

# Bridging the Gap: About Integrating Survey and GIS<sup>1</sup>

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First of all I would like to thank our FIG corporate member ESRI, and especially the honorary chair of our FIG Foundation *Jack Dangermond* and his representative to FIG *Mike Weir* for the invitation to give this keynote opening speech at this Survey Summit opening day.

Ladies and Gentlemen today being a surveyor, planner or an other professional like a representative of GIS industry that deals with daily problems in various fields means that we are also responsible for the future of our one world. Our goal should be to jointly collaborate in order to contribute to a more sustainable and more just world.

But this means that today apart from the pure technical aspects that used to be a main scope of duties for many of us we also have to address ourselves to broader multi-faceted topics like sustainability, civil society, good governance, poverty reduction, secure tenure, urban and rural land development and interrelationship, or last but not least decision making or disaster management.

Thus acting today means to face new complex challenges and to work in a multidisciplinary environment. To achieve this goal the surveyors and especially FIG as their global organization are in demand too, as exactly the topics I quoted are the main fields of their work and of the activities of the FIG. But they are not alone, they have partners!

Especially companies like ESRI that develop and constantly enhance Geographic Information Systems and practice corporate citizenship worldwide stood abreast of these required changes by providing surveyors and other professionals with visions, new ideas and exactly the technological tools they need in order to deal with complex spatial, environmental, socio cultural etc. topics, questions and challenges.

If one talks about survey today one talks almost automatically about GIS, too. Therefore I would like to make **7 comments** about integrating survey and GIS:

## **1. GIS as a key infrastructural component with immense value and benefits for surveyors as well as for spatial planners and scientists**

What **benefit** do we actually have by using GIS?

Ladies and Gentlemen I would like to answer a part of this question by quoting a column written by Jeff Thurston (Director Integral GIS, Inc.) about ‘Determining Benefits and

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<sup>1</sup> I would like to thank very much Dipl.-Geogr. Stefan Neumeier for most valuable contributions to this keynote speech.

Advantages of GI' that appeared in the October/November 2002 edition of the periodical GeoInformatics.

“GI has emerged from the lone individual in the corner office working away on some unknown project and using some unknown technology and this individual was very hard to communicate with during coffee breaks. Those GI people seemed to speak a different language. Every once in a while a person would produce a colorful and useful map. It looked simple enough, and over time more and more people kept asking for maps. Then they wanted to compare things spatially. Next thing we knew there was a GPS and some satellite data in the organization. Then more and more people wanted to do different things with the data and the organization hired more of these people (...)” (Thurston, J.: 2002).

The text continues with the narrator questioning his fictional Boss about the purpose and the benefit of this technology he does not fully understand.

“It surprised me when the Boss said we are providing GIS data for business, entertainment, and environmental applications, sociological, population and even for research studies for other organization amongst others. (...)” (Thurston, J.: 2002).

Last but not least the text ends with the awareness that the information contained in GI-datasets like cadastral and legal land registers, utility registers and map databases is a key infrastructural component carrying immense (capital) value (*Falk, T.; Oliv, S.:2003*).

But it is not only the value of the datasets we also profit from the ability of GI-Systems to analyze, compare and combine them in their complex spatial context. So by using these systems they can help us finding answers for spatial questions easily we would otherwise have great difficulties to get or we would sometimes not be able to solve at all.

Therefore it is not exactly surprising that since *Roger Tomlinson* coined the term "Geographic Information System" for the Government of Canada in the early 1960s (*Coppock, J.T.; Rhind, D.W.: 1991*) the development of GI-Systems and –Applications has made great steps forward.

For most of us GIS even has become a commodity without knowing it and it is hard for us to imagine our everyday life without this commodity. But – this is my question here – do we already know and use all possibilities and advantages of GIS in our profession and for broadening the scope of our activities? I do not forget that it was FIG and the German DVW president that organized the first international conference on Land Information Systems (nowadays discussed under the general term GIS) in Germany 1978 that I have attended and the response of practitioners and academics was near to zero ! It took about 10 – 15 years that GIS became popular and a hot issue amongst at least German and continental surveyors and universities (*Schilcher, M.: 2001*).

