

EuroSDR – a research organisation serving Europe’s geospatial information needs

Christian Heipke¹ and Kevin Mooney²

¹Vice president Research EuroSDR, Leibniz Universität Hannover, Germany

²Secretary-General EuroSDR, Dublin Institute of Technology, Ireland

www.eurosdrr.net

Abstract

EuroSDR is a European spatial data research organisation that undertakes collaborative applied research projects, hosts focussed workshops, publishes an official series of reports, delivers an annual series of short distance learning courses, contributes to the development of specifications and standards by OGC, ISO and CEN and participates in the drafting of the INSPIRE implementing rules. Membership consists of organisations representing national geospatial information production and/or research throughout Europe, currently from seventeen countries. Its strength lies in its functioning as a network of delegates, commission chairs and project leaders from production and research organisations. Research activities, undertaken through international co-operation and guided by a rolling research plan address the whole chain of reference spatial data production, management, visualisation and delivery. This paper describes the organisation, its modus of operation, and presents a list of currently running activities to illustrate its impact on the European geoinformatics community.

EuroSDR vision and mission

EuroSDR is a European spatial data research organisation with a tradition of more than 50 years. In the rapidly changing world of geospatial information (GI) EuroSDR according to its vision strives

to be the European research platform for National Mapping and Cadastre Agencies (NMCAs), 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 context (EuroSDR 2007).

In order to fulfil this vision EuroSDR undertakes collaborative applied research projects, hosts focussed workshops, publishes an official series of reports, delivers an annual series of short distance learning courses, contributes to the development of specifications and standards by OGC, ISO and CEN and participates in the drafting of the INSPIRE implementing rules. These activities are also mirrored in the EuroSDR mission statement (EuroSDR 2007), which sets out the following tasks:

- *To develop and improve methods, systems and standards for the acquisition, processing, production, maintenance and dissemination of reference information and to promote applications of all such data. Special emphasis is placed on the further development of airborne and space borne methods for data acquisition, on methods for information extraction from such sources and on the integration of such information with information from other sources.*
- *To encourage interaction between research organisations and the public and private sector to exchange ideas about relevant research problems and to transfer research results obtained to geoinformation production organisations.*

EuroSDR was founded in 1953 in Paris as OEEPE (Organisation Européenne d'Études Photogrammétriques Expérimentales) in the frame of an international treaty; see Paresi (2003) for a description of the first 50 years of the organisation. Today, membership consists of organisations representing national GI production and/or research throughout Europe, currently from seventeen countries (see Fig. 1). Its strength lies in its functioning as a network of experts, mainly from NMCA's and research organisations, but also from private industry, working together on a common research agenda.

EuroSDR internal structure

EuroSDR is governed by a science committee and a board of delegates comprised of representatives of the EuroSDR members, which meets twice a year in different parts of Europe, and makes decisions on all major issues including new projects, workshops etc. The organisation is represented by the president (the position rotates between member organisations every two years), the vice president (elected for a maximum of four years), and the secretary-general (elected for a maximum of eight years).

During science committee meetings the host country regularly presents highlights of its GI activities to the EuroSDR delegates and members of the



Figure 1: EuroSDR has members from seventeen countries: Austria, Belgium, Croatia, Cyprus, Denmark, Finland, France, Germany, Iceland, Ireland, Iceland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, UK

local GI community. This interaction between the national GI group and EuroSDR is a key element of each meeting and has proven to be essential in creating a better understanding of common issues in GI throughout Europe.

Research is carried out in five different commissions. Each commission chair is elected for a maximum of six years. Projects and workshops are normally organised within the commissions, notwithstanding the fact that for some activities commissions join forces. While topics for projects and workshops (including project leaders) are usually proposed by the commission chairs interested parties from inside and outside EuroSDR are encouraged to come up with an interesting theme. EuroSDR has two inter-commission working groups on education and on standards and creates short term task forces whenever the need arises.

It should be noted, while being beneficial to all involved, work for EuroSDR is voluntary in all cases. No salaries or honoraria of any kind are available for EuroSDR officers. Funding for projects is sought from national and international sources. Data costs can often be avoided through the participation of NMCAs which usually provide the necessary data free of charge for the purpose of EuroSDR activities.

General research perspectives

EuroSDR research goals and the strategy to achieve these goals are laid down in the Rolling Research Plan (see also Molenaar 2003). The plan reflects and predicts developments in the GI sector which are seen to impact EuroSDR members, and draws conclusions with respect to applied research. The term “Rolling” indicates that, while a plan is set up for a period of four years, it is reviewed and if necessary updated in much shorter cycles. The plan is a culmination of a process that draws on the expertise and experience of national GI production organisations, such as NMCAs, research institutes and industry.

