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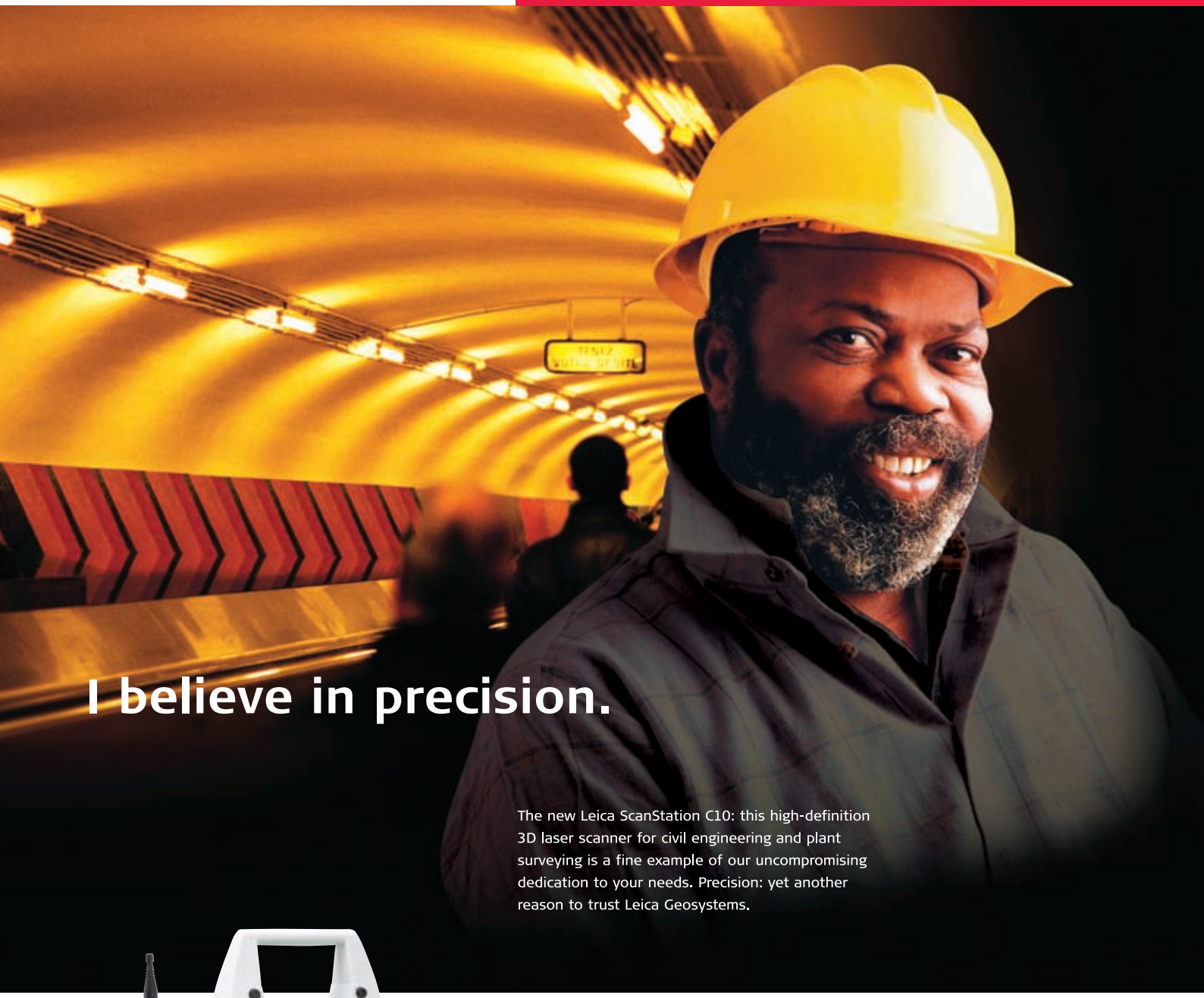
- Racurs Conference
- Gatewing
- Migration to ArcGIS Server 10.1
- Real-time construction monitoring with GIS
- Pleiades-1A satellite imagery

CMedia



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GeoInformatics is the leading publication for Geospatial Professionals worldwide. Published in both hardcopy and digital, GeoInformatics provides coverage, analysis and commentary with respect to the international surveying, mapping and GIS industry.
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GeoInformatics has a collaboration with the Council of European Geodetic Surveyors (CLGE) whereby all individual members of every national Geodetic association in Europe will receive the magazine.

