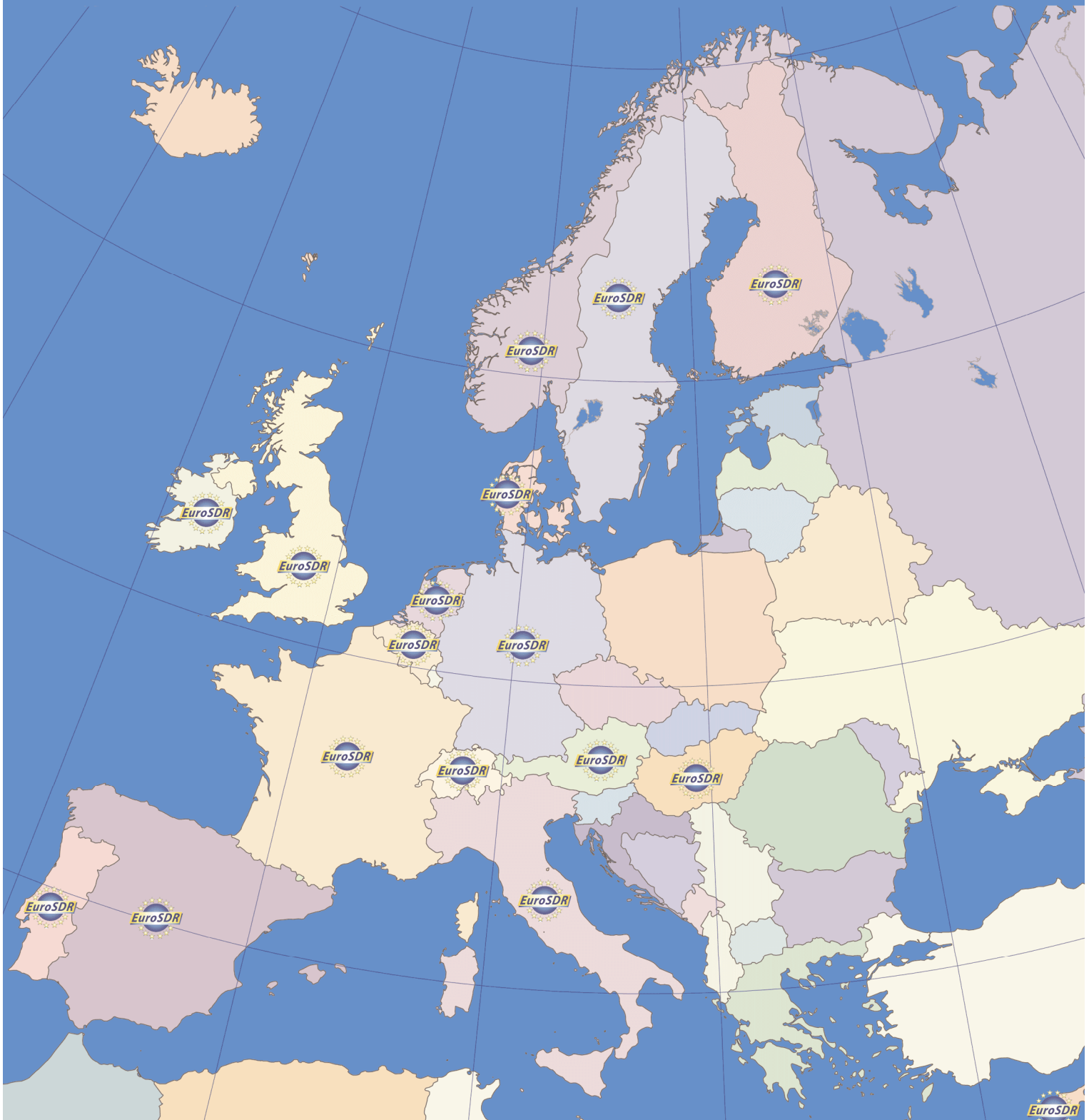




# Annual Report 2006

[www.euroedr.net](http://www.euroedr.net)

## European Spatial Data Research



# About EuroSDR

EuroSDR is a pan-European organisation established by International Treaty, as OEEPE, in 1953 in Paris in accordance with a recommendation passed by the Council of the Organisation for European Economic Co-operation. Organisations from European countries that are members of the Council of Europe represent the spatial data research interests of those countries through membership of EuroSDR.

The result is a network of delegates, from European Geographic Information organisations and research institutes, effectively and practically addressing Europe's spatial data research requirements.

Collaborative research projects address the acquisition, management and delivery of spatial data and services while international workshops and courses, in collaboration with related organisations, address key issues in a timely and focussed manner.

## Our Member States and their Prime Delegates

<b>Austria</b>	Michael Franzen	Bundesamt für Eich- und Vermessungswesen (BEV)
<b>Belgium</b>	Ingrid Vanden Berghe	Institut Géographique National
<b>Cyprus</b>	Christos Zenonos	Department of Lands and Surveys
<b>Denmark</b>	Joachim Höhle	Aalborg University
<b>Finland</b>	Risto Kuittinen	Finnish Geodetic Institute
<b>France</b>	Marc Pierrot Deseilligny	Institut Géographique National
<b>Germany</b>	Dietmar Grünreich	Bundesamt für Kartographie und Geodäsie
<b>Hungary</b>	Arpad Barsi	Budapest University of Technology and Economics
<b>Ireland</b>	Colin Bray	Ordnance Survey Ireland
<b>Italy</b>	Carlo Cannafoglia	Ministero del l'Economia e Finanze
<b>Norway</b>	Jon Arne Trollvik	Norwegian Mapping and Cadastre Authority
<b>Portugal</b>	Berta Cipriano	Instituto Geográfico Português
<b>Spain</b>	Antonio Arozarena	Instituto Geografico Nacional
<b>Sweden</b>	Stig Jönsson	Lantmäteriet
<b>Switzerland</b>	Francois Golay	Ecole polytechnique fédérale de Lausanne (EPFL)
<b>The Netherlands</b>	Jantien Stoter	ITC, Enschede
<b>United Kingdom</b>	Keith Murray	Ordnance Survey of Great Britain

**Our Vision** is to be **the European research platform** for National Mapping and Cadastral Agencies, Academic Institutes, the Private Sector, Industry and User Groups on issues related to the implementation of technology developments with respect to optimising the provision (collection, processing, storage, maintenance, visualisation, dissemination and use) of reference information (data serving as a spatial framework for organisations involved in monitoring, management and development) in a Geoinformation Infrastructure (GI) context.

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# Message from the President

Stig Jönsson

The most important event in Europe during 2006 concerning spatial data was probably the political agreement on the INSPIRE Directive. We will now have a firm legal framework for the development of the European spatial data infrastructure. This will support a coordinated approach and be of advantage for more efficient governance, lead to better services to citizens and support market development.

In the long run cost savings in production and maintenance of spatial data will be achievable, while costs – or the financing of costs – for the transition from today's situation might be a problem. Another advantage with the Directive is that spatial data has been placed on the political agenda. We who are active in this sector have a good opportunity to show the benefits from efficient handling of geographic information and GIS tools.