The general research perspectives of EuroSDR have been agreed as the following (EuroSDR 2007):

- EuroSDR research should serve the whole European Geoinformatics Community, deal with problems of more than local significance, and be carried out by means of international co-operation. In particular pan-European developments should be closely integrated into the EuroSDR activities.
- While retaining a special emphasis on data acquisition EuroSDR research is concerned with the whole chain of reference information production, management, visualisation and delivery.
- EuroSDR should profile itself as a professional research exchange platform that is commercially neutral and which provides services to the European GI community.
- Private sector and industry should be involved in EuroSDR research, in particular through funded and non-funded projects.
- EuroSDR research results should be timely, having short project phases with intermediate and final deliverables.

The EuroSDR Rolling Research Plan 2007-2010

The current plan 2007-2010 (EuroSDR 2007) recognises that developments in the geoinformatics sector in Europe in recent years have been profound and continue at a very fast pace. These have been driven mainly by changing needs of society and developments in the area of information technology.

The plan addresses, through its research perspectives, the changing role of a typical national GI production organisation from a provider of paper and digital map data to a data warehouse primarily concerned with maintaining, updating and disseminating modern reference geoinformation supporting the development of advanced and integrated geoinformation infrastructures; from an agency using analogue technology and specialised hardware and software to one employing increasingly mainstream IT solutions; from an independent national agency to one among many players in a larger pan-European context of Galileo, GMES and INSPIRE; from a national administrative body with in-house production to an agency with an increasing share of commercial activities, including outsourcing significant parts of its activities.

Research topics, to be addressed by projects and workshops during 2007-2010 have been identified as:

1. Investigation of new sensor systems and platforms, related calibration aspects, including digital aerial and satellite sensors, laser and hyper-spectral scanners, SAR sensors, unmanned aerial vehicles, and mobile mapping systems;
2. Geometric data acquisition issues (sensor orientation and geo-referencing, digital surface models, digital terrain models);
3. Acquisition and update of static and moving objects (topographic vector data, digital terrain models and data from other objects) from images and collateral data in order to serve traditional and novel applications;
4. 3D reference information and 3D city models: spatial modelling, acquisition, analysis and visualisation;
5. Process modelling and interfaces (product diversity/servicing);
6. Geospatial reference databases (data modelling, currency/maintenance, unique identifier, metadata, changes only);
7. Standards and open software for data and metadata;
8. Ontologies, schema translation, and data integration;
9. Model generalisation and multi-resolution and multi-representation data bases;
10. Cartographic generalisation in terms of up- and downscaling, for traditional and non-traditional displays;
11. Delivery and data publishing mechanisms and, in particular, Geospatial Data Infrastructure and associated topics in ontologies and translation services;

12. Geoinformation data quality.

Projects are collaborative in nature involving a project centre (often a university) that agrees to co-ordinate the project, devise its aim and objectives, decide a methodology and distribute data and instructions to international participant organisations. These organisations actively participate in the project by working with the distributed data and returning their results to the project centre where they are analysed and a publication is prepared. Projects are typically structured in different phases and often have a length of a few years.

In contrast to projects, workshops seek to establish the state-of-the-art in a particular field through a face-to-face meeting of a relatively small group of experts. While presentations introduce the area, major focus is given to intensive discussions. In some cases workshops have proved to be a catalyst for a later EuroSDR project. Workshops are short-term activities. A time interval of six months between the idea and the workshop itself is typical.

Actual research work is currently carried out within five commissions, which deal with

1. Sensors, primary data acquisition and geo-referencing;
2. Image analysis and information extraction;
3. Production systems and processes;
4. Data specifications;
5. Network services.

Sensors, primary data acquisition and geo-referencing includes in its terms of reference:

- Sensor orientation and calibration;
- Accuracy and reliability of orientation, calibration and georeferencing;
- Earth observation platforms;
- Standards for sensor orientation and calibration.

Image analysis and information extraction includes in its terms of reference:

- Information content of multi-spectral, multi-sensor, multi-resolution, and multi-temporal imagery;
- Methods and algorithms for automated acquisition of geospatial data and the description of data quality;
- Methodology for the integrated acquisition and update of geospatial data from imagery and collateral information.

Production systems and processes includes in its terms of reference:

- Evaluating and, where applicable, testing solutions from industry for integrated (geometric/semantic) data provision processes, with special

emphasis on 3D reference information, data base integration and data quality;

- Performance (time, cost, flexibility) of integrated data provision systems/processes;
- Encouraging industry to contribute to EuroSDR activities with mutual benefits such as providing project proposals related to their field of activities and interests, defining the aim of experiments with focus on the end-user, providing independent non-commercial test results, and presenting new techniques in practical approaches to potential clients;
- Supporting the standardization for data exchange of sensor data, geometric data and semantic data.

