA's Earth Science Enterprise programme to measure human-induced global environmental chan-

ges. The satellite carries the first laser-ranging (lidar) instrument for continuous global observations, called GLAS (Geoscience Laser Altimeter System). The instrument will provide data on atmospheric cloud and aerosol structure in the polar regions, and give information on the height and thickness of cloud layers for short term climate and weather prediction. More information: icesat.gsfc.nasa.gov/index.html.

SORCE

On 25 January 2003, a Pegasus rocket from Orbital Sciences Corporation successfully air-launched NASA's Solar Radiation and Climate Experiment (SORCE) into a circular 645 km orbit with 40° inclination. The four instruments on SORCE are the Total Irradiance Monitor (TIM), the Spectral Irradiance Monitor (SIM), Solar Stellar Irradiance Comparison Experiment (SOLSTICE), and the Extreme Ultraviolet Photometer System (XPS). The instruments will provide daily measurements to study long-term atmospheric change, climate prediction, atmospheric ozone and ultraviolet-B radiation. The satellite will be operated by the Laboratory for Atmospheric and Space Physics of the University of Colorado (LASP). More information: lasp.colorado.edu/sorce/.

What was in the News?

METSAT-1 re-named KALPANA-1

In remembrance of Dr. Kalpana Chawla, the Indian Space Research Organisation has renamed India's first weather satellite METSAT-1 to KALPANA-1. Kalpana Chawla (1 July 1961 – 1 February 2003) was a space shuttle mission specialist on STS-107 (Columbia). She was killed when the craft disintegrated after re-entry into the Earth's atmosphere. She was born in India and moved to the United States in 1982. Press release: www.isro.org/.

Artemis

On 12 July 2001, an ESA Ariane 5 launched the communication satellite Artemis (Advanced Relay and Technology Mission) into a 31,000 km orbit. The satellite was left in this much lower than intended orbit due to a malfunctioning in the launcher's upper stage. Normally the satellite would have been lost, but Artemis was carrying an experimental ion engine that has proved suit-

able for lifting the satellite to its originally planned geo-stationary orbit. On 31 January 2003, after about 1.5 years, ESA announced that Artemis completed its recovery and reached its operational 36,000 km orbit. During the recovery phase, Artemis was tested for what it was designed for: on 30 November 2001, an image acquired by the French SPOT 4 was sent in real-time by a laser connection to Artemis. Artemis in turn sent the image to the image processing centre at Spot image in France. This marked the first transmission of an image by laser link from one satellite to another. Once the validation period is over, Artemis' communication systems will allow EO data from SPOT, ENVISAT, ADEOS-II, etc. to be transmitted much faster and directly to the relevant ground stations. More information: www.esa.int/artemislaunch/. (See also report in Section 3.1.3).

MSG-1: First GERB images published

The first images from the SEVERI instrument on board the Meteosat Second Generation satellite MSG-1 were already published in October 2002. However on 12 December 2002 also the first GERB images were published. The GERB instrument is a research instrument initiated by ESA to study the Earth's Radiation Budget and its influence on climates. GERB instruments will also be flown on the future MSG-2 and MSG-3 satellites. More information is on the web-site of the GERB Consortium: www.ssd.rl.ac.uk/gerb/default.HTM.

RADARSAT-1 mission continues

About four years after the launch of the Canadian radar satellite Radarsat-1, the platform started to show problems to maintain attitude control for precise pointing of the satellite. This was due to excessive friction and temperatures of the first pitch momentum wheel. Since September 1999, RADARSAT-1 depended on its secondary momentum wheel to maintain attitude control, but this back-up developed similar problems and was taken off-line on 27 November 2002, leaving the satellite in a safe and controlled tumble. On 4 December, imaging operations were suspended to fix the problem. On 30 December, the Canadian Space Agency announced new procedures that rely on roll and yaw wheels and torque rods to accurately point

the spacecraft. RADARSAT-1 can now continue operating. More information: www.space.gc.ca/asc/eng/default.asp.