Maps and Local Search

Apple Maps has been released on iOS6 and the warning signals suggesting that building a map service from the ground takes time, have become a reality: the initially released maps were full of errors and inaccuracies. Fortunately, user comments on web sites, such as nytimes.com, express a more weighted view, as they praise Apple Maps' turn-by-turn directions. These views give an indication as to how map products are being used in different ways these days. The map is not dead, but the way maps are used has changed a great deal.

Take for instance Google's worldview: maps on smart phones are interfaces to local search, as Ed Parsons (Google) put in a recent blog post ('Bad maps…really a search problem', October 3, www.edparsons.com). That's one way of looking at it, and Google has made a good business out of this. The relevance of his blog post is that he stresses that it takes time to set up a good search engine, not only from a technological perspective, but also from a business perspective. It takes time to get establish cooperation with local data owners to get it all into one system and make it searchable.

Back to Apple Maps; the Apple company claimed their mapping service would get better as more people used it. This caused some surprise amongst some users, who complained about privacy policy. Apparently, many people don't know that by using an app, you give up a great deal of privacy. In effect, you permit vendors to make use of your information and track you wherever you go, especially if you use a GPS. One can only hope Apple will take note of lessons learned by other companies regarding this issue.

In the geospatial business, the notion that maps are no longer a stand-alone end product, but rather a derivative of a 3D model or part of a range of cartographic products and services, is slowly gaining ground. But in all honesty, there can be no going back. Technological innovations as well as tighter budgets are forcing national mapping and cadastral agencies to change their way of business. This notion is also being voiced by academic research groups, where there is less funding and sometimes less theoretical depth in research. On the other hand, however, they are in the position to be vendor-independent and experiment with all new technology to hand.

This is the case, for example, with the use of UAV technology. In the review of the Racurs conference in this issue, you can read about new application fields where UAV has a large potential, even with the current drawbacks that the technology faces. But, as Apple Maps shows, you are not always starting from a perfect situation.

Enjoy reading,

Eric van Rees
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Photography: www.bestpictures.nl

At the cover:
Arrival of fourth Galileo satellite in Kourou (source: www.esa.eu).
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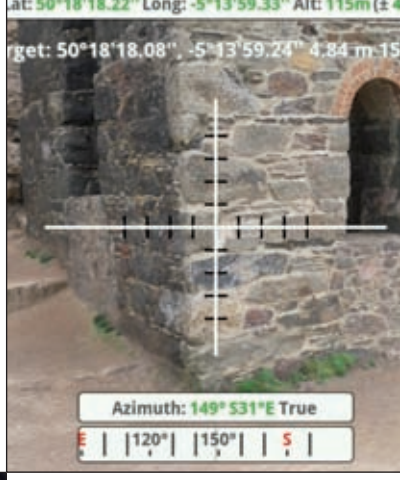

10 This article shows the data is capable of generating high accuracy orthos using a geometric correction method with a few ground controls.

32 This article examines the Third Industrial Revolution. Used to describe a major paradigm shift in product design and manufacture, it is impacting on the way information is gathered and used also.

14 The evolution of information technologies requires geospatial systems and infrastructures to refocus efforts and skills in order to improve the last mile to the user: the geospatial application.

50 Ingrid Vanden Berghe, General Administrator of the National Geographic Institute, Belgium was re-elected President of EuroGeographics at its recent General Assembly. The event was hosted by the National Land Survey of Finland which recently marked its 200th anniversary.

29 The development and construction of the North/South metro line in Amsterdam, the Netherlands, called for an ambitious monitoring effort. To be able to limit or prevent damage to the historic inner city, over 1400 buildings, surface and sub-surface, are being monitored on a real-time basis.

26 Maarten Vandenbroucke talks about the recent acquisition, the company's flagship product, the Gatewing X100, an unmanned aerial mapping system and interesting new market areas that are rapidly adopting their technology.

16 By integrating cloud technology in its core platform, Esri's latest ArcGIS 10.1 release is now fully cloud-enabled. 'Geography is now pervasive in the whole organization', says Esri CEO Jack Dangermond. A look at a new way of working, managing and sharing geographical information.