For EuroSDR the INSPIRE Directive, as well as the development of national, regional and local spatial data infrastructures, implies demanding challenges. There is a need for better knowledge and understanding concerning, for example, data modelling, data integration, schema translation, evaluation and quality control, efficient implementation of standards and open software, and provision of services through standardised interfaces. Therefore, it is a pleasure to note that the EuroSDR rolling research plan for 2007-2010 is clearly focussed on research areas of importance for the development of SDI's.

Work with the EuroSDR rolling research plan during 2006 has also been carried out with a user driven approach. We have introduced procedures to guarantee that highest priority is given to research activities meeting actual needs within the national mapping and cadastral agencies.

Important work supporting the implementation of INSPIRE is now carried out within the INSPIRE Drafting Teams. A great number of staff from EuroSDR members are engaged in these teams. I am convinced that this will help development of well-balanced detailed regulations concerning metadata, interoperability of spatial data sets and services, network services and data sharing. By well-balanced I mean regulations that are both far-sighted and based on established methods and standards.

An important strategy for EuroSDR is to establish efficient co-operation with related organisations, such as EuroGeographics, AGILE, ICA, JRC and

ISPRS. Looking back at 2006 I notice a great number of joint activities and exciting exchange of experiences and ideas.

This report contains a summary of all the activities of the organisation during 2006. It is part of our aim to keep our stakeholders better informed. Likewise the EuroSDR News has been well received and continuously improved and we now reach a much wider audience than before. A couple of years ago we opened up the opening session of our Science Committee meetings, which generally focuses on national developments in the host country, to all interested parties. During 2006 we had such meetings in Sweden and Portugal and I have received positive feed-back from the representatives from government, state agencies, local authorities, research institutions and others who participated. I am also convinced that the members of the Science Committee gain a much better understanding of the situation in the host country through this type of arrangement.

I would like to record my thanks to the Past President, the Vice President, the Commission Chairmen and our Secretary-General for all their hard work during the year. We have all been supported by a Science and Steering Committee that is getting stronger all the time and we would like to thank project leaders, workshop organisers and support staff for all their work and contributions this year. Thanks also to collaborating organisations and all those who participated in workshops.

Finally, I hope the overview given in this report will make you interested to learn more about EuroSDR and our achievements. We represent a fruitful European-wide collaboration between true experts from national mapping and cadastral agencies and researchers from leading universities and research institutes.

Stig Jönsson  
President  
EuroSDR



# Message from the Vice-President

Christian Heipke

2006 continued to be a year of change for EuroSDR. At year end I dare say it was change for the better. We have achieved significant progress in science and development through our projects and workshops and we have found an improved scheme for our meetings, allowing the participants to play a more active role in presentations and deliberations. Last but not least, we have adopted a new research plan for the years 2007 – 2010. While leaving the number and general directions of the five commissions unchanged, the new plan contains new Commission Terms of Reference and action plans and offers the possibility of establishing inter-commission working groups.

Four projects were finalised and published during 2006, dealing with automatic road and building extraction, a comparison between optical and radar imagery and a test on automatic change detection. Besides these, projects such as the EuroSDR digital aerial camera network, the projects on unconventional platforms, direct georeferencing, automatic tree extraction, the detection of unregistered buildings, DTM quality and on automatic generalisation, contribute to the active and progressive research picture EuroSDR has continued to paint during 2006.

Workshop topics included automatic orientation and calibration, quality assurance of geographic data, data models as well as the impact of GMES on national mapping and cadastre agencies. These topics were discussed in small, focussed expert groups. The workshop proceedings have been or will be made available to the wider audience on CD and via the Internet.



Stig Jönsson, Berta Cipriano and Arménio Castanheira at the EuroSDR meeting in Lisbon

EuroSDR meetings, held twice a year, have become more vibrant, since the introduction of a new general meeting agenda. We now identify one or two topics of general interest and discuss them in breakout sessions. Topics for 2006 included *Future directions in GI and its implications for EuroSDR*, and *Current activities and practices in EuroSDR member organisations*.

These sessions contribute to a more relaxed, while at the same time a more professional, atmosphere where each participant attentively interacts with the group and as a result reaps the benefit of more information. A further change is the introduction of Invited Talks, each touching upon a specific aspect of our work. In June 2006, we had Prof. Ian Dowman from UCL, currently serving as ISPRS President, with us to discuss the mutual benefit of a closer co-operation between ISPRS and EuroSDR. At the fall meeting, Dr. Andreas Illert from BKG, Frankfurt, reported on the latest developments in INSPIRE and offered his expertise in this field. Both talks were extremely interesting and were followed by breakout sessions on the same topic, thus linking the two new items on the meeting agenda.

A new research plan was discussed at various meetings and was formerly adopted in June. While giving a general frame and direction for research in the years to come, it leaves enough freedom to fine-tune our activities to new developments. As a new element inter-commission working groups dealing with aspects of relevance across different commissions were set up for two areas. The *Working Group on Standards* aims at providing EuroSDR with enough information to understand the existing and upcoming OGC and ISO standards in GI and to anticipate the consequences for the member organisations. The working group on *Education* looks at technology transfer between EuroSDR partners and organises the EuroSDR Educational Service EduServ, the fourth edition of which was run in spring 2006.

I close in thanking wholeheartedly everybody who has put effort and time into EuroSDR research activities, including the active participants, project leaders, organisers of workshops and my colleagues in the executive team. Without such voluntary work an organisation like EuroSDR could not exist. In particular, I would like to thank *Ismael Colomina*, *Colin Bray* and *Peter Woodford*, who have stepped down as Chairmen of Commissions 1, 4 and 5 after very productive and successful periods. All three have influenced the scientific work of EuroSDR tremendously, and we cannot thank them enough for having done so.

Finally, the three new Commission Chairmen on the executive team have already started to shape the future of our organisation. Welcome *Michael Cramer* (Commission 1), welcome back *Keith Murray* (Commission 4) and welcome *Mike Jackson* (Commission 5).

Christian Heipke  
Vice-President  
EuroSDR



# Sensors, Primary Data Acquisition and Georeferencing

Ismael Colomina

2006 was a year of practical progress in the digital photogrammetric community as the sales of digital metric cameras consolidated and the user community started to understand the potential and challenges of its digital imaging sensors. Commission 1 has concentrated on four main activities as reported below. Additionally, a recent initiative of the Commission resulted in the establishment of the EuroSDR Working Group on Standards whose report of activities is to be found elsewhere in this report.

**Network “Digital Camera Calibration”.** This is certainly one of the flagship projects of EuroSDR. It is a joint Commission 1 and 3 (Production Systems and Processes) project led by Dr. Michael Cramer, Institute of Photogrammetry, University of Stuttgart, Germany. The project was launched at the 103<sup>rd</sup> meeting in Munich in 2003 and was structured in two phases. Since February 2006 the project is in its second phase for which the pilot centre has already evaluated the results of the various participant groups and presented a preliminary, though rather comprehensive, report at the 109<sup>th</sup> EuroSDR meeting (<http://www.ifp.uni-stuttgart.de/euroedr/EuroSDR-109-CameraCalibration-CRAMER.pdf>). The report covers analysis of the three main large-format, metric cameras in use; Leica’s ADS40, Intergraph’s DMC and Vexcel’s UltraCamD.