Coming up soon:

After being rescheduled several times since the original launch date in September 2002, Orbital now officially announced that Orbview-3 will be launched on 30 April 2003. Orbview-3 will provide 1-metre panchromatic and 4-metre multispectral imagery. More information can be found at www.orbimage.com/. Canadian SCISAT-1 is scheduled for launch on 20 May 2003. The mission's major scientific goal is to measure and understand the chemical processes in the ozone layer. More information is at the Canadian Space Agency web-site: www.space.gc.ca/asc/eng/csa_sectors/space_science/atmospheric/scisat/scisat.as.

4.2 Irish IACS uses eSpatial's web-enabled GIS

Introduction

IACS (Integrated Administration and Control System) is an EU initiative for managing applications for aid based on farmland area, in which farmers themselves file their applications every year to their National Administrations. Thus far each EU state has commissioned the production of database and processing software to manage the requirements of IACS. These include the accurate integration of remotely sensed data with land parcel vector data, for reference parcel validation. The system must provide fast remote access to ortho-photos and satellite images across the Internet. It must also facilitate on-the-spot checking with access and updating of data from field operatives.

The Irish IACS System

The Irish Department of Agriculture required a system that truly integrated spatial data with the business rules and financial data needed to manage grant claims and awards. This would enable department officials to work directly on physical representations of farmland to calculate field areas and uses, which in turn could be used to automatically determine the size of relevant grants.

eSpatial were commissioned to deploy a single, integrated web-enabled information system to manage IACS for the Irish Department of Agriculture. The system needed to unify the existing GIS datasets into one Oracle database. These datasets included ortho-corrected aerial photography coverage for the whole of Ireland, raster-scanned map data, and departmental Area Aid transactional data. The finished system comprises a single solution rather than a collection of packages. A large component of the system was ortho-rectified aerial photography used as a backdrop control for the verification of claims. The system needed to be entirely dynamic so that new field boundaries could be inserted at any time, and grants recalculated on that basis.

The final solution integrates 153Gb of imagery and other GIS datasets with the departmental Area Aid transactional data, all within one Oracle database. It is an integrated solution enabling areas to be defined and downloaded for viewing and editing remotely across the Internet. This achievement was made possible by iSmart, eSpatial's leading spatial application development environment, which facilitates the combination of image, vector and attribute data within one database.

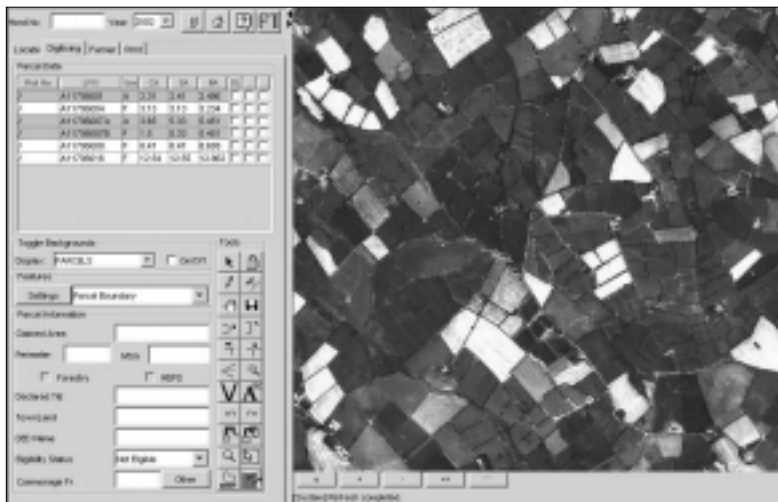
The Technology

One of the major challenges in producing such a system was the real-time viewing of the image data across the network. The Department of Agriculture's data included 63Gb of ortho-corrected aerial photos and 90Gb of raster-scanned map data. The "viewability" of such large data sets was made possible by the Image Loader, a utility designed to load scanned aerial / satellite photos and topographic maps into an Oracle database. The loaded imagery is then available for "heads up" viewing and manipulation (e.g. digitising). This technology uses an established approach to digital image handling, by pre-processing the image data into multi-resolution representations. This eliminates the need to resample the image at run-time by loading the best-fit resolution to the zoom level currently active in the web browser. The Image Loader also automates geo-referencing of these files. eSpatial's iSmart technology advances this technique by using intelligent

indexing. Thus, when a web browser is viewing a particular geographic location, only that area at the requested zoom factor will be physically sent over the network.

