

EuroSDR
(European Spatial Data Research)



ROLLING RESEARCH PLAN

2007-2010

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1 Introduction

The EuroSDR Rolling Research Plan defines the framework within which EuroSDR research is performed. Its main purpose is to properly structure the work in the coming years, while leaving enough flexibility to be able to react to unforeseen developments. In order to achieve this goal, the document first contains the EuroSDR vision and mission statements, followed by comments on the coming challenges in our field, relating these to the general EuroSDR research perspective and topics. The areas of interest of the five EuroSDR Commissions are then described, which together cover the whole technical field of Geoinformatics. Operational issues such as guidelines for planning and executing projects can be found in the appendix.

The EuroSDR Steering Committee (SC) discussed the outline of the plan 2007-2010 in three stages:

- In a number of breakout sessions during the 107th meeting in Nicosia, Cyprus, in autumn 2005 all delegates presented their priorities for future research and for an evolution of the organisation as a whole.
- Based on these observations the Management Team (MT) prepared a draft of the new EuroSDR Research Plan 2007-2010. The proposal was discussed and approved by the SC during its 108th meeting in Stockholm in spring 2006.

2 EuroSDR Vision

To be the European research platform for National Mapping and Cadastre Agencies (NMCA's), 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.

3 EuroSDR Mission

The aim of EuroSDR is 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.
- 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.

Our organisation is therefore unique in Europe: a network of NMCAs, leading universities and research institutes engaged on the common goal of exploring the future needs of geoinformation infrastructures at national and European levels.

4 EuroSDR Research perspective and topics

Mainly driven by changing needs of society and developments in the area of information technology, developments in the geoinformatics sector in Europe over the last couple of years have been profound and continue at a very fast pace. Key questions to be answered today are

- what happens where and when?
- how will potential responses look?
- why do they look like this?

Answering these questions quickly and with high reliability in a pan-European context will require constant monitoring efforts, as well as integration and linking of distributed information sources, often in real-time.

In this transformation, while former tasks remain important, the emphasis of many European National Mapping and Cadastre Agencies (NMCA) changes rapidly

- from a provider of paper and digital map data to a data warehouse primarily concerned with maintaining, updating and disseminating modern reference geoinformation to support the development of advanced and integrated geoinformation infrastructures;
- from an agency using analogue technology and specialised hard- and software to one employing increasingly mainstream IT solutions;
- from an independent national agency to one of many players in a larger pan-European context of Galileo, GMES, INSPIRE and EuroSpec;
- from a national administrative body with in-house production to an agency with an increasing share of commercial activities, including outsourcing significant parts of their activities.

During these times of change knowledge about latest technology is recognised as a major advantage. Cooperation between European NMCAs and research institutions is the key to ensuring appropriate applied research is carried out and knowledge is transferred between research laboratories and NMCA operations.

It is against this background that the following research principles have been formulated.

4.1 EuroSDR Research perspective

- 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 developments such as Galileo, GMES, INSPIRE and EuroSpec 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 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.

4.2 EuroSDR Research topics

Key EuroSDR research topics, for the period 2007-2010, are:

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, DTMs 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. Core geoinformation databases (data modelling, currency/maintenance, unique ID, 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.

Commissions	1	2	3	4	5
Research topics					
1: Sensor systems	X	(x)	(x)		
2: Geometric data acq. issues	X	(x)	(x)		
3: Topographic data acquisition and update	(x)	X	(x)		
4: 3D reference information		X	(x)	X	(x)
5: Process modelling and interfaces			x		
6: Core databases		(x)	(x)	X	(x)
7: Standards and open software					
8: Ontologies and data integration		(x)		X	X
9: Model generalisation, MRDB				X	X
10: Cartographic generalisation			X	X	X
11: Geospatial data infrastructures			X	X	X
12: Data quality	X	X	(x)	X	(x)

Table 1: Mapping of research targets to the Commission structure
x means primary field of interest of the Commission,
(x) means secondary field of interest of the Commission

4.3 EuroSDR Research alliances:

To ensure a global perspective and participation EuroSDR will actively seek to intensify cooperation and collaboration with sister organisations at the European level as part of the European GI Network EGIN and beyond.

EuroSDR will seek a strong working link with EuroGeographics as the NMCAs provide the drivers for both organisations.

Collaboration with organisations such as the Joint Research Centre and the European Commission is encouraged. The EU Framework programme in particular should be exploited for funding EuroSDR projects.