Surveyors Day celebrated in Republic of Moldova

In 2011, Vasile Chiriac, President of Moldavian Union of Surveyors UGM reported about an interesting tradition in his home country: Surveyors Day! Based on this idea, we've introduced the Day of the European Surveyor and GeoInformation. Hereafter we report about the latest edition of this celebration in Moldova.

Logo of the Union of Moldovan Surveyors

According to the Parliament of the Republic of Moldova decision No. 433-XII, dated 26th December 1990, the Government adopted the Decision to promote the Surveying Profession in the private and public sector with a declaration to celebrate " Surveyors Day" each year on the last Sunday of July.

Secretary General Dr. Livia Nistor-Lopatenco in front of her President Dr. Vasile Chiriac (Left) and Mr. Anatolie Ghilas, General Director of the Land Relation and Cadastre Agency

On July 26th 2012 a General Assembly of the Moldavian Union of Surveyors was organized with special guest Mr. Anatolie Ghilas, General Director of the Land Relation and Cadastre Agency. After Dr. Vasile Chiriac, UGM President, delivered the Annual Report, greeting messages from private and international surveying organizations were announced.
Ms. Aliona Scutelnic, UGM member, presented the results from the young surveyors' participation in the III international and professional training course organized by The Consiglio Nazionale Geometri Laureati in Athens, from 3rd to 15th October 2011, strongly supported by CLGE. She also gave a short report of her experience as a participant in the First FIG Young Surveyors' Conference in conjunction with the FIG Working Week in Rome, Italy in May 2012 and presented a FIG Foundation Young Surveyor Fellow Award. Other related UGM members issues were also discussed.

Aliona Scutelnic proudly shows the Young Surveyors Award

On the weekend, outdoor picnics and sports were organized by state institutions and private companies for the staff and guests.

For the future we are planning a National Conference to coincide with the Surveyors Day, in collaboration with national and international organizations, with awards for the best surveyors of the year. An Open Day for the younger generation is to be organized by state organizations, private companies and educational institutions.

Dr. Livia Nistor-Lopatenco,
UGM Secretary General

5 March 2012 … 22 March 2013

In 2012 the Day of the European Surveyor took place on March 5th, next year it will be on March 22nd. This year we've honoured Mercator. On 12 – 13 October 2012, the CLGE General Assembly gathered in Hanover, will decide about the illustrious surveyor to honour next year.

In 2012, the Day of the European Surveyor and GeoInformation gave us the opportunity to honour Gerardus Mercator (the poster by the Belgian Designer Arianne Weyrich we've edited on that occasion is published in this issue).
Next year the Day of the European Surveyor and GI will be organized in conjunction of the Surveyors Week that takes place in the United States.
CLGE aims at the organization of a worldwide professional event.
Talks with other Regional bodies and FIG are on-going. Whoever's interested to join the idea can contact us jean-yves.pirlot@clge.eu.

Those who want to have this poster in a 70 x100 cm format can obtain it on demand at poster2012@clge.eu for the prize of €80,- shipment in Europe included. This can become a collector...
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Poster of 2012 by Arianne Weyrich

What the hell is DPKB?

The Dynamic Professional Knowledge Base: 'DPKB' A revolutionary new database for geodetic surveying in Europe powered by CLGE.

The Council of European Geodetic Surveyors (CLGE) is currently working on a project that could revolutionize the access to information about geodetic surveying in Europe. It had become obvious during the past years that there is a considerable lack of information when it comes to national rules, regulations and practices of geodetic surveying throughout Europe. At the same time there was a rising demand for such concise information.

So CLGE decided to take the initiative and drafted a concept for a so called " Dynamic Professional Knowledge Database" . The CLGE data base will be in English and is meant to be a regularly updated comprehensive collection of all relevant information about the profession of Geodetic Surveyors in all CLGE Member countries. All information that is already available on the profession of Geodetic Surveyors on national or European level or within CLGE will be integrated in the database after a validation check.

The structure of the contents shall be clear and simple in order to avoid interpretational misunderstandings and to make the regular updating simple. Additionally this shall make the use of the database as easy as possible also for clients and non-experts.