Other Applications of the Technology

iSmart allows access and editing, from anywhere in the world, to vector and image data on a central server. This means that operators in a range of disciplines including forestry, geology and utilities can have global access to satellite images in the field on hand-held devices. Ground truthing and real-time field mapping (vector editing) can be undertaken directly on top of remotely sensed data and updated immediately onto a remote central server.



User-interface of eSpatial's web-enabled GIS solution for the Irish IACS

About eSpatial

eSpatial is a world leader in Online Spatial Processing. The company has extensive experience in the development of enterprise spatial mapping and decision support solutions. Based upon open, standards-based technologies and Oracle's 9i spatial database environment, eSpatial has implemented solutions for national government organisations, utility companies, and large multinational organisations throughout the world. For more information contact Mr. Glen Millar (e-mail: gmillar@espatial.com) or visit the web-site www.espatial.com.

4.3 Two French instruments on NASDA's ADEOS-II

NASDA (National Space Development Agency of Japan) successfully placed into

orbit its ADEOS-II satellite (Advanced Earth Observing Satellite II) on 14 December 2002 atop a Japanese H-IIA launcher. The satellite is carrying two French instruments: the POLDER 2 imaging polarimeter and the Argos-Next data localisation and collection instrument, in the frame of a French-Japanese co-operation. The Argos-Next instrument, developed by NASDA and CNES (French Space Agency), was switched on 29 January 2003. The first images from POLDER 2, developed by CNES, were acquired 1 February 2003 over Europe and Africa in eight spectral bands, from the visible to the near infrared, in natural and polarised light. Initial analysis shows that the data meet technical mission specifications. POLDER 2 – CNES's contribution to the ADEOS-II climate research programme, an international effort involving space agencies worldwide, including CNES, NASDA, NASA and NOAA – is now ready to begin its mission. The international scientific community will use POLDER 2 data to study the interactions between clouds, aerosols and the Earth's radiation balance, and to gain a closer understanding of the role of marine phytoplankton and the continental biosphere in the carbon cycle. These new data will serve in particular to measure the impact of human activities on climate change in the light of rising greenhouse gas emissions. This article is based on a report at www.cnes.fr/espace_pro/communiqués/cp2003/en/2_20.html.

4.4 NASA study on remote sensing of snow

On 10 February 2003, it was reported that scientists and students from six federal agencies and many universities in the USA would study the snow-packs of the Colorado Rockies from the ground, air and space this winter and spring, to improve forecasts of spring-time water supply and snow-melt floods, and to study how snow-cover affects the Earth's weather and climate. The 2003 Cold Land Processes Experiment (CLPX) was conducted during February and March 2003, in the central Rocky Mountains of the western USA, where there is a wide array of different terrain, snow, soil, and ecological characteristics.



"We'll use the information derived from this project to better understand the formation and evolution of snow-packs, especially the processes involving the timing of snow-melt," said Don Cline, NOAA scientist at NWS / NOHRSC and leader of CLPX. "Measurements we made during CLPX last year have already been extremely useful in helping us understand how to update water and weather forecast models with observed snow information." Further studies will help design better sensors to measure the water content of snow from space. In future, new remote sensing (RS) measurements coupled with water and weather forecast models should improve prediction of water supplies, floods, weather and climate.

"The primary goal of CLPX is to determine the best methods of finding the liquid water equivalent of snow using RS techniques," said Jared Entin, Manager of NASA's Terrestrial Hydrology Program. Entin said that RS of snow is a challenge, because different techniques are required for wet and dry snow. "Snow is very crucial to the western USA, where 40-50% of the precipitation falls

as snow, and more than 80% of the run-off can come from the snow-pack. Improving our ability to measure the water quantity stored as snow and knowing more about snow-melt processes will enable better use of water resources," Entin noted.