5 EuroSDR Commissions

All commissions should

- Explore common areas of interest:
 - suggest specific topics,
 - conduct informal discussions with representatives from NMCAs,
- Initiate and direct new projects in these areas,
- Organise workshops and tutorials on specific topics,
- Seek to involve the private sector into the commission activities,
- Present relevant research results in scientific and technical meetings and journals,
- Engage in training and capacity building in their respective area.

5.1 COMMISSION 1: SENSORS, PRIMARY DATA ACQUISITION AND GEOREFERENCING

Mission:

To explore, demonstrate, and/or further develop sensors and platforms for geo-spatial data collection with emphasis on the accuracy, reliability and standardization of orientation, calibration and georeferencing procedures.

Terms of reference:

- Sensor orientation and calibration
- Accuracy and reliability of orientation, calibration and georeferencing
- Earth Observation platforms
- Standards for sensor orientation and calibration

Action Plan:

Current research projects and workshops:

- Network on Digital Camera Calibration – in cooperation with Commission 3
- DirectTRUST-0
- NewPLATFORMS,
- Biennial workshop EuroCOW 2006

Research project possibilities:

- Airborne LIDAR block adjustment
- Terrestrial LIDAR block adjustment
- Airborne InSAR block adjustment
- Rigorous calibration of airborne and terrestrial LIDAR and digital camera systems
- Applications of multispectral and hyperspectral sensing to the development of NMCAs core spatial databases
- Potential and applications of web sensors and sensor networks
- High altitude sensor platforms
- UAV sensor platforms
- The impact of Galileo on sensor orientation, calibration and on georeferencing
- Global Differential GNSSPS for airborne photogrammetry and remote sensing
- Development of implementation standards for sensor orientation and calibration
- Terrestrial laser scanning applications

Needed research alliances

To ensure a global perspective and participation in dealing with the relevant challenges and solutions, Commission 1 seeks close co-operation with:

- International Society for Photogrammetry and Remote Sensing (ISPRS)
- International Association of Geodesy (IAG).
- Open GeoSpatial Consortium (OGC) and the World Wide Web Consortium (W3C)
- EUROGEOGRAPHICS
- American Society for Photogrammetry and Remote Sensing (ASPRS)
- Sensor manufacturers (world-wide).
- European Space Agency
- The international standardization bodies and stakers (ISO, CEN, OGC,...)

5.2 COMMISSION 2: IMAGE ANALYSIS AND INFORMATION EXTRACTION

Mission:

To explore, demonstrate, and further develop the applicability of image analysis methods for automatically extracting and updating geo-spatial data from images and collateral information

Terms of reference:

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

Action Plan:

Current research projects:

- Information for mapping from SAR and optical imagery
- Automatic extraction, refinement, and update of road databases from imagery and other data
- Evaluation of Quality of Digital Terrain Models
- Tree Extraction
- Change Detection
- Detection of Unregistered Buildings for updating databases

Research project possibilities:

- New applications of digital camera data for NMCA's and value-adding companies
- Multipurpose use of national laser scanning data
- Algorithms of laser scanning for NMCA's and value-adding companies
- Practical integration of digital multi-spectral camera data and laser point clouds
- Applications of multi-temporal laser and digital camera data
- From centralized mapping to de-centralized mapping and the use of unconventional platforms
- Possibilities of space-borne SAR for NMCA's
- Fast and high quality updating of topographic databases by terrestrial mobile mapping
- Information retrieval from terrestrial laser scanners

Needed research alliances:

To ensure a global perspective and participation in dealing with the challenges involved, Commission 2 seeks close co-operation with other international research organisations such as:

- International Society for Photogrammetry and Remote Sensing (ISPRS)
- Value adding companies and NMCAs
- Other EuroSDR Commissions, especially Commissions 1 and 3
- Sensor manufacturers (world-wide)
- American Society of Photogrammetry and Remote Sensing (ASPRS)
- IEEE Geoscience and Remote Sensing Society
- IEEE Computer Vision Society
- EARSeL

5.3 COMMISSION 3: PRODUCTION SYSTEMS AND PROCESSES

Mission:

To evaluate, demonstrate and further develop production systems and processes for handling geo-spatial information by closely incorporating private industries in these EuroSDR activities.

Terms of reference:

- Evaluating and, where applicable, testing problem solutions from industry for Integrated (geometric/semantic) data provision processes, with special emphasis on
 - 3D reference information
 - Data base integration
 - Data quality
- Performance (time, cost, flexibility) of integrated data provision systems/processes.
 - Encouraging private industries 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
 - Presenting new techniques in practical approaches to potential clients
- Supporting the standardization for data exchange of sensor data, geometric data and semantic data.