Data specifications includes in its terms of reference:

- Evaluate, and where applicable, test and document applications and best practice for reference information databases in terms of data models, data content (specification) and database technology capabilities, supporting interoperability;
- Best practice in geoinformation data quality in terms of accuracy, currency, completeness and consistency relative to requirements;
- Methods and mechanisms for database updating and maintenance;
- Methods and mechanisms for data integration with 3rd party data, either directly as part of the database update process or indirectly as in linking all kinds of associated data;
- Models and approaches in the development of 3D geospatial reference databases to support new applications such as virtual reality;
- Models and approaches in the development of spatio-temporal reference databases;
- Methods and approaches to support the derivation or automated publication (in many forms) of lower resolution databases/data sets from the large-scale database.

Network services includes in its terms of reference:

- Methods and mechanisms for integrating geospatial reference data with other geoinformation and business (or value-added) data, both by data linking and by interoperable data access;
- Harmonisation requirements on geospatial reference data, including cross-jurisdiction issues;
- Adoption of new delivery mechanisms, including mobile communications and distributed spatial data infrastructures, and their effect on the business models and practices of NMCAs;
- Methods and mechanisms for delivery of metadata with emphasis on discovery and registry services and data quality information;

- Multi-purpose deployment of data, including schema translation services and semantic query;
- Applications of visualisation technology to geoinformation information.

Recent and Continuing Research Activities

Both, project reports and workshop proceedings are published in the official EuroSDR publication series. Within the last couple of years the following projects have been completed and published¹:

- Evaluation of building extraction - evaluating semi-automatic and automated extraction based on photogrammetric and airborne laser scanning techniques (No. 50, 2006);
- Change detection – comparing different methods (No. 50, 2006);
- Information for mapping from SAR and optical imagery - comparing the potential of airborne SAR with optical sensors for mapping applications (No. 50, 2006);
- Automatic extraction, refinement, and update of road databases from imagery and other data - thoroughly evaluating the current status of research (No. 50, 2006);
- Checking and improving of Digital Terrain Models – quality control of Digital Terrain Models using stereoscopic imagery and orthophotos (No. 51, 2006);
- Direct georeferencing reliability - identifying the reliability concepts applicable to INS/GPS trajectory determination for sensor orientation (No. 51, 2006);
- Tree Extraction - evaluating the quality, accuracy and feasibility from laser scanner data (No. 53, 2007);
- CityGML – the new OGC standard for 3D city models (No. 54, 2008).

Publications containing proceedings of workshops since 2006 are:

- Positional accuracy improvement II: achieving geometric interoperability of spatial data, Munich, Germany (No. 49, 2006);
- Next generation 3D city models, Bonn, Germany (No. 49, 2006);
- Feature/object data models, Munich, Germany (No. 49, 2006);
- Land and marine information integration, Malahide, Ireland (No. 52, 2007);

¹ The numbers refer to the number of the Official EuroSDR Publication Series. More information on the projects, workshop and the publications is available at www.eurosd.net.

- Production partnership management, Southampton, UK (No. 54, 2008);
- EuroCOW – International calibration and orientation workshop, Barcelona, Spain (No. 54, 2008);
- Geosensor networks, Hannover, Germany (No. 54, 2008).

EuroSDR also publishes results of its activities in scientific journals, proceedings and magazines. Examples include *Champion* (2008) and *Cramer* (2007).

Projects continuing as of July 2009 include:

- Digital Aerial Camera Calibration - describing current practice and methods based on the experiences and advice of individual experts;
- EuroDAC² – certification of digital airborne cameras;
- Medium format digital aerial cameras – demonstrating the state-of-the-art in this rapidly growing field;
- Radiometric aspects of digital aerial imagery – adding and investigating a new dimension to calibration;
- NewPLATFORMS: Unconventional platforms for remote sensing – compiling a comprehensive list and documenting characteristics and intended applications;
- Detection of unregistered buildings for updating cadastral databases - evaluating the feasibility of updating cadastral maps by means of aerial colour images;
- Radiometric calibration of airborne laser scanning intensity – towards integrating two complimentary technologies for aerial survey;
- Road environment mapping using vehicle-based laser scanning – investigating the technical possibilities for and the role of NMCAs in the relatively new area;
- Virtual globes – assessing the influence of aerial and satellite images available to the public at large;
- Retrieval of vegetation parameters from digital aerial sensors – making use of the additional potential of digital aerial imagery;
- State of the art in generalisation - establishing the state-of-the-art, particularly using reference data;
- Persistent test bed for geospatial interoperability research, education and demonstration – testing and demonstrating the advantages of interoperability in a long-term effort;
- Towards a standard for GI production partnership management – collaborative efforts to make use of standards and best practice procedures;

- Multiple representation and consistency – investigating the concept of multiple representation/resolution of databases for reference data.