Jointly sponsored by NASA and the National Oceanic and Atmospheric Administration (NOAA), CLPX is a research mission concerned with frozen landscapes, where water is frozen either seasonally or permanently. Cold land regions form a major component of the Earth's hydrologic system. This is the second year of intensive snow measurements in Colorado's mountains and high-elevation rangelands. A major advance in this year's mission is the inclusion of several advanced satellite and airborne sensors to determine the best ways to conduct RS of the global cryosphere. Dozens of scientists will be using skis, snow-mobiles, and aircraft to survey and sample snow during the CPLX field experiment. They will also use microwave measurements from satellites and aircraft to measure characteristics of snow-pack and the freeze-thaw state of the land surface. Measurements from four aircraft and NASA's Terra and Aqua satellites will gather snow data by RS. The data gathered on the ground and from the aircraft will then be compared to that obtained by the satellites to determine the accuracy of the satellite data. Researchers hope someday to be able to measure snow quantity and frozen ground from space anywhere in the world without a ground team, particularly in inaccessible areas. Ground teams, however, do play a crucial part in instrument validation and calibration. This article is based on a report at earthobservatory.nasa.gov/Newsroom/NasaNews/

5 REVIEWS, PUBLICATIONS AND REPORTS

5.1 New textbook on RS, photogrammetry & GIS

A new text book on RS and GIS, entitled "Geoinformation – Remote Sensing, Photogrammetry and Geographic Information Systems", and authored by Professor Got-

fried Konecny (a longstanding and active member of the EARSel organisation) of the University of Hannover, Germany, has just been published (2003) by Taylor and Francis (ISBN 0-415-23795-5 / pbk; ISBN 0-415-23794-7 / hbk). The aim of the book is to provide the fundamental theory behind

each of the traditionally separated fields of remote sensing, digital photogrammetry and GIS, within the broader context of the relatively new discipline of geoinformatics. The book, which comprises 248 pages and is amply illustrated with 159 figures, 16 tables, and 32 colour plates, includes separate chapters on the basic principles of remote sensing, photogrammetry, geographic information systems, and global positioning systems, as well as a chapter on cost considerations of the various surveying and mapping options. Overall, the book contains a lot of technical details on the mathematical and geometrical methods underlying the various inter-related geoinformatics disciplines, and should appeal to its targeted audience, from advanced undergraduates to professionals in geoinformatics. For further information, please contact the book's author, Professor Konecny, at the following coordinates: Universität Hannover, Nienburger Straße 1, D-30167 Hanover, Germany (telephone: +49-511-7622487; fax: +49-511-7622483; e-mail: konecny@ipi.uni-hannover.de).

5.2 Forest fire conference (Luso, Portugal)

Emilio Chuvieco (Chairman of EARSeL Forest Fires SIG), Department of Geography, University of Alcalá, Spain

The fourth conference on Forest Fire Research was held in Luso (near Coimbra, central Portugal), on 18-23 November, 2002. On this occasion the conference was joined by the 2002 Wildland Fire Safety summit, as well as by several courses on Fire Behaviour and Fire Safety, in the days before or after the conference. This series of scientific conferences on fire-related research started in Coimbra, in 1990, on the initiative of Professor Domingos X. Viegas, who co-ordinates a long-run group on fire research in this university, and which has been repeated on a four-year basis. Each edition has seen an increase in the number of participants, paper and poster contributions, and in international representation. Although mainly European, the attendees come from many different countries, especially from those more actively involved in fire research, such as Australia, USA, Canada, as

well as Brazil, Russia and South Africa.

The conference was organised around the following topics: Keynote Lectures; Human and Institutional Aspects; Fire Prevention; Fire Behaviour; Fire Safety; Fire Effects. The invited lectures were mainly on safety aspects, since the conference was held in conjunction with the Wildland Safety Summit annually organised by the International Association of Wildland Fire. However, the papers presented covered all topics related to fire issues, from fire prevention to fire behaviour modelling and fire effects. Human and Institutional Aspects received twelve paper or poster contributions. Fire Prevention issues were the topic of 65 papers or posters. Fire Behaviour modelling featured in 55 papers and posters (although not all were focused on propagation issues, but also in input variables, e.g. fuel properties or wind modelling). Fire Safety was addressed in 18 papers and posters. Fire Effects were analysed in 46 papers and posters.