The information will be updated by the CLGE Member organisations on a regularly basis. To ensure the efficient collection of the information as well as the regular updates each CLGE Member organisation will nominate a responsible person or team for the maintenance of the database within the national organisation. Additionally the CLGE will check on the updates and clarify information if necessary.

The aims of the database are manifold:

The information is of course going to be a help for CLGE as the representative organisation of European Geodetic Surveyors to

© Otto Hainzl: Dipl. Ing. Rudolf Kolbe, CLGE Vice President, responsible for the implementation of the CLGE DPKB

even better explain and transport the situation and the necessities of the professionals and their clients to the European Institutions.

It will also help competent authorities on national level to learn more about the situation in other European countries, which will help them in matters of professional recognition and will improve the contacts between competent authorities in different countries and enhance an exchange of best practice. Additionally the database can and probably will be an important source of information for European Institutions, as such a clear overview of national regulatory and educational structures combined with practical contact and statistical information is not available anywhere else.

A very important aspect of the database is to provide an information pool and guidance for individual Geodetic Surveyors who are interested in providing their services in other countries. This element could give a boost to mobility within the profession.

Last but not least the database can be a source of information for clients and can help them understand and compare surveying services in Europe.

The key elements of the database are already quite clear:

• National legal framework: The core of the data base is a collection of the national legislation about the profession including any laws containing relevant regulation in relation to the profession (e.g. building laws, legislation on real property or living space or any other legislation that relates to the profession of Geodetic Surveyors).

• Fields of activity: As the fields of activities of Geodetic Surveyors differ very much the database will give a description of the scope of the profession of Geodetic Surveyors in each country and describe the different fields of activities (e.g. real property assessment, property division, land use planning etc.) and the requirements (education, authorization etc.) for working in these fields.

• Professional recognition: The database will show all requirements in relation with the different fields of activity and the procedures and contact persons for Geodetic Surveyors from another country who want to a) supply cross border services or b) get permanently established in that country.

• Education programmes: National Universities/other institutions offering education/training programmes for the profession of Geodetic Surveyor plus a description of the relevant curricula will be listed in the database.
Additionally it will give information about requirements/obligations and possibilities in view to continued professional education.

• Statistical data/economic data: The database will also show statistical and economic data that is available about the profession, e.g. number of liberal professional surveyors, number of employed surveyors, number of male/female surveyors, number of civil servants, number of students etc.

The realisation of the database is already currently on-going:
The defining of the technical solution, the final structure of the content and the setting up of detailed requirements in all categories of the database is done professionally by a company from the Netherlands, the winner of a tendering procedure that was done by CLGE.
" There is still quite a lot of work ahead of us" , says Rudolf Kolbe, CLGE Vice-President and responsible for the implementation of the database. " But we are sure that it is definitely worth it."

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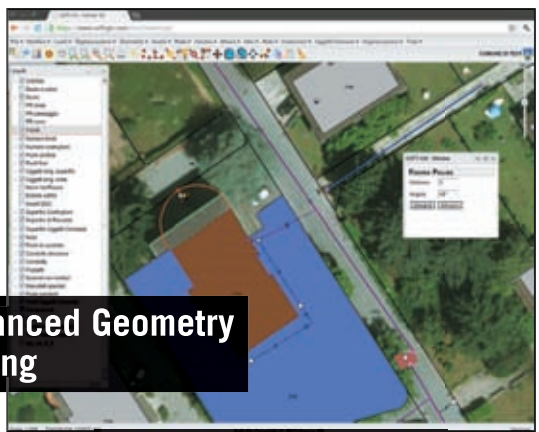

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Geometric Correction, Pan-sharpening and DTM Extraction

Pleiades Satellite

The successful operation of the Pleiades-1A satellite provides another alternative using high resolution satellite imagery. With the panchromatic sensor at 0.7m resolution and the multispectral sensor at 2.8m resolution, the data can be used in different applications. This article shows the data is capable of generating high accuracy orthos using a geometric correction method with a few ground controls. A pan-sharpening method can be applied to fuse the panchromatic and multispectral data to produce high resolution multispectral data, and a DTM can be extracted using the stereo data with a DSM to DTM conversion software.