## **2. Despite the progress within GIS development further efforts to bridge the still existing gap between different standards have to be made**

We have lost a lot of time: So it is not surprising, that GIS still is a relatively new and constantly expanding technology and science. If we take a close look at the applications and data we realize that today we – as just mentioned- are far away from being able to benefit from the full potential that is inherent in this GIS development. The reasons are mainly the

confusing amount of different interfaces and proprietary standards for description of GIS data and data accuracy. Although first steps in the right direction with great achievements regarding standardization have already been undertaken in the name of the 1994 established Open GIS Consortium (OGC) no real uniform GIS standard that every GIS – application and – software can handle without problems exists until today.

But in order to use the full potentials of the GIS –technology and to open up new innovative markets for GIS and its applications we have to make further efforts to bridge the gap between these different proprietary standards and develop a common ‘language’ every application and every GIS is able to understand at last. We have to force an interdisciplinary understanding of object oriented information instead of discussing on a higher level of GIS-data formats.

The importance of this topic can be seen if you take a close look for example at the German Land surveying Offices. In my home country the Bavarian land surveying office established lots of high quality official datasets like cadastre maps, ATKIS, Digital Topographic Maps, Digital Orthorectified Imagery, Geocoded Addresses and so on. For all of these datasets the Bavarian Land Surveying Office has established different standards and interfaces. Our own experiences from GIS applications we use at our institute give an idea about the time, efforts and sometimes money invested to convert and integrate these data because of the lack of a common standards.

Similar official datasets have also been created by the 15 other German Land Surveying Offices. In order to maintain interoperability and standardisation in Germany the so-called AdV (Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany) was founded but until now there are still no common standards and interfaces. Every federal State in Germany still has its own standards. If you turn a close look on the different European States you will see that no common European GIS standard exists. And if you take a worldwide perspective you will encounter the same problem.

The user driven approach however might bring what could not be solved in the past: Nowadays we discuss in Germany about a more integrated approach on geographic objects used in different applications like Cadastre or topography.

At the national level, the National Mapping Agencies are playing a key role in the development of national Spatial Data Infrastructures. In Germany the “Interministerial Committee for Geoinformation” (**IMAGI**) under the chairmanship and management of the Federal Ministry of the Interior (BMI) works towards a national geo data infrastructure (GDI-DE) for Germany.

At the European level, EuroGeographics as the association of Europe’s National Mapping Agencies provides the focal point for coordination of National Mapping Agencies activity in the implementation of **INSPIRE** (*Land, N: 2003*). **I**nfrastructure for **S**patial **I**nformation in **E**urope is the latest name given to the E-ESDI initiative (Environmental European Spatial Data Infrastructure) being itself the first practical implementation in building the European Geographic Information Infrastructure mentioned in the EuroGeographics mission statement ([http://www.gsi.go.jp/PCGIAP/brunei/seminar/euroge\\_strtgy.pdf](http://www.gsi.go.jp/PCGIAP/brunei/seminar/euroge_strtgy.pdf)). This discussion on a higher level about Infrastructure for Spatial Information in Europe with its user driven approach coming from a joint interest of sharing environmental information seems to make good progresses.

An approach similar to IMAGI and INSPIRE is pursued in the USA lead-managed by the Federal Geographic Data Committee (FGDC). This FGDC – as many of our American colleagues know - is a 19 member interagency committee composed of representatives from the Executive Office of the President, Cabinet-level and independent agencies. FGDC is developing the National Spatial Data Infrastructure (NSDI) in cooperation with organizations from State, local and tribal governments, the academic community, and the private sector. The NSDI encompasses policies, standards, and procedures for organizations to cooperatively produce and share geographic data (<http://www.fgdc.gov/>).

The worldwide initiative on GSDI (Global Spatial Data Infrastructure) is a similar example for that. The Global Spatial Data Infrastructure is a non-profit global organization made up of members from more than 50 countries. Their membership includes emerging and developed nations, industry and government organizations, and individuals (Global Spatial Data Infrastructure a).

All that is not about data – it is much more about integrating and improving procedures and services with an interdisciplinary approach.

### **3. The relationship between Surveyors and GIS is outstandingly strong as the surveyor is the classical expert for spatial data acquisition**

Because of the benefits GIS offers it is not surprising that today lots of professionals focusing on spatial topics like Planners, Geographers, Geologists, Archeologists, and Surveyors etc. deal with the further development of GIS-Technology and standardization.