The degree of innovation and relevance of results was, in general, very high, showing the latest research being developed in the field of forest fires, which has increased greatly in the last years. This is because very diverse groups are getting interested in this topic: from physicists and mechanical engineers (propagation aspects), to sociologists and economists (human aspects involved in fire management), plus the traditional effort of ecologist, geographers and foresters.

Remote sensing (RS) and GIS groups working on fire applications have also increased steadily in recent years, maybe as a result of a growing concern on improving current methods for fire prevention rating and fire effects assessment. In the Luso conference, from the 146 papers published, 31 use RS images or GIS tools to map fire risk patterns, detect active fires or evaluate fire effects. These papers are mainly written by European researchers working in Mediterranean Environments (Spain, France, Italy, Greece or Portugal). Methods used in these papers are very diverse: spectral mixture analysis, multi-temporal change detection techniques, classification trees, spectroscopy, object-oriented classification, and spatial statistics. For regional to national studies the use of AVHRR images is still

predominant, although new sensors are also being used, such as Terra-Modis, and IRS-Wifs. At local scales, the introduction of high-resolution images is greatly appreciated, mainly Ikonos data, although Landsat images are still the most widely used.

In summary, the Forest Fire Research conference was a great opportunity to acquire a global view on the active research in the field. The conference proceedings were published for in-situ distribution, and include a paper version of the abstracts, plus the extended text in an accompanying CD-ROM. Both were published by Millpress Science Publishers, a Rotterdam based company. The CD-ROM includes all the documents in .pdf format along with the author and keyword indices.

5.3 IUFRO forestry conference (Palermo, Sicily)

European Commission. 2002. Proceedings of the IUFRO conference on "Collecting and Analysing Information for Sustainable Forest Management and Biodiversity Monitoring with Special Reference to Mediterranean Ecosystems". Conference held in Palermo, Sicily (Italy) on 4-7 December 2001. Editors: Corona, P., S. Folving and M. Marchetti. EUR 20392 EN. 219p.

The conference was organised on the initiative of two of the working parties of IUFRO (International Union of Forestry Research Organisations), in conjunction with the Institute for Environment and Sustainability of the European Commission's Joint Research Centre. The major objectives of the conference were to: review the state-of-the-art of forest inventory data and methodology, with special reference to Mediterranean forest and other wooded ecosystems, remote sensing and spatial analysis; review inventory / monitoring techniques relevant to high forest landscape heterogeneity and forthcoming technologies; review mensuration and information technology advances for distinctive issues such as monitoring wild-fires, biomass estimation, grazing pressure on forests, etc.; discuss the possible con-

necting role of landscape ecology and the inventory implementation of habitat classification approaches in the view of biodiversity assessment; facilitate co-operation between Mediterranean countries, enhancing externalities perspective development as the greater contribution to natural and semi natural areas management in such environments. The proceedings contain thirty-four papers, directly linked to Mediterranean ecosystems and / or biodiversity issues. These constitute more than half the presentations made at the conference. The proceedings are available free of charge from the European Commission, JRC Information and Public Relations Unit, Brussels, Belgium (fax: +32-2-2996322 / +39-0332-785409; e-mail: guelperi.vural@cec.eu.int / ulla.engelmann@cec.eu.int).

5.4 Treemail: online RS publications & services

Treemail (www.treemail.nl) is an advisory company and publishing house that works on strategic issues in international development and remote sensing (RS). The Treemail series set a benchmark for high quality, independent scientific thinking and research. Treemail delivers both contract research and strategic advice. Upon request of the Dutch Remote Sensing Board, we surveyed RS-related technologies for forestry applications and advised on a future strategy for co-ordinating these research activities in The Netherlands. Treemail helped formulate the European Space Agency's strategy and Ministerial Resolution on its relation with developing nations in the fields of science, Earth observation and telecommunication. Treemail assisted Privateers NV in numerous RS operations, including disaster relief services in the case of hurricanes (see web-link: earth.esa.int/Disaster/RMS/welcome_uk.htm) and for victims of an earthquake in El Salvador (see web-link: news.bbc.co.uk/2/hi/science/nature/1172346.stm). As a result of an intensive Privateers NV and Treemail research programme, timber volumes can now be estimated directly from satellite images. For more information, send an e-mail to info@treemail.nl.