By Philip Cheng

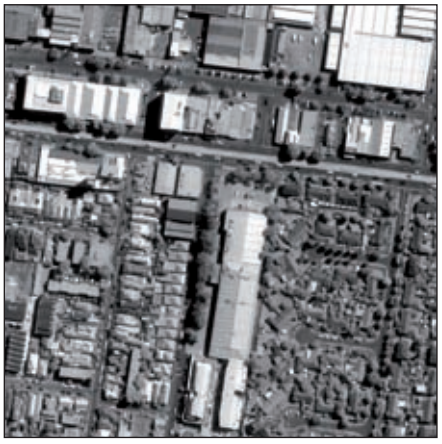


Figure 1a: Pleiades panchromatic image of Melbourne, Australia

Figure 1b: Pleiades PMS image of Melbourne, Australia

Figure 1c: Pleiades PCI pan-sharpened image of Melbourne, Australia

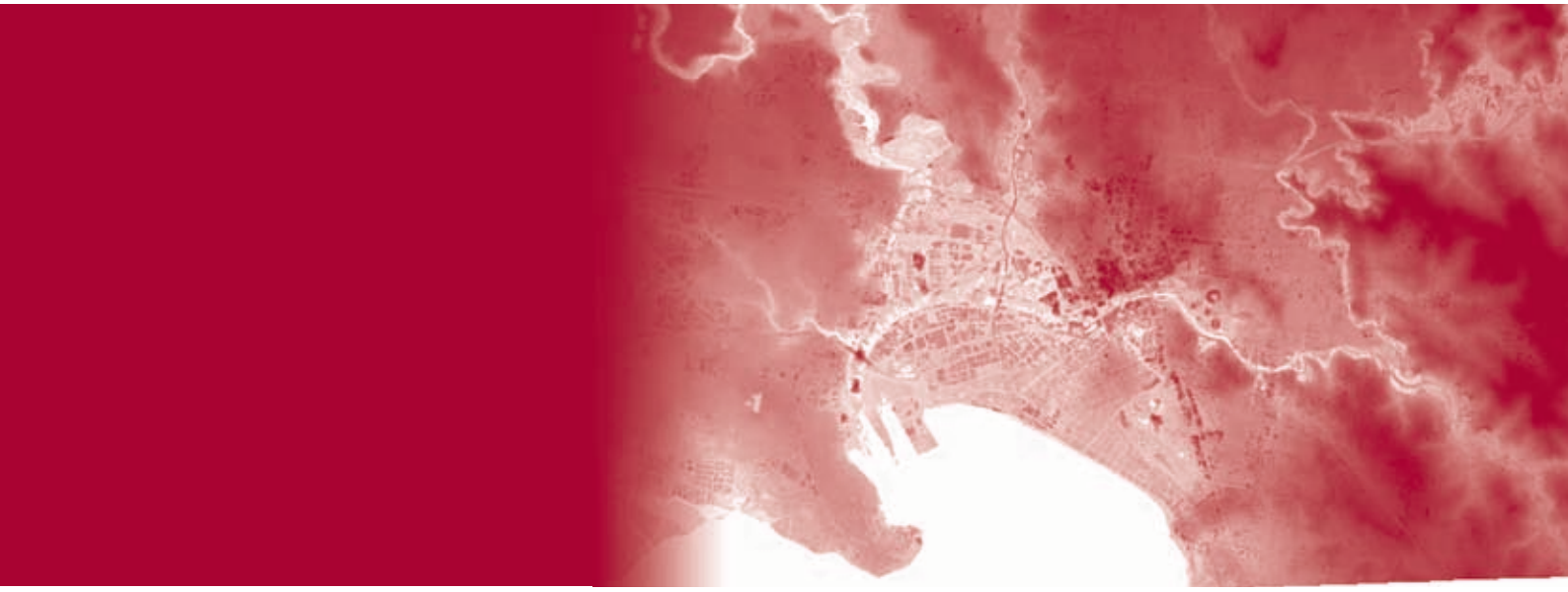
On December 16, 2011, the Pleiades-1A was launched successfully in orbit via a Russian Soyuz ST rocket out of French Guiana. Pleiades-1A is the first satellite of the Pleiades constellation. The Pleiades constellation will be composed of two very high-resolution optical Earth-imaging satellites on a Sun-synchronous orbit at 694km. With Pleiades 1A in orbit and Pleiades 1B scheduled for launch in 2013, the Pleiades constellation will provide very high-resolution optical products in record time, offering daily revisit to any point on the globe and acquisition capabilities tailored to meet the full spectrum of civil and military requirements. Pleiades acquisition capacity and exceptional agility maximize the number of images of a given area of interest, so more requests can be satisfied on the same pass including along track stereoscopy and tri-stereoscopy images. The satellite consists of a panchromatic band with resolution of 0.7m in nadir viewing and four spectral bands (blue, green, red and near infrared) with a resolution of 2.8m in nadir viewing. Image correction accuracy within 1m and 10m can be obtained with and without ground control points (GCPs), respectively.