A very interesting resultant outcome of this project has been the discussion held on a possible European Digital Airborne Camera Certification initiative in order to provide a unified European set of criteria, methodologies and even procedures to calibrate large and medium-format digital cameras for airborne mapping.

**DGReliability-0: Direct Georeferencing Reliability.**

This project was concluded in 2006 with a report presented at the 108<sup>th</sup> meeting in Skåvsjöholm (Sweden) and a real-life case analysis presented at the 109<sup>th</sup> meeting in Lisbon (Portugal). The project was led by Dr. Jan Skaloud, Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland. The goal of the project was to explore the reliability issues of Direct Sensor Orientation, to summarize the status in a report and to propose a vision for a longer period. The work of Dr. Skaloud and his team at EPFL has produced a comprehensive analysis of all the factors that have an influence on the reliability of direct sensor orientation, a survey of available literature and an illustration with an actual, real-life problematic project.

Ismael Colomina  
Chairman  
Commission 1



**NewPLATFORMS: Unconventional Platforms for Remote Sensing.** This project has been running since 2005 under the leadership of Jurgen Everaerts (VITO, Mol, Belgium) and aims at keeping EuroSDR and the geoinformation community informed and up to date on the alternatives to airplanes and satellites as platforms for Earth Observation sensing. The project has evolved into an open, permanent project whose main goal is to scrutinize non-standard platforms such as Unmanned Aerial Vehicles (UAV), balloons, powered paragliders, blimps, etc.

**EuroCOW 2006.** The first edition of the European Calibration and Orientation Workshop was organized by the Institute of Geomatics (Castelldefels, Spain) on behalf of EuroSDR and ISPRS Working Group 1.3 - Multi-Platform Sensing and Sensor Networks. The meeting took place from 25<sup>th</sup> to 27<sup>th</sup> January and brought together more than eighty participants. The workshop proceedings include twenty-eight papers covering direct and indirect sensor orientation and calibration of analogue and digital cameras as well as of LiDAR sensors. The keynote speakers were Dr. Peter Friess (Optech International, USA) and Prof. Dr. Wolfgang Kresse (University of Applied Sciences Neubrandenburg, Germany). EuroCOW 2008 is planned for 30<sup>th</sup> January to 1<sup>st</sup> February 2008 and will be co-organized with ISPRS Working Groups 1.3 and 1.4.

**New Commission Chairman.** EuroSDR’s Commission 1 ended 2006 with the appointment of a new chairman. From the many strong candidates, Dr. Michael Cramer was appointed. Michael Cramer has a long and wide experience in the field of sensor orientation and calibration; he has been involved in many digital camera orientation and calibration tests and has served EuroSDR as leader of its Network on Digital Camera Calibration.



# Image Analysis and Information Extraction

Juha Hyyppä

Four projects were completed in 2006. The project reports are contained in official EuroSDR Publications No 50 and 51.

**Information for mapping from SAR and optical imagery**, chaired by Olaf Hellwich, Technical University of Berlin, compared the potential of airborne synthetic aperture radar data with imagery from optical sensors for topographic mapping using visual interpretation. In general all of the linear and areal features could be interpreted quite well in SAR images. Classification appears to be much more difficult in SAR images, as railways were sometimes classified as streets. Smaller linear objects, such as roads, alleys and small rivers, led to more errors when locating and classifying them in SAR images. While comparing areal areas, large contiguous areas are usually well detected while small areas seem to be barely detectable in SAR imagery, whereas they can be found in optical images. More conclusions can be found in the final report.

**Automatic extraction, refinement, and update of road databases from imagery and other data**, was chaired by Helmut Mayer, Bundeswehr University Munich, Germany, and Manos Baltsavias, ETH Zurich, Switzerland. The aims of the project were to evaluate the current status of research and to test and compare existing semi- and fully automated methods in order to have a fast implementation of operational procedures for road extraction, update, and refinement. In summary, the results show that it is possible to extract roads with a quality in terms of completeness and correctness, which should be useful for practical applications, although only for scenes with limited complexity, namely up to medium complex rural scenes (aerial and high resolution satellite data). A practical limitation is that most approaches cannot deal with images larger than about 2000 by 2000 pixels at the moment. Particularly in the case of high resolution data such as from the ADS40, much needs to be done to improve the quality of automatic processes. The work is expected to continue on a longer term basis through co-operation with ISPRS working group III/5 on "Models and Algorithms for Road Extraction and Traffic Monitoring". Details of the project can be found in the final report.

**Evaluation of Quality of Digital Terrain Models**, was chaired by Prof. Joachim Höhle, Aalborg University. The goal of the project was to develop procedures for DTM quality control and to test existing or new methods. One method, which derives corrections for the delivered DTM by means of parallaxes between two overlapping orthoimages, was applied to all test

areas and achieved the best results. More conclusions can be found in the final report.

**Change Detection**, was chaired by Klaus Steinnocher from ARC system research GmbH, Austria. The project focussed on the development and implementation of a change detection process that automatically locates change occurrences rather than defining the type or the detailed geometry of change. The main principle of the methodology developed was that the images were first segmented and then classified to identify basic land cover types such as meadow, forest and water as well as different urban classes. The next step shows where the changes have taken place. The methodology was designed such that segmentation, classification and comparison can be adapted to both image as well as land use data. An evaluation of the usability of the change map showed that its integration in the update process improves the quality of the updating results significantly.

Currently, two projects are running. In the joint EuroSDR/ISPRS **Tree Extraction Project**, chaired by

Juha Hyyppä, Finnish Geodetic Institute, methods of obtaining individual tree geometry information are compared using laser scanning, photogrammetry and hybrid methods. More than ten international groups have provided their 3D models for the verification. Re-

sults obtained for individual tree extraction in literature have varied significantly from study to study. First results show that the quality of the methods does not reflect that reported in the literature. The variation of forest conditions seems to play a major role.

**Detection of Unregistered Buildings for Updating Databases**, chaired by Nicholas Champion, IGN, France. The project focuses on analysing the unregistered buildings from three test sites: Lyngby, Denmark, Marseille, France and Toulouse, France.



An example of an output from the Tree Extraction comparison project

Juha Hyyppä  
Chairman  
Commission 2



# Production Systems and Processes

Eberhard Gülch

Three projects were successfully concluded, either entirely or in part in 2006.

## **Evaluation of building extraction - Leader: Prof Dr Juha Hyyppä, Finnish Geodetic Institute**

The results of this empirical test have been published in EuroSDR publication No 50. A scientific paper is planned to be published in the ISPRS Journal. An invitation has been extended to the Commission Chairman and project leader to contribute to a book on this subject. The project leader has prepared a distance e-learning course as part of EuroSDR's education service, EduServ5 event from March-June 2007.

## **Digital Camera Calibration – Phase 2 - Leader Dr Michael Cramer, University of Stuttgart**

The data sets for phase 2 on the geometric aspects of camera calibration have been distributed. Results from more than seventeen participants with more than seventy individual cases have been analysed. A final report for phase 1 and phase 2 is planned for spring 2007.