Furthermore a steadily growing trend towards the use of mobile computing and GIS in the everyday field work can be registered amongst these professionals.

But from all this professionals the relationship between Surveyors and GIS is outstandingly strong as the surveyor has the expertise to practice the science of measurement; to assemble and assess land and geographic related information; to use that information for the purpose of planning, valuation, and implementing the efficient administration and management of the land, the sea and structures thereon; and to instigate the advancement and development of such practices.

The merge of global geodata requires the surveyor's well-based knowledge about reference systems, map projections, geodetic data and about the background of their needs. Or with other words: Once having started with "data gathering" surveyors have moved on to "data modeling" and now they strongly should go toward the "integrated competence of land, property and construction managing". That is our FIG vision of surveyors competence (*Magel, H.: 2003 a*)! To do this in a professional way and successful manner we naturally have to intensively cooperate with neighbor disciplines and professions like lawyers, land economists, civil engineers etc. Here GIS gives surveyors the ability to combine and analyze spatial data in their complexity.

Briefly it is mainly the surveying and mapping and its neighboring disciplines that produces, provides and uses the information and the data pool as basis for GIS-Applications. So it is quite obvious that surveyors should not only be experts in mapping, digitizing and

georeferencing these data. They should also be specialists concerning principles of GIS, Geoservices, Spatial Information Management and appropriate use of GIS itself.

#### **4. FIG supports the development and use of GIS through its Commission 3 that is closely intertwined with its other commissions and leading GIS experts and GIS industry**

Exactly this is one of the reasons why the International Federation of Surveyors established the Commission 3 ‘Spatial Information Management’.

FIG, especially its Commission 3, works among others towards interoperability and standardization, too. So one of the important topics of FIG is to use its influence in order to enforce further efforts towards interoperability.

Furthermore FIG also supports the use of GIS and distribution of GIS- knowledge. Last but not least FIG encourages the use of GIS to change the way problems are solved in society by adding a spatial or geographic component to the problem solving process for a better decision making.

Of course Commission 3 is strongly intertwined with FIG’s other commissions. For example in Commission 7 ‘Cadastre and Land Management’ we encourage the development of appropriate concepts and tools for land administration and land management. FIG encourages knowledge, skills and capabilities of surveyors in this field. Here the appropriate use and further technical development of GIS is amongst others needed as key tool in order to provide a successful field work. Vice versa the insights that are made by doing Land Management can lead to the further enhancement and development of GI-applications and datasets.

Our commissions do not only cooperate within FIG but also outside with other international organizations and industries: As one current example of our efforts to achieve this goal I would like to name the cooperation of FIG with ESRI in order to develop an ArcGIS Cadastre Data Model template based on the Cadastre 2014 concepts of the FIG.

Together with FIG and the International Institute for Geo-Information Science and Earth Observation (ITC), ESRI recently co-hosted an international cadastre data model workshop at the ITC headquarters in Enschede, the Netherlands. More than 30 cadastre data modeling experts from around the world gathered to share their expertise and project experience to help define the core data model requirements. The goal of the workshop was to refine the initial 2014 cadastral data model so it could be used to implement core requirements, which include the management of multiple property rights and restrictions by cadastre agencies (ESRI: 2003 a).

#### **5. GIS is no end in itself - doing GIS requires more than just coping with technical aspects**

In our discussion about GIS and its benefits, potentials and technical problems we sometimes forget that GIS is no end in itself. Within the surveyor’s community we can observe that many surveyors deal either with pure technical GIS aspects or with survey engineering, Geodesy, Land Management and Land Tenure. The representatives of the different subject areas of surveying and mapping often do not have a spirit of collaboration. Instead unfortunately they only focus on their own narrow subject.

Therefore one often gets the wrong impression that a surveyor is either a GIS specialist or a survey engineer or a Land Manager. But instead of 'either or' surveyors must develop good skills in all subject areas and should be open minded to an interdisciplinary cooperation.

Me and the FIG are of the opinion that today a surveyor as well as every other professional dealing with space and spatial and socio-political etc. topics has to master both general competence and special knowledge in one or more fields of surveyor's range or vice versa. What is needed is the 'well grounded specialized generalist' (Magel, H.: 2003 b). Only this well grounded specialized generalist will be able to meet the requirements of today's multidisciplinary field of surveying that I have outlined at the beginning of my speech.