Pleiades image data is distributed in either JPEG or TIFF format. There are two levels of processing products available: primary and ortho. The primary product is closest to the image acquired by the sensor and restores perfect collection conditions. The sensor is placed in a rectilinear geometry and the image is clear of any radiometric distortion. This level is optimal for users familiar with satellite imagery processing techniques who wish to apply their own production methods (for example orthorectification or 3D modeling). To this end, Rational Polynomial Coefficients (RPCs) and the sensor model are provided with the data. The ortho product is georeferenced images in Earth geometry, corrected from off-nadir acquisition and terrain effects. The user can order bundled (panchromatic and multispectral) product or PMS (pan-sharpened) product.

Most users would like to perform custom orthorectification using primary data. In this article we will examine different methods of processing Pleiades primary data. Firstly, we will test pan-sharpening using Pleiades panchromatic and multispectral data. Secondly, the geometric correction method and accuracy with and without GCPs will be examined. Lastly we will test the digital surface model (DSM) extraction using the tri-stereoscopy data and a tool to convert the DSM to a digital terrain model (DTM). A sample Pleiades primary data set consisting of panchromatic, multispectral, PMS and tri-stereoscopy images of Melbourne, Australia, was provided by Astrium Geo Services. The image consists of mainly urban areas with vegetation and buildings.

Pan-sharpening

Similar to most high resolution satellites, Pleiades panchromatic and multispectral data provide the opportunity to create 0.7m multispectral pan-sharpened images. Although the user can purchase Pleiades pan-



sharpened (PMS) product directly, in some cases the user may want to apply their own pan-sharpening. It is always preferable to perform the pan-sharpening process before geometric correction if a pan-sharpened orthorectified image is desired, and this method works for most areas with gentle terrain. Performing pan-sharpening after geometric correction of the separate panchromatic and multispectral data often results in small misalignments between the ortho data due to the accuracy of GCPs and DEMs used in the orthorectification process. The PCI pan-sharpening program was used to test this case. The algorithm was written by Dr. Yun Zhang at the University of New Brunswick, Canada. It is based on least squares approximation of the grey level value relationship between the original multispectral, panchromatic, and the pan-sharpened image bands for a best color representation. Figure 1a, 1b and 1c show the panchromatic, PMS, and PCI pan-sharpened Pleiades images of the same area, respectively.

Geometric Correction

In order to leverage the Pleiades images for applications such as GIS, it is necessary to orthorectify the images. A geometric model, ground control points (GCPs) and a digital elevation model (DEM) are required. The Rational Function Method (RFM) has been the most popular geometric correction method in orthorectifying high resolution images. This method uses the RPCs provided with the satellite data to perform orthorectification. More details about the RFM can be found in the paper written by Grodecki and Dial (2003). Since the Pleiades primary product is provided with RPCs, RFM can be used to orthorectify the data.

No. of GCPs	No. of Check Points	RPC Adjustment Order	RMS Error (m) X	RMS Error (m) Y	Maximum Error(m) X	Maximum Error(m) Y
0	37	0	8.7	6.8	9.1	7.3
1	36	0	1.8	1.5	2.2	2.2
3	34	0	0.9	0.8	1.4	1.6
3	34	1	1.6	1.1	1.7	1.3

Table 1: Error report using 0 and 1st RPC polynomial adjustment

The latest version of PCI Geomatics' OrthoEngine software was used for this testing. This software supports reading of the data, manual or automatic GCP/tie point (TP) collection, geometric modeling of different satellites using RFM or Toutin's rigorous model, automatic DEM generation and editing, orthorectification, and either manual or automatic mosaicking. Since biases or errors still exist in the RPCs, the results can be post-processed with a polynomial adjustment and several accurate GCPs. One of the purposes of this paper is to determine which polynomial order of RPC adjustment is required for Pleiades data. 0 and 1st order polynomial adjustment require a minimum of 1 and 3 GCPs, respectively. 0 order polynomial adjustment is always preferable because the GCPs can be collected anywhere on the image. 1st order polynomial adjustment requires the GCPs to be collected uniformly on the image and cover the entire image.