A new initiative on camera certification has been prepared and will be discussed with interested parties and NMCAs (National Mapping Cadastral Agencies) during Spring 2007.

Ideas for phase 3 with a focus on radiometric aspects of camera calibration are emerging.

## **City/GML – Phase 1 - Leader: Dr Thomas Kolbe, Technical University Berlin**

The CityGML standard for city models has attracted world-wide attention and was accepted as an OGC discussion paper in June 2006. CityGML is currently being evaluated in OGC Test Bed #4. Of special interest here is the relation to IFC, the standard in Architecture (CAAD, AEC/FM). Dr. Kolbe is continuing discussions with representatives from OGC, SIG 3D and the IAI to discuss interfaces and modelling adaptations. The Workshop on Next Generation City Models 2005 has been published as EuroSDR Publication No 49.

This Commission plans to continue its work in the following areas:

Eberhard Gülch  
Chairman  
Commission 3

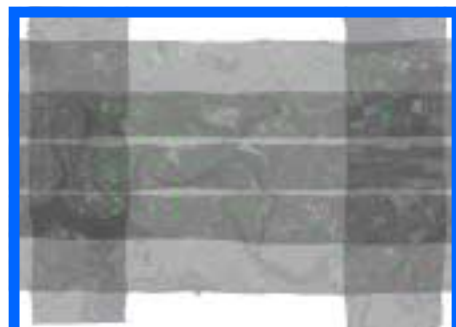


- Integration of terrestrial (including CAD and GIS datasets) and aerial methods for 3D city modeling - evaluation of current status in close cooperation with Commission 2.
- Mobile Mapping

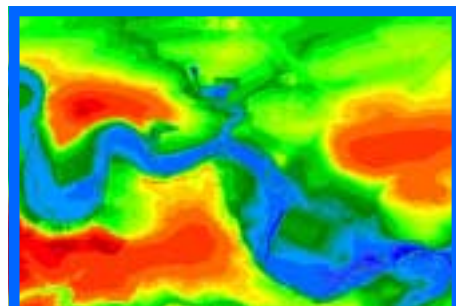
approaches in the navigation industries - potential and chances for cooperation on a European level

- Digital globes: chances, challenges and opportunities - evaluation of the impact the on geospatial industry.
- Business process modelling in the context of increasing outsourcing/subcontracting of NMCAs and public/private partnerships.
- Creating and maintaining an industrial partner database from earlier and ongoing projects to increase dissemination of research results, to serve as a forum for discussion on future needs in R&D and to encourage potential participants and project leaders from industry.
- Planned contributions to UDMS Conference, Stuttgart University of Applied Sciences, October 10-12, 2007.

## *From the EuroSDR Digital Camera Calibration Project (see page 12)*



ADS40 test data set, distribution of check points in Vaihingen/Enz test site



ADS40 test data set, digital height model Vaihingen/Enz test site



# Core Geoinformation Databases

Keith Murray

I start this years report by thanking Colin Bray for his work as Chairman of Commission 4. Colin held the post since 2004 until May this year when he had to step down due to pressure of work arising from changes within Ordnance Survey Ireland. I agreed to resume this role which I undertook from 1998-2004 for a further two years. I will soon be seeking volunteers to pick up the role in early 2008!

## Developments in Geographic Information

The world of GI is changing faster than ever. Business in both the public and private sectors and the general public have more access to geoinformation today than they ever had. In the past year millions of new users have been brought into the fold through innovations such as Google Earth and Microsoft Virtual Earth and in-car sat-nav systems. At the same time the next generation Spatial Data Infrastructures (SDI) are starting to be designed at national and at European levels (ESDI and INSPIRE). These initiatives require investment and then maintenance. Their funding has to be recovered from the benefits that are derived from such developments. Hence the new data infrastructures will need to be developed more on the lines of professional Information and Communications Technology [ICT] systems using international standards and common protocols.

To achieve this step change in operation, we need to revisit the kind of data we hold and maintain; how it is modelled and what it is designed to do. The lesson that one dataset cannot necessarily be easily reused for another purpose has been learnt the hard way by many practitioners. If we want to link information we have to build this into the data model and if we wish to derive lower resolution datasets, likewise we have to design the capability into the overall schema.

Of course it would be nice to start again and design everything top-down, but we cannot do that. The costs would be prohibitive and we have to start with the data that we have today, taking steps towards better integration, fitting in with and exploiting new technologies, migrating to better data structures, greater connectivity and making improvements in data quality and consistency at each step.

A EuroSDR Task Force has just been established to help determine how EuroSDR can assist in the development of SDI's and related developments. Such developments are at the heart of Commission 4.

## Commission 4 in 2006 and plans for 2007

By exploring examples of best practice we seek to learn faster and bypass errors/avenues that lead nowhere. During 2006 these objectives have been reflected in the programme of events that Commission 4 has engaged in. The start of the **Generalisation Project** was delayed slightly but is progressing well. Commission 4 also co-organised with Commission 5 the **Features and Objects Workshop** in Munich in April (see the Commission 5 report for more information). That workshop was run in connection with the INSPIRE Data Specifications Drafting Team (also see **the INSPIRE report** on page 11).



One of the surprise outcomes of the Features and Objects workshop was a high level of interest in Land-Marine information integration. Following that workshop a questionnaire was sent to all National mapping and Cadastral Agencies and European members of the International Hydrographic Organization (IHO). As a consequence there was strong demand for a workshop to share best practice and knowledge. The workshop on **Land-Marine Information Integration** will be a joint EuroSDR and IHO organised event and will be open to all interested parties. This is now planned to take place at **Malahide, near Dublin on 21-23 March 2007**.

**Data Quality** will remain a key issue; without reliable and consistent information, many of the true benefits of geoinformation will remain elusive. However the cost of quality improvement becomes increasingly exponential as quality level targets reach the higher range of 95-99%. At the successful data quality workshop held with EuroGeographics in 2005 it was agreed that another event of its kind should be held and planning for this will start in 2007. A provisional theme for a workshop is "*standards and accreditation*".

Keith Murray  
Chairman  
Commission 4



# Integration and Delivery of Data and Services

Mike Jackson

The major event for 2006 was the joint Workshop with EuroGeographics on Feature/Object Data Models held in Munich on 24-25 April. This Workshop, hosted by the Bavarian Office for Surveying and Geographical Information (LVG), was a sequel to the 'NMCA's and the Internet II – eDelivery and Feature Serving' Workshop held in 2005.



Participants at the Feature/Object Data Models Workshop, Munich, April 2006

The objectives of the Workshop were:

- To understand the rationale and business benefits of feature/object data models
- To evaluate current experience and establish current best practice/state of the art in design and implementation
- To understand the current status and future plans for moving to feature/object data models
- To identify outstanding research and development issues
- To facilitate interoperability at the data model level

The Workshop was attended by forty-four delegates from fifteen countries and was timed to immediately precede and input to a meeting of the 'Data Specifications' Drafting Team for the INSPIRE Implementation Rules most of the members of which were also participants to the Workshop.