6 FORTHCOMING MEETINGS AND COURSES

6.1 Multi-temporal RS workshop: MultiTemp-2003

The development of effective methodologies for the analysis of multi-temporal data is one of the most important and challenging issues that the RS community should face in the next years. The importance and the timeliness of this issue are directly related to the ever increasing quantity of multi-temporal data provided by the numerous RS satellites that orbit around our planet.

The response to the First International Workshop on the Analysis of Multi-Temporal Remote Sensing Images (MultiTemp-2001), held at the University of Trento, Trento, Italy, in September 2001, demonstrated that the workshop is timely, and that there is a clear need to advance theory and applications of multi-temporal RS image analysis. For this reason, the Second International Workshop (MultiTemp-2003), to be held at the European Commission's Joint Research Centre, Ispra, Italy, on 16-18 July 2003, will be organised with the same style: a high quality workshop, focusing on the methodological aspects of multi-temporal RS image analysis and their applications. The workshop's main goal is to assess the state of the art of both theory and applications in the analysis of multi-temporal RS images and geospatial data. This workshop should greatly contribute to define common research priorities according to end-users' needs, and its proceedings should become a unique, first-class reference for multi-temporal geospatial data analysis.

The workshop will address the following topics: registration techniques and reduction of registration noise; correction and calibration algorithms for multi-temporal images; supervised and unsupervised change-detection techniques; detection of spectral changes and land-cover transitions; analysis of SAR and InSAR multi-temporal data; understanding changes; updating of geographic information; shape change detection; change detection in hyper-spectral data; data fusion in multi-temporal image analysis; classification of multi-temporal images; assessment of per-

formances in change detection; applications.

For the latest information about the workshop and details about the submission procedure, please visit us at www.multitemp.org. For more information, contact: MultiTemp 2003, Workshop Secretariat, c/o P.C. Smits, EC-JRC, TP 262, I-21020 Ispra, Italy (e-mail: multitemp-2003@jrc.it; telephone: +39-0332-785279).

6.2 EURISY conference on EO & maritime security

A EURISY conference on "The Impact of Satellite Technology on Maritime Security", co-organised with INTA (Instituto Nacional de Técnica Aeroespacial), Spain, will be held in Spain (exact venue to be announced) on 24-27 June 2003.

As recent events have clearly shown, maritime security is of vital importance to Europe. From the detection of oil slicks to the protection of fishing stocks and the prevention of piracy and smuggling on the other, satellites can play a key role in the search for practical means for detection on the high seas. The ever-increasing amount of container traffic with corresponding problems of security to combat terrorism or drug traffic or illegal immigration, leads to a need to find new solutions to verify that the content is that stated on the manifest. Satellites already play an important role in monitoring weather and climate parameters (e.g. wind forces and wave heights) which are consulted routinely in questions of ship navigation, especially in the Arctic and Antarctic regions, ocean racing, rescue and return operations. Space technology has been successfully applied for oil slick detection and algae bloom monitoring, which have important economic and environmental impacts on the affected regions. Advanced research projects with new European satellites are providing new and exciting applications which can be adapted to operational needs. By bringing together those who deal with the myriad aspects of marine security, technical experts and researchers, a dialogue can be established and information

exchanged on user needs, what solutions are now available from the application of satellite technology and what could be developed in the future to meet the needs which cannot be satisfied now.

The aim of the conference is to draft resolutions in each session covering needs and technical possibilities. These resolutions will be examined in a final plenary session and once adopted, forwarded to the relevant European or national institution (e.g. European Commission, ESA, INTA, CNES, DLR) or regulatory body. Parallel sessions will be held on the following four themes: (1) maritime operations (weather and climate, ship routing, mapping including maritime protected and security areas, ice monitoring, ocean racing, search and rescue); 2. pollution (oil slicks, dangerous transport, chemical discharge, poisonous algae); 3. security (containers, oil rigs, wrecks, piracy, defence, human trafficking, insurance); 4. sustainable exploitation (oil

and mineral exploration, fishing and evaluation of fishing stocks, whaling salvage).