Information on all these activities is available through the EuroSDR website and from the EuroSDR secretariat.

Inter-European and international cooperation

To ensure a global perspective and participation EuroSDR actively seeks to intensify cooperation and collaboration with sister organisations at the European and the global level. In particular, EuroSDR signed a memorandum of understanding to strengthen its links with EuroGeographics as European NMCAs provide drivers for both organisations. EuroSDR also recently signed a memorandum of understanding with OGC, the Open Geospatial Consortium, to improve the contacts in the area of geospatial standards (see also below).

Collaboration with organisations such as the Joint Research Centre (JRC) of the European Commission and the Commission itself is also encouraged. In terms of scientific relations, EuroSDR is a regional member of ISPRS (International Society for Photogrammetry and Remote Sensing) and has excellent links to AGILE (Association of Geographic Information Laboratories in Europe), EARSel (European Association of Remote Sensing Laboratories), FIG (Fédération Internationale de Géomètres) and ICA (International Cartographic Association). It is worth noting that while EuroSDR is a truly European organisation, many activities also have non-European participants and EuroSDR projects and workshops are regularly organised on a joint basis with sister societies from around the world.

On the occasion of the 21st Congress of ISPRS in Beijing in July 2008, EuroSDR was pleased to host a very active special session entitled ‘*From national mapping to a European and Global Spatial Data Infrastructure*’ and comprising ten international presentations in total. Papers associated with these presentations form part of the official proceedings of the congress and the presentations are available from the EuroSDR website (www.eurosd.net). EuroSDR was also asked to put together a user forum on “On-demand geospatial data updating, integration and web-based geo-spatial information services”. After short statements by the panellists the topic was discussed in very lively manner by all attendees. Finally, EuroSDR took the opportunity of engaging in exploratory talks with ISPRS and some of its regional member

organisations with a view to strengthening effective collaboration in the future.

Knowledge Transfer

The ultimate aim of EuroSDR is to address the research needs of GI acquisition, management, delivery and utilisation across Europe. Publication of research and workshop reports is, in itself, not sufficient to attain the necessary goal of transferring the outcomes of EuroSDR research activities from the research to the user domain, in other words to key personnel in the GI production organisations and the user community. The impact of EuroSDR research is lessened if the results and outcomes are not translated into the GI production process.

To address these concerns EuroSDR commenced its education service (EduServ) in October 2002, an annual series of short distance e-learning courses based on specific research projects or on the recommendations of workshops (see also Höhle 2008). Four courses are offered each year, usually from April to June, with participants committing to an average of thirty hours of online learning over a period of two weeks for each course. In keeping with the norm of all EuroSDR activities, these courses are offered to an international audience.

To date courses have included:

- Integrated sensor orientation (by Leibniz Universität Hannover);
- Automatic orientation of aerial images on databases (by Aalborg University);
- Laserscanning and airborne interferometric SAR (by ITC, Enschede);
- Digital cameras and sensors (by The Ohio State University);
- Co-ordinate systems and transformations for spatial data position (by Dublin Institute of Technology);
- Positional accuracy improvements in GI databases (co-hosted by Ordnance Survey GB, Technical University Berlin and Dublin Institute of Technology);
- Quality of geospatial data and on related statistical concepts (by ITC, Enschede);
- Quality control of DTMs (by Aalborg University);
- Mapping with SAR (by Technical University Berlin);
- Laserscanning for 3D city models (by Finnish Geodetic Institute);
- Geometric performance of digital airborne cameras (by Universität Stuttgart);

- CityGML (co-hosted by Technical University Berlin and University of Gävle);
- Schema transformation for INSPIRE (by University of Gävle).

Standards and INSPIRE

EuroSDR has established formal liaison-relationships with the ISO/TC 211 “Geographic information / Geomatics” and with the CEN/TC 287 “Geographic information” and, as a result, contributes to the development of new international standards in the field of geographic information. The present standardization projects of ISO/TC 211 cover a wide range of topics of interest to EuroSDR members and CEN/TC 287 publishes the new European standards for the Spatial Data Infrastructure as profiles of the ISO-19100 standards.