Mike Jackson  
Chairman  
Commission 5



A full report and copies of papers are available from [www.eurocdr.net/workshops/models\\_2006](http://www.eurocdr.net/workshops/models_2006) and results were also presented by Peter Woodsford at the 12<sup>th</sup> EC-GI & GIS Workshop held in Innsbruck, Austria 21-23 June 2006.

The success of the Workshop is a tribute to the energy and commitment of Peter Woodsford who came to the end of his term as Commission Chairman during the year. Our thanks go to Peter for his leadership of the Commission - he will be a hard act to follow.

2006 also saw the commencement of planning for a joint EuroSDR/AGILE/OGC Workshop on the theme of geospatial interoperability and the development within Europe of a persistent test-bed facility. The objective is not just to test the current fitness for purpose of geospatial standards but to support on-going research into interoperability as well as providing a reference capability and testing environment for organisations considering procurement of solutions. The Workshop will be held on May 8<sup>th</sup> 2007 in Aalborg, Denmark and will precede the AGILE annual Conference.

## Technology Roadmap Think Tank

An inter-commission Working Group on the subject of a 'Technology Roadmap Think Tank' was set up at the 109<sup>th</sup> meeting. Its aim is to bring together collective thinking on technical trends that will affect NMCA's in the near term (next 2 years), medium term (next 5 years) and long term (next 10 years). It is headed by Peter Woodsford. To date experiments in collaborative working using the Moodle software have been set up by Dave Chapman of University College London (UCL). These are being evaluated in a test run using students on the UCL M.Sc. course, with a view to initiating activity across the group in 2007.



## The Legislation

On the evening of 21<sup>st</sup> November 2006 several years of discussion, debate and latterly negotiation ended when representatives of the European Parliament and the Council of Ministers agreed the text of a handful of amendments to the draft INSPIRE directive. In early 2007 we can expect to see both bodies formally approve the directive after which it will be published in the European Journal and after a set period of time (20 days) will become European law. Member states will then complete the process by transposing the directive into national laws and statutes; this usually takes a further two years. Therefore member states will be expected to have the directive established by the summer of 2009.

The directive itself contains several clear statements as regards metadata, data specifications, network services and data sharing policy as well as three Annexes that list geographic themes that are in scope of the directive.

Each team will prepare documents, based on the reference material provided by user communities and state-of-the-art evidence. These documents will eventually become (directly or indirectly) the Implementing Rules. The review process initially includes the other drafting teams and the Commission's Coordination Team. Once each document is ready for wider review the current plan is for it to be released to SDICs and LMO's. After this it will be updated and enter further consultation and a committee of representatives of member states will adopt the rules whereupon it will emerge as part of the supporting official documentation of the legislation. Occasionally questionnaires may emerge from the drafting teams to support the drafting work and its feasibility (such as the metadata questionnaire issued in 2006).

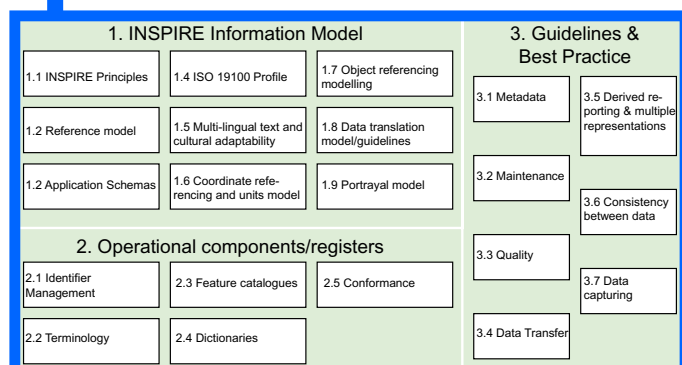
## Implementing Rule reviews in 2007

The SDIC/LMO review process is expected to start in early 2007 and to run for a large part of the year. Therefore SDICs and LMOs should prepare themselves to engage in the review process during 2007. While there will not be very many documents the content may be detailed and will often require specialist technical or business knowledge in order to respond effectively.

The main document from the Data Specifications team is the General Conceptual Model (D2.5). This describes the documentation and standards required to define each theme and key components such as schema definition, unique identifiers, referencing, coordinate systems and so on. A generic glossary is being developed to support the Implementing Rules so as to avoid misunderstanding and ambiguity.

Workshops have been held to help determine the state of the art in several topic areas. EuroSDR organised the Features and Objects workshop in Munich but more recently the Commission has held short workshops investigating multi-lingual aspects and the multi-representation of objects at different resolutions.

This last year has been a busy one for most of the drafting teams, but with the clock now ticking on the legislation and transposition process starting in 2007 – the pace is expected to increase next year. The continued support from SDICs and LMOs to assist in the drafting process will be important as will active participation in the forthcoming documentation reviews.



## The Implementing Rules

In English, at least, there is a phrase “the devil is in the detail” which means that, while it is fine to agree the principles, we need to understand the details to determine whether a proposal will or will not work. So too with INSPIRE; the Implementing Rules will support the directive with the aim of providing more details and information regarding the framework. This will instruct and guide and inform users working within the directive. The Drafting Teams for the Implementing Rules were selected from Spatial Data Interest Communities [SDICs] such as EuroSDR, and Legally Mandated Organisations [LMOs] such as most NMCAs. Indeed EuroSDR successfully placed around fifteen experts across the five teams. Each drafting team covers a specific domain: Metadata; Data Specifications; Network Services; Data and Service Sharing and Monitoring & Reporting.

Keith Murray  
Chairman  
Commission 4



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## *EuroSDR's 50th Publication*

*Kevin Mooney*

EuroSDR is very proud that 2006 saw the distribution of its 50th publication in November. Official Publication No. 50 contains the reports of four completed EuroSDR projects or project phases:

- Evaluation of Building Extraction by Harri Kaartinen and Juha Hyypä
- Change Detection by Klaus Steinnocher and Florian Kressler
- Sensor and Data Fusion Contest: Information for Mapping from Airborne SAR and Optical Imagery (Phase I Report) by Anke Bellmann and Olaf Hellwich
- Automated Extraction, Refinement, and Update of Road Databases from Imagery and Other Data by Helmut Mayer, Emmanuel Baltsavias, and Uwe Bacher

The publication is in colour in book form and consists of 286 pages. A CDROM version will be distributed in Spring 2007.

Publication No.49, also published in 2006, contains the proceedings of three EuroSDR workshops, namely:

- PAI2: Achieving Geometric Interoperability of Spatial Data (June 2005)
- Next Generation 3D City Models (June 2005)
- Feature/Object Data Models (April 2006)

EuroSDR (OEEPE prior to 2001) has been publishing the findings and outcomes of its research activities for over forty years and these have covered a range of topics across the spatial data provision, management

and delivery spectrum.

The majority of publications are in book form being the reports of applied research projects, but in recent years an increased number of CDROM publications has reflected the growth in focused workshops aimed at assessing state-of-the-art and key issues in targeted areas.