The presentations will be followed by discussion and drafting of resolutions in each session. There will be both users and technical experts in each session. During the week preceding the conference, a Summer School for PhD Students will be held on Oceanography and Maritime Insurance. For more information contact EURISY Association, 3-5 rue Mario Nikis, 75015 Paris, France (telephone: +33-1-47340079; fax: +33-1-47340159; e-mail: eurisy@micronet.fr), or visit the website www.eurisy.asso.fr/.

The Eurisy Association was founded in 1989 as part of Europe's preparations for International Space Year (ISY-92). In 1993, the Association's members decided that EURISY should continue its work, given that raising public awareness of the value of European space activities was a long-term task requiring an extended effort.

6.3 Calendar of forthcoming meetings

NEW

13-16 May 2003
Oberpfaffenhofen
(near Munich),
Germany

3rd EARSel Workshop on Imaging Spectroscopy

Contact: Andreas Müller, DLR, Oberpfaffenhofen, Germany. E-mail: Andreas.Mueller@dlr.de / sigis-workshop@dlr.de. Web: www.op.dlr.de/DAIS/SIG-IS/sigis3.html.

22-23 May 2003
Berlin, Germany

Joint ISPRS WG III/6 / IEEE / EARSel Workshop on Remote Sensing and Data Fusion over Urban Areas

Contact: Prof. Olaf Hellwich (hellwich@fpk.tu-berlin.de), WG III/6 Chair. Web: www.fig.net/figtree/events/events2003.htm

3-6 June 2003
Ghent, Belgium

23rd EARSel Symposium: "Remote Sensing in Transition"

Contact: Prof. Rudi Goossens (Rudi.goossens@rug.ac.be / earsel@meteo.fr), University of Ghent, Belgium.

5-7 June 2003
Ghent, Belgium

4th EARSel Forest Fires Workshop: "Remote Sensing and GIS Applications to Forest Fire Management – Innovative Concepts and Methods"

Contact: Dr. Emilio Chuvieco (Emilio.chuvieco@uah.es). Web: www.geogra.uah.es/EARSel/SIG_group.htm

6-7 June 2003
Ghent, Belgium

1st EARSel Workshop on Remote Sensing of the Coastal Zone

E-mail: Dr. Rainer Reuter (r.reuter@las.physik.uni-oldenburg.de). Web: las.physik.uni-oldenburg.de/projekte/earsel

NEW

24-27 June 2003
Spain (exact venue
to be announced)

EURISY Conference on the Impact of Satellite Technology on Maritime Security

Contact: eurisy@micronet.fr. Web: www.eurisy.asso.fr.

- NEW**
25-27 June 2003
La Coruña, Spain
- 9th EC-GI&GIS Workshop: "ESDI - Serving the User"**
Organised by: European Commission - DG Joint Research Centre
E-mail: ec-gis@jrc.it. Web-site: <<http://www.ec-gis.org/>>
- 27-29 June 2003
Regensburg,
Germany
- 4th International Symposium "Remote Sensing of Urban Areas"**
Contact: Dr. Carsten Juergens (carsten.juergens@geographie.uni-regensburg.de).
- NEW**
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
- NEW**
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/rslucoat1/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).
- NEW**
15-18 Sept. 2003
Elba Island, Italy
- TIWRS (Tyrrhenian International Workshop on Remote Sensing) 2003**
Organised by: Italian Consortium for Telecommunications (CNIT). Web: www.in-cordgmp.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**
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
- 26-30 July 2004
Portland, Oregon,
USA
- International Symposium: Ice-Water-Ice – Processes Across the Phase Boundary**
Contact: Int_Glaciol_Soc@compuserve.com Web: www.igsoc.org
- 23-27 August 2004
Geilo, Norway
- International Symposium: Arctic Glaciology**
Contact: Int_Glaciol_Soc@compuserve.com
Web: www.igsoc.org