EuroSDR member organisations have contributed a number of their professionals to the drafting teams that have just completed the Implementing Rules for the INSPIRE directive of the European Commission. European Union member states will be expected to have the directive established by the summer of 2009. 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. Each drafting team covered a specific domain – Metadata, Data Specifications, Network Services, Data and Service Sharing, and Monitoring & Reporting. Indeed, EuroSDR successfully placed around 15 experts across the five teams.

Concluding Remarks

EuroSDR is anxious to attract new member countries in Europe and to cooperate with organisations around the world in order to address the research needs of the national production, academic and industrial sectors of the GI community on a truly representative basis. We hope to help build research capacity in European GI through collaborative projects, short courses and effective networking of experts from research and production alike. The international GI community is invited to join EuroSDR as participants in its many research projects and workshops.

If the organisation accomplishes some or all of the themes of its vision and mission, EuroSDR will have done a service to the fine aspirations of the original signatories to the international treaty of OEEPE - Organisation

Européenne d’Études Photogrammétriques Expérimentales – in October 1953. If, furthermore, the model of collaboration chosen by EuroSDR could also serve as a catalyst or even a template for other regions in the world, the success of the organisation would even be greater. If desired EuroSDR is happy, indeed, to support and contribute to such initiatives.

References

- Champion N., 2008: A test of 2D building change detection methods: comparison, evaluation and perspectives, *International Archives of Photogrammetry, Remote Sensing and the Spatial Information Sciences*, Vol. XXXVII, Part B4. Peking, 297-304.
- Cramer M., 2007: The EuroSDR performance test for digital aerial camera systems. In: Fritsch D. (ed.), *Photogrammetric Week '07*, Wichmann, Heidelberg, pp. 89-106.
- EuroSDR 2007: EuroSDR Rolling Research Plan 2007 – 2010, www.eurosd.net (last accessed July 2, 2009).
- Höhle J., 2008. E-learning in Practice. *GIM Journal* Vol 22(9), p. 18-19, /www.gim-international.com/issues/articles/id1170-Elearning_in_Practice.html (last accessed July 2, 2009).
- Parsi C., 2003: Evolution of photogrammetry and the work of the OEEPE in the past 50 years. In: Heipke C., Kuitinen R., Nagel G. (eds.), *From OEEPE to EuroSDR: 50 years of European spatial data research and beyond*, EuroSDR Official Publication No. 46, p. 93-99.
- Molenaar M., 2003: The research goals and the research strategy of the EuroSDR. In: Heipke C., Kuitinen R., Nagel G. (eds.), *From OEEPE to EuroSDR: 50 years of European spatial data research and beyond*, EuroSDR Official Publication No. 46, p. 75-83.
- Recent publications of the EuroSDR official series
- EuroSDR Official Publication No. 54, 2008
Production Partnership Management Workshop, *Patrucco R. and Murray, K. (eds.)*;
International Calibration and Orientation Workshop EuroCOW 2008, *Colomina I. and Hernández, E. (eds.)*;
Geosensor Networks Workshop, *Heipke, C. and Sester, M. (eds.)*;
EuroSDR CityGML Project, *Kolbe, T.*
- EuroSDR Official Publication No. 53, 2007
Tree Extraction - evaluating the quality, accuracy and feasibility of tree extraction from laser scanner data, *Kaartinen, H. and Hyypä, J.*
- EuroSDR Official Publication No. 52, 2007
Land and Marine Information Integration Workshop, *Murray, K. (ed.)*.
- EuroSDR Official Publication No. 51, 2007
Checking and Improving of Digital Terrain Models, *Höhle, J. and Potuckova, M.*
Reliability of Direct Georeferencing Phase 1: An Overview of the Current Approaches and Possibilities, *Skaloud, J.*
Reliability of Direct Georeferencing Phase 2: A Case Study on Practical Problems and Solutions, *Legat, K., Skaloud, J. and Schmidt, R.*
- EuroSDR Official Publication No. 50, 2006
Evaluation of Building Extraction Report, *Kaartinen, H. and Hyypä, J.*
Change Detection Report, *Steinnocher, K. and Kressler, F.*
Sensor and Data Fusion Contest: Information for Mapping from Airborne SAR and Optical Imagery (Phase I Report), *Bellmann A. and Hellwich, O.*

Automated Extraction, Refinement, and Update of Road Databases from Imagery and Other Data, *Mayer, H., Baltsavias, E. and Bacher, U.*

EuroSDR Official Publication No. 49, 2006

PAI2: Achieving Geometric Interoperability of Spatial Data, *Roensdorf, C. (ed.);*

Next Generation 3D City Models, *Kolbe, T., Gröger, G. (eds.);*

Feature/Object Data Models, *Woodsford, P. (ed.).*