Official EuroSDR publications are generously sponsored by Bundesamt für Kartographie und Geodäsie (BKG), Frankfurt, Germany where master documents are prepared. Printing and distribution is carried out under contract with a commercial print-on-demand publishing company - Gopher in Utrecht, the Netherlands.

All publications may be accessed via our website [www.eurosd.net](http://www.eurosd.net) and are available in three forms:

- Publications that contain the proceedings of workshops are available as dedicated online websites containing comprehensive information such as the workshop programme, presentations, reports and photos. These may be accessed directly from our homepage at [www.eurosd.net](http://www.eurosd.net).
- Low resolution versions of book publications are also available on the EuroSDR website ([www.eurosd.net](http://www.eurosd.net)) as downloadable pdf files.
- Full book publications and CDROM publications may be ordered online directly from our print-on-demand publishing company for a fee that reflects printing and distribution costs. The link to Gopher is available from the EuroSDR website.

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## *Digital Camera Calibration*

*Michael Cramer*

Activities in 2006 were mainly focused on the empirical analysis of airborne sensor data from well controlled photogrammetric test flights. Data from the Intergraph ZI DMC, Microsoft/Vexcel UltracamD and Leica ADS40 cameras were distributed to interested network members. Most evaluated one of these flights and tried to obtain optimal performance from the given data. Afterwards, different evaluations and versions were returned to the pilot centre, where the abso-

lute quality of the results was checked from independent check point analysis.

In almost all cases additional parameters were introduced to compensate for remaining systematic effects in the imagery. Mathematical polynomial corrections or physical relevant parameters have mostly been applied. Two participants introduced sensor specific corrections, explicitly developed for the individual cam-

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# Digital Camera Calibration (cont'd)

Michael Cramer

era layout. In almost all cases the absolute accuracy was increased, mainly in the height component.

Specifically some results from the DMC test data are considered. The images were acquired in the test field Frederikstad / Norway with a ground sampling distance of approximately 15cm. Four different participants returned several versions using different software for tie point transfer (like LPS, Match-AT, Pho-

toMod, ISAT), different bundle adjustments (BLUH, Match-AT, PhotoMod, IS Photo-T) and different additional parameter sets. Although each participant used the same input images and control points, the obtained absolute accuracy behaved differently. Larger variations are obvious especially in the vertical component. This is due to the different mathematical models used and the individual performance of manual and automatic image point measurements.

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## EduServ

Joachim Höhle

The education service of EuroSDR, EduServ4, continued in 2006 with four **e-learning courses**:

- Co-ordinate Systems and Transformations for Spatial Position from the Dublin Institute of Technology
- Positional Accuracy Improvements from Ordnance Survey Great Britain and TU Berlin
- Quality of Geospatial Data and the Related Statistical Concepts from ITC Enschede
- Methods for Checking and Improving of Digital Terrain Models from Aalborg University

The courses were preceded by a two day **educational seminar** at ITC in the Netherlands, where the topics and courses were introduced.

EduServ4 was organised by Prof. Alfred Stein and ITC. Each course had between ten and fourteen participants. They came from nine countries (EuroSDR member countries, South Korea, Oman, and Kenya). Communication around the globe was carried out over the Internet and by special communication software, 'WebCT' (course 1 and 2) or 'Blackboard' (course 3 and 4). EduServ4 was therefore a truly global education event.

Planning began in 2006 for the next module of the EuroSDR education service, **EduServ5**, which will offer the following courses:

- Methods for Checking and Improving of Digital Terrain Models
- Quality of Geospatial Data and the Related Statistical Concepts
- Mapping with SAR
- Laserscanning for 3D city models

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## Standards

Wolfgang Kresse

EuroSDR continued to influence the development of new International Standards in the field of geographic information through its formal liaison-relationships with ISO/TC 211 "Geographic information / Geomatics" and with CEN/TC 287 "Geographic information".

The present standardization projects of ISO/TC 211 cover a wide range of topics.

Reference model and metadata for imagery will be published by the middle of 2008.

Three OGC-originated standards are completed: Geography Markup Language, Web Feature Service, and Filter Encoding.

A "second generation" of standards for Location Based Services will refer to Transfer Nodes and Linear Referencing Systems.

The ISO 19130 "Sensor data models for imagery and gridded data" was cancelled due to the expiration of the 5-year-period, and will be restarted in 2007.

CEN/TC 287 publishes new European standards for the Spatial Data Infrastructure as profiles of the ISO-19100 standards while the INSPIRE initiative develops the related Implementation Rules.

A Memorandum of Understanding (MoU) has been identified as the most suitable way of establishing a formal relationship with the Open Geospatial Consortium (OGC), and EuroSDR has started the process of reaching an agreement with OGC that will serve the interests of both organisations.

# Organisational Developments in 2006

Kevin Mooney

We are very pleased that The Netherlands became the eleventh country to transfer its membership from that based on the original and continuing OEEPE treaty to membership of EuroSDR as an organisation incorporated under Irish Company Law. The Netherlands Geodetic Commission was officially confirmed as the member for The Netherlands in October 2006 and continues the country's long and active membership of OEEPE/EuroSDR, which dates back to the signing of the original OEEPE Treaty on behalf of The Kingdom of the Netherlands in 1953.

A further milestone was passed during the year with the admission of the first EuroSDR Associate Member. The National Land Survey of Finland was formally admitted as an Associate member of EuroSDR in October 2006.

A number of personnel changes also occurred during

the year. Dr. Ismael Colomina, Institut de Geomàtica (Castelldefels, Catalunya, Espanya), Mr. Colin Bray, Ordnance Survey Ireland (Dublin, Ireland) and Mr. Peter Woodsford, Laser-Scan (Cambridge, UK) all stepped down as Chairmen of Commissions 1, 4 and 5 respectively. They were replaced by Dr. Michael Cramer, Institut für Photogrammetrie (Universität Stuttgart, Deutschland), Mr. Keith Murray, Ordnance Survey of Great Britain (Southampton, UK) and Prof. Mike Jackson, Centre for Geospatial Science (University of Nottingham, UK) respectively all of whom took up their positions during 2006.

Finally, the organisation was joined by Ms. Oonagh Birchall of the Dublin Institute of Technology (DIT), who took up the position of Assistant to the Secretary-General in November. Based at the Secretariat offices at DIT, Oonagh replaced Ms. Stephney Moore who filled the position from October 2004.

## Financial Overview 2006

(Subject to audit)

Income		Expenditure	
Membership fees 2006	93,993.65	Research (1)	12,518.86
Workshops	769.07	Services	124.71
		Executive Team	15,491.74
		Secretariat	57,200.32
		Annual recurring (2)	2,940.48
		Legal	9,680.00
<b>Totals</b>	<b>€94,762.72</b>		<b>€97,956.11</b>
<b>Income Surplus</b>	<b>-€3,193.39</b>		

**Notes:**

- (1) Allocated as project seed funding. Projects are largely financed by contributions from members and project participants.
- (2) Subscription Fees, Newsletter costs, Web hosting, Bank charges, Publication costs.