Action Plan:

Current research projects:

- Evaluation of building extraction with emphasis on commercial systems.
- EuroSDR project network on "Digital camera calibration" (together with Commission 1).
- CityGML project
Strong links of this group to the Open Geospatial Consortium on standardization issues.

Research project possibilities:

- Integration of terrestrial (including CAD and GIS datasets) and aerial methods for 3D city modelling. Evaluation of current status – in close co-operation with Commission 2.

- Mobile Mapping approaches in navigation industries. Potential and chances for cooperation on European level (could be combined with the previous project idea) – in close co-operation with Commission 2.
- Digital globes: Chances, challenges and opportunities. Evaluation of impact 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.

Needed research alliances:

The work involves close co-operation with:

- Private industries – System manufacturers, production companies and user groups.
- Open Geospatial Consortium and other standardization organisations.
- International Society of Photogrammetry and Remote Sensing (ISPRS).
- Public sector – NMA's, City offices.
- Other EuroSDR Commissions. There is a need for more intercommission projects, i.e. also a strengthened intercommission co-operation.

5.4 COMMISSION 4: CORE GEOINFORMATION DATABASES

Mission:

To investigate, evaluate and document the development of geoinformation databases for storing and maintaining national core/framework data. This includes related data management research topics in extending the capability of such databases such as:

- Data/information structures (incorporating data models and classification mechanisms)
- Linking & integrating 3rd party data,
- Developing the height and temporal component of spatial data models and
- Deriving smaller scale datasets/products from the definitive database.

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 core geoinformation databases to support new applications such as virtual reality
- Models and approaches in the development of spatio-temporal core geoinformation 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.

Action Plan:

Current research projects:

- Develop an overview of geoinformation Quality, to determine scope, best practice and knowledge sharing.
- Generalisation – To establish by a small set of controlled tests the state-of-the-art in generalisation, particularly with reference to reference data for map production, so as to inform both potential users and ongoing research
- Collaborate with EuroGeographics on the EuroSpec project.
- Establish an operational/management structure for EuroSpec with EuroGeographics
- Cooperate on operational technical developments
- Identify and lead on downstream issues requiring research
- Establish stronger links with GI experts in NMCA's and universities across Europe
- Initiate new projects in these areas where applicable

Research project possibilities:

- Database versioning and updating
- Database schema – classification, models and structures
- Data integration/interoperability (internal reference information and user/reference information, use of identifiers)
- Managing height in the database
- Temporal aspects
- Database archiving
- Generalisation: (linking with EuroSDR Commission 5)
 - Continue on Generalisation, linking to ICA
 - Consider replacing by multi-resolution, multi-scale databases

Needed research alliances:

The research work of Commission 4 involves close co-operation with:

- EuroSDR Commission 5
- National Mapping Agencies (NMCA's) and EuroGeographics
- AGILE
- OpenGIS Consortium
- International Society for Photogrammetry and Remote Sensing (ISPRS)
- International Cartographic Association (ICA)
- International Federation of Surveyors (FIG)

5.5 COMMISSION 5: INTEGRATION AND DELIVERY OF DATA AND SERVICES

Mission:

To investigate, evaluate and document developments in the technologies for the integration and delivery of all forms of geoinformation, including information derived from imagery. Major themes are the impact of the Internet and Web services, and related technologies such as XML, the shift to service-based architectures and the use of object models for information.

Terms of Reference:

- Methods and mechanisms for integrating core (framework) data with other geoinformation and business (or value-added) data, both by data linking and by interoperable data access. (Strong interaction with Commission 4)
- Harmonisation requirements on core data, including cross-jurisdiction issues.
- The 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

Action Plan:

Current research projects:

- State-of-the-art in Generalisation (in support of EuroSDR Commission 4)

Workshop and research project possibilities:

- Ontology's and translation services (with JRC, JRC taking the lead in near-term practical aspects and EuroSDR the lead in research)
Feature/Object data models (with EuroGeographics and INPSIRE Implementation Rules Drafting Team on Data Specifications) – following highly successful workshop (April 2006) a recommendation from the workshop/JRC was made for this to be an annual event.
- Service provision in local, regional and global SDIs
- Delivery and use of 3D data including City Models (with Commissions 3 and 4)

Needed research alliances:

The research work of Commission 5 involves close co-operation with:

- EuroSDR Commission 4
- EUROGEOGRAPHICS and EuroSpec
- OpenGeospatial Consortium (OGC) and OGCEurope
- ISO TC211
- CEN287
- Tracking the work of industry standards bodies such as the World Wide Web Consortium (W3C)
- Collaboration with AGILE has been proposed initially in the area of interoperability testbed development
- A new research area has been proposed in the area of land-sea data harmonisation by the hydrographic community.