Even if a surveyor's main interest lies in the technical aspect of GIS only a profound knowledge of at least the fields of GIS applications is helpful in order to develop useful practical oriented applications, adaptations and new techniques.

At our Technical University of Munich we offer courses for our students with topics that deal with technical GIS aspects and their application in Land and Disaster Management and survey engineering. In lectures, seminars and projects we encourage our students to widen their perspective towards a multidisciplinary one.

But at our university we also try to contribute to the postulated interoperability by developing a webbased OGC compliant 'GeoPortal' where experts are able to access and use data from different official Geodatabases online.

## **6. GIS – a bridging role for disciplines and professions**

If we discuss about integrating GIS and survey we should widen our perspective and should also take a close look at the GIS- community as a whole; then one will realize that the GIS experts and users have quite different backgrounds. They are either surveyors or geographers or archeologists or geologists or experts for agriculture, forestry, landscape or spatial planning and so on. All of them have different specific professional skills and all see space and spatial topics from different viewpoints, even – as we know it from the surveyor - within the same profession. But all of them are somehow connected by the phenomenon GIS as a tool for visualizing, analyzing and transferring information. It gives them a spirit of collaboration. The common interest in the topic GIS brings together different professionals with their different backgrounds. On meetings, discussions and conferences experiences and know-how is exchanged. A surveyor as well as any other professional using GIS has therefore the possibility to benefit from the knowledge outside ones own field as he can get new ideas and perspectives and last but not least can learn a different way to deal with topics than he is used to do. This is applied interdisciplinary work and this is for example the goal of FIG Regional Conferences, as it will happen in Marrakech in December 2003 again about the multidisciplinary topic "urban- rural relationship for sustainable environment".

Sharing of experience and know-how is also the aim of the most important annual European, possibly even most important global, surveying event - visited not only by surveyors but by other "spatial professionals", too - the German DVW run INTERGEO. At the INTERGEO GIS and its use and applications are already for quite a few years one of the central conference and exhibition topics. The hot issues of this year's INTERGEO held in Hamburg in September will be among others spatial data infrastructure and the use of geodata.

So the common interest in GIS brings together individuals from different spatial sciences and disciplines.

## **7. GIS and survey – from partnership to integration for a sustainable world**

Let me come to the end: It is no doubt that GIS is an essential technology and tool for lots of daily decisions and professional work. I even would like to underline what Jack Dangermond last year at the 22nd Annual International User Conference has said: “Geography and GIS are necessary tools if we are willing to sustain our world” (*Dangermond, J.: 2003 cited after ESRI: 2003 b*).

GIS can well contribute to sustainability in two ways:

1. The databases and the data management used in geodatabases contribute to an economically sustainable data storage and sustainable use of the core of every GIS-application. And it represents a vast amount of highly valuable geodata about our world and its environment.
2. GIS projects and systems can help to get a better understanding for processes and problems of our world and therefore contribute to a sustainable use and management of resources, environmental protection and last but not least to a more just world.

Let me go on with the quotation of Jack Dangermond: Not only Geography and GIS, but also or even mainly – in my opinion - survey and GIS are necessary tools for sustaining our world. So it is no more a question to bridge the gap between survey and GIS, it is no more only a question to come to a closer partnership between both, no it is really ultimate time to integrate survey and GIS with the goal of a new entity. That is exactly what has happened in the last decade in the countries of the so called ‘Old Europe’, especially in Germany. If you want to study survey at universities there you will find a new term – not Geomatics (because this does not cover the full range of surveyors activities or competences) but “Geodesy and Geoinformation”. The message is very clear: GIS is an indispensable essential of the study, but only as one of many other fields and competences. For the range “from the single land parcel up to the planet mars” (that is for example the slogan in Munich) GIS knowledge and competence must be combined with additional competences and oriented toward various fields of application.

On this background I will continue to encourage FIG and its commissions and our partners to help establishing GIS – knowledge and competence centres in all parts of the world. With its exemplary education and its grateful university programs ESRI is an outstanding model of corporate citizenship and one of our most brilliant flagships of FIG partners and corporate members!

Many thanks for your support. Let’s jointly go on implementing our vision of worldwidely bridging the gap and let’s make integration solutions happen in order to contribute to a better world!

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