# Over 40 Years of EuroSDR Publications

1. *Trombetti, C.*: "Activité de la Commission A de l'OEEPE de 1960 à 1964" - *Cunietti, M.*: "Activité de la Commission B de l'OEEPE pendant la période septembre 1960 - janvier 1964" - *Förstner, R.*: "Rapport sur les travaux et les résultats de la Commission C de l'OEEPE (1960-1964)" - *Neumaier, K.*: "Rapport de la Commission E pour Lisbonne" - *Weele, A.J. v.d.*: "Report of Commission F." - Frankfurt a.M. 1964.
2. *Neumaier, K.*: "Essais d'interprétation de >>Bedford<< et de >>Waterbury<<. Rapport commun établi par les Centres de la Commission E de l'OEEPE ayant participé aux tests" - "The Interpretation Tests of >>Bedford<< and >>Waterbury<<. Common Report Established by all Participating Centres of Commission E of OEEPE" - "Essais de restitution >>Bloc Suisse<<. Rapport commun établi par les Centres de la Commission E de l'OEEPE ayant participé aux tests" - "Test >>Schweizer Block<<. Joint Report of all Centres of Commission E of OEEPE" - Frankfurt a.M. 1966.
3. *Cunietti, M.*: "Emploi des blocs de bandes pour la cartographie à grande échelle - Résultats des recherches expérimentales organisées par la Commission B de l'OEEPE au cours de la période 1959-1966" - "Use of Strips Connected to Blocks for Large Scale Mapping - Results of Experimental Research Organized by Commission B of the OEEPE from 1959 through 1966" - Frankfurt a.M. 1968.
4. *Förstner, R.*: "Sur la précision de mesures photogrammétriques de coordonnées en terrain montagneux. Rapport sur les résultats de l'essai de Reichenbach de la Commission C de l'OEEPE" - "The Accuracy of Photogrammetric Co-ordinate Measurements in Mountainous Terrain. Report on the Results of the Reichenbach Test Commission C of the OEEPE" - Frankfurt a.M. 1968.
5. *Trombetti, C.*: "Les recherches expérimentales exécutées sur de longues bandes par la Commission A de l'OEEPE". - Frankfurt a.M. 1972.
6. *Neumaier, K.*: "Essai d'interprétation. Rapports des Centres de la Commission E de l'OEEPE". - Frankfurt a.M. 1972.
7. *Wiser, P.*: "Etude expérimentale de l'aérotiangulation semi-analytique. Rapport sur l'essai >>Gramastetten<<". - Frankfurt a.M. 1972.
8. "Proceedings of the OEEPE Symposium on Experimental Research on Accuracy of Aerial Triangulation (Results of Oberschwaben Tests)" *Ackermann, F.*: "On Statistical investigation into the Accuracy of Aerial Triangulation. The Test Project Oberschwaben" - "Recherches statistiques sur la précision de l'aérotiangulation. Le champ d'essai Oberschwaben" - *Belzner, H.*: "The Planning, Establishing and Flying of the Test Field Oberschwaben" - *Stark, E.*: "Testblock Oberschwaben, Programme I. Results of Block Adjustment by Independent Models" - *Ebner, H.*: "Comparison of Different Methods of Block Adjustment" - *Wiser, P.*: "Propositions pour le traitement des erreurs non-accidentelles" - *Camps, F.*: "Résultats obtenus dans le cadre du projet Oberschwaben 2A" - *Cunietti, M.*; *Vanossi, A.*: "Etude statistique expérimentale des erreurs d'enchaînement des photogrammes" - *Kupfer, G.*: "Image Geometry as Obtained from Rheid Test Area Photography" - *Förstner, R.*: "The Signal-Field of Baustetten. A Short Report" - *Visser, J.*; *Leberl, F.*; *Kure, J.*: "OEEPE Oberschwaben Réseau Investigations" - *Bauer, H.*: "Compensation of Systematic Errors by Analytical Block Adjustment with Common Image Deformation Parameters". - Frankfurt a.M. 1973.
9. *Beck, W.*: "The Production of Topographic Maps at 1:10,000 by Photogrammetric Methods. - With statistical evaluations, reproductions, style sheet and sample fragments by Landesvermessungsamt Baden-Württemberg Stuttgart". - Frankfurt a.M. 1976.
10. "Résultats complémentaires de l'essai d'<<Oberriet>> of the Commission C de l'OEEPE - Further Results of the Photogrammetric Tests of <<Oberriet>> of the Commission C of the OEEPE".  
*Hárry, H.*: "Mesure de points de terrain non signalisés dans le champ d'essai d'<<Oberriet>> - Measurements of Non-Signalized Points in the Test Field <<Oberriet>> (Abstract)" - *Stickler, A.*; *Waldhäusl, P.*: "Restitution graphique des points et des lignes non signalisés et leur comparaison avec des résultats de mesures sur le terrain dans le champ d'essai d'<<Oberriet>> - Graphical Plotting of Non-Signalized Points and Lines, and Comparison with Terrestrial Surveys in the Test Field <<Oberriet>>" - *Förstner, R.*: "Résultats complémentaires des transformations de coordonnées de l'essai d'<<Oberriet>> de la Commission C de l'OEEPE - Further Results from Co-ordinate Transformations of the Test <<Oberriet>> of Commission C of the OEEPE" - *Schürer, K.*: "Comparaison des distances d'<<Oberriet>> - Comparison of Distances of <<Oberriet>> (Abstract)". - Frankfurt a.M. 1975.
11. "25 années de l'OEEPE".  
*Verlaine, R.*: "25 années d'activité de l'OEEPE" - "25 Years of OEEPE (Summary)" - *Baarda, W.*: "Mathematical Models". - Frankfurt a.M. 1979.
12. *Spiess, E.*: "Revision of 1:25,000 Topographic Maps by Photogrammetric Methods." - Frankfurt a.M. 1985.
13. *Timmerman, J.*; *Roos, P.A.*; *Schürer, K.*; *Förstner, R.*: "On the Accuracy of Photogrammetric Measurements of Buildings - Report on the Results of the Test "Dordrecht", Carried out by Commission C of the OEEPE. - Frankfurt a.M. 1982.
14. *Thompson, C.N.*: Test of Digitising Methods. - Frankfurt a.M. 1984.
15. *Jaakkola, M.*; *Brindöpke, W.*; *Kölbl, O.*; *Noukka, P.*: Optimal Emulsions for Large-Scale Mapping - Test of "Steinwedel" - Commission C of the OEEPE 1981-84. - Frankfurt a.M. 1985.
16. *Waldhäusl, P.*: Results of the Vienna Test of OEEPE Commission C. - *Kölbl, O.*: Photogrammetric Versus Terrestrial Town Survey. - Frankfurt a.M. 1986.
17. *Commission E of the OEEPE*: Influences of Reproduction Techniques on the Identification of Topographic Details on Orthophotomaps. - Frankfurt a.M. 1986.
18. *Förstner, W.*: Final Report on the Joint Test on Gross Error Detection of OEEPE and ISP WGIII/1. - Frankfurt a.M. 1986.
19. *Dowman, I.J.*: Spacelab Metric Camera Experiment - Test of Image Accuracy - Frankfurt a.M. 1987.
20. *Eichhorn, G.*: Summary of Replies to Questionnaire on Land Information Systems - Commission V - Land Information Systems - Frankfurt a.M. 1988.
21. *Kölbl, O.*: Proceedings of the Workshop on Cadastral Renovation - Frankfurt a.M. 1988.
22. *Rollin, J.*; *Dowman, I.J.*: Map Compilation and Revision in Developing Areas - Test of Large Format Camera Imagery - Frankfurt a.M. 1988.
23. *Drummond, J. (ed.)*: Automatic Digitizing - Frankfurt a.M. 1990.
24. *Ahokas, E.*; *Jaakkola, J.*; *Sotkas, P.*: Interpretability of SPOT Data for General Mapping - Frankfurt a.M. 1990.
25. *Ducher, G.*: Test on Orthophoto and Stereo-Orthophoto Accuracy - Frankfurt a.M. 1991.
26. *Dowman, I.J. (ed.)*: Test of Triangulation of SPOT Data Frankfurt a.M. 1991.
27. *Newby, P.R.T.*; *Thompson, C.N. (ed.)*: Proceedings of the ISPRS and OEEPE Joint Workshop on Updating Digital Data by Photogrammetric Methods - Frankfurt a.M. 1992.
28. *Koen, L.A.*; *Kölbl, O. (ed.)*: Proceedings of the OEEPE Workshop on Data Quality in Land Information Systems - Frankfurt a.M. 1992.
29. *Burman, H.*; *Torlegård, K.*: Empirical results of GPS-Supported Block Triangulation - Frankfurt a.M. 1994.
30. *Gray, S. (ed.)*: Updating of Complex Digital Databases - Frankfurt a.M. 1995.
31. *Jaakkola, J.*; *Sarjakoski, T.*: Experimental Test on Digital Aerial Triangulation - Frankfurt a.M. 1996.