High accuracy control points with accuracies within 10-15cm were provided by Professor Clive Fraser from the University of Melbourne, Australia. Pleiades panchromatic image was used for the testing in this case. Table 1 shows the results using 0 and 1st order polynomial RPC adjustment with different number of GCPs and check points. From the table it can be seen that using 0 order polynomial RPC adjustment with a few GCPs give the best results with root mean square (RMS) errors within 1m.

DSM Extraction

A great innovation of the Pleiades system is to offer high resolution stereoscopic coverage capability. The stereoscopic coverage is realized by only a single flyby of the area, which enables collection of a homogeneous product quickly. In addition to the " classical" forward and backward looking stereoscopic imaging, Pleiades can acquire an additional quasi-vertical image (tri-stereoscopy), thus enabling the user to have an image and its stereoscopic environment. In general, a forward and backward looking stereo pair produces the highest accuracy, but this combination is limited to areas with gentle terrain. A nadir and forward/backward looking stereo pair can be used in most kinds of terrain.

A tri-stereoscopy data set of the same area was provided. The along-track viewing angles of the backward, forward and nadir looking images are -14.91, 14.31 and -0.9 degrees, respectively. Using 0 order polynomial RPC adjustment and 3 GCPs collected on each image, the RMS errors of 38 check points on each image area are 0.3m in X, 0.4m in Y, 0.5m in X and 0.5m in Y, and 0.9m in X and 0.7m in Y, respectively. Since the images consist of mostly urban areas with gentle terrain, only the backward and forward looking images were chosen to generate a 2m spacing DSM using PCI OrthoEngine software. Comparing the extracted DSM with the check points, the vertical RMS error is 1.6m with an average error of 1.2m and a maximum error of

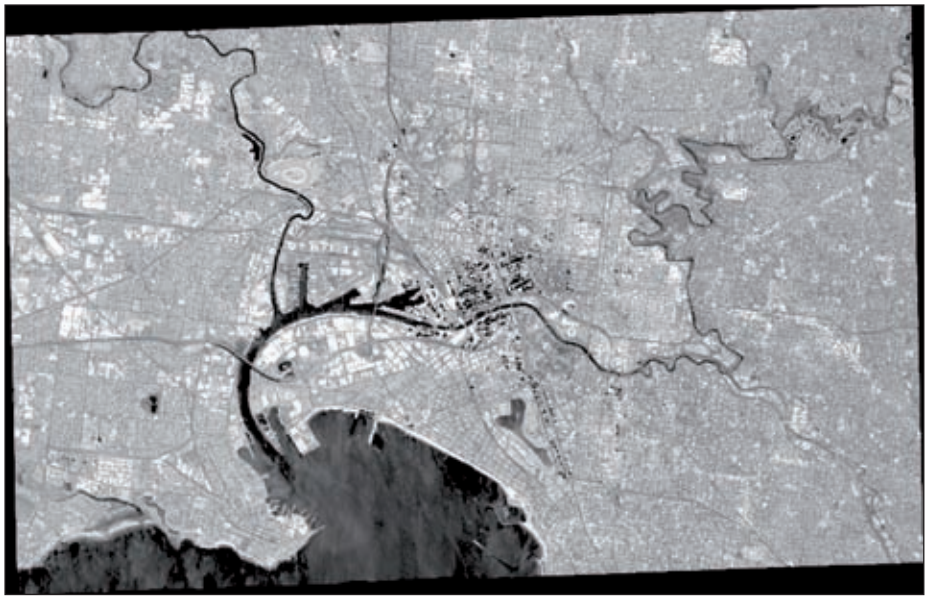


Figure 2.1: Pleiades Melbourne image