(Continued on page 16)

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32. *Dowman, J.J.*: The OEEPE GEOSAR Test of Geocoding ERS-1 SAR data - Frankfurt a.M. 1996.
33. *Kölbl, O.*: Proceedings of the OEEPE Workshop on Application of Digital Photogrammetric Workstations - Frankfurt a.M. 1996.
34. *Blau, E.; Boochs, F.; Schulz, B.-S.*: Digital Landscape Model for Europe (DLME) - Frankfurt a.M. 1997.
35. *Fuchs, C.; Gülch, E.; Förstner, W.*: OEEPE Survey on 3D-city models  
*Heipke, C.; Eder, K.*: Performance of Tie-Point Extraction in Automatic Aerial Triangulation, Frankfurt a.M. 1998.
36. *Kirby, R.P.*: Revision Measurement of Large Scale Topographic Data , *Höhle, J.*: Automatic Orientation of Aerial Images on Database Information; *Dequal, S.; Koen, L.A.; Rinaudo, F.*: Comparison of National Guidelines for Technical and Cadastral Mapping in Europe ("Ferrara Test") Frankfurt a.M. 1999.
37. *Kölbl, O. (ed.)*: Proceedings of the OEEPE Workshop on Automation in Digital Photogrammetric Production - Frankfurt a.M. 1999.
38. *Gower, R.*: Proceedings of the OEEPE Workshop on National Mapping Agencies and the Internet *Flotron, A.; Kölbl, O.*: Precision Terrain Models for Civil Engineering, Frankfurt a.M. 2000.
39. *Ruas, A.*: Automatic Generalisation Project: Learning Process from Interactive Generalisation - Frankfurt a.M. 2001.
40. *Torlegård, K.; Nelson, J.*: OEEPE Workshop on Airborne Laserscanning and Interferometric SAR for Detailed Digital Elevation Models - Frankfurt a.M. 2001.
41. *Radwan, M., Onchaga, R. and Morales, J.*: A Structural Approach to the Management and Optimization of Geoinformation Processes - Frankfurt a.M. 2001.
42. *Heipke, C., Sester, M. and Willrich, F.*: Joint OEEPE/ISPRS Workshop - from 2D to 3D - Establishment and Maintenance of National Core Geospatial Databases, *Woodsford, P. (ed.)*: OEEPE Workshop – Use of XML/GML, Frankfurt a.M. 2002.
43. *Heipke, C., Jacobsen, K. and Wegmann, H.*: Integrated Sensor Orientation - Test Report and Workshop Proceedings - Frankfurt a.M. 2002.
44. *Holland, D., Guilford, B. and Murray, K.*: Topographic Mapping from High Resolution Space Sensors - Frankfurt a.M. 2002.
45. *Murray, K.*, 2003. OEEPE Workshop on Next Generation Spatial Database - 2005.  
*Altan, O. & Tastan, H.*, Eds., OEEPE/ISPRS Joint Workshop on Spatial Data Quality Management. Frankfurt a.M. 2003.
46. *Heipke, C., Kuitinen, R. and Nagel, G.*, 2003. From OEEPE to EuroSDR: 50 years of European Spatial Data Research and beyond. Seminar of Honour. Frankfurt a.M. 2003.
47. *Koua, E. & Woodsford, P.*, 2004. Proceedings of EuroSDR Workshop 'Visualisation and Rendering'. Frankfurt a.M. 2004.
48. *Bray, C. & Woodsford, P. (eds.)* 2005. Proceedings of EuroSDR Workshops: "NMCA's and the Internet II" - Electronic Delivery and Feature Serving (23rd-25th February 2005, Frankfurt, Germany).  
Ontologies & Schema Translation Services (15th-16th April 2004, Mame-La-Vallee, Paris).  
Positional Accuracy Improvement: Impacts of improving the positional accuracy of GI databases (5th-7th May 2004, Dublin). Frankfurt a.M. 2005.
49. *Roensdorf, C.*, 2006. Proceedings of EuroSDR Workshop: "PAI2: Achieving Geometric Interoperability of Spatial Data", Munich, Germany (June 2005),  
*Kolbe, T. & Gröger, G.*, 2006. "Next Generation 3D City Models", Bonn, Germany (June 2005)  
*Woodsford, P.*, 2006. "Feature/Object Data Models", Munich, Germany (April 2006). Frankfurt a.M. 2006.
50. *Kaartinen, H. & Hyypää, J.*, 2006. Evaluation of Building Extraction Report.  
*Steinnocher, K. & Kressler, F.* 2006. Change Detection Report.  
*Bellmann, A. & Hellwich, O.*, 2006. Sensor and Data Fusion Contest: Information for Mapping from Airborne SAR and Optical Imagery (Phase I Report).  
*Mayer, H.; Baltasvias, E. and Bacher, U.*, 2006. Automated Extraction, Refinement, and Update of Road Databases from Imagery and Other Data Report. Frankfurt a.M. 2006.
51. *Höhle, J. & Potuckova, M.*, 2006. The EuroSDR Test "Checking and Improving of Digital Terrain Models  
*Skaloud, J.*, 2006. Reliability of Direct Georeferencing, Phase 1: An Overview of the Current Approaches and Possibilities  
*Legat, K., Skaloud, J. and Schmidt, R.*, 2006. Reliability of Direct Georeferencing, Phase 2: A Case Study on Practical Problems and Solutions. Frankfurt a.M. 2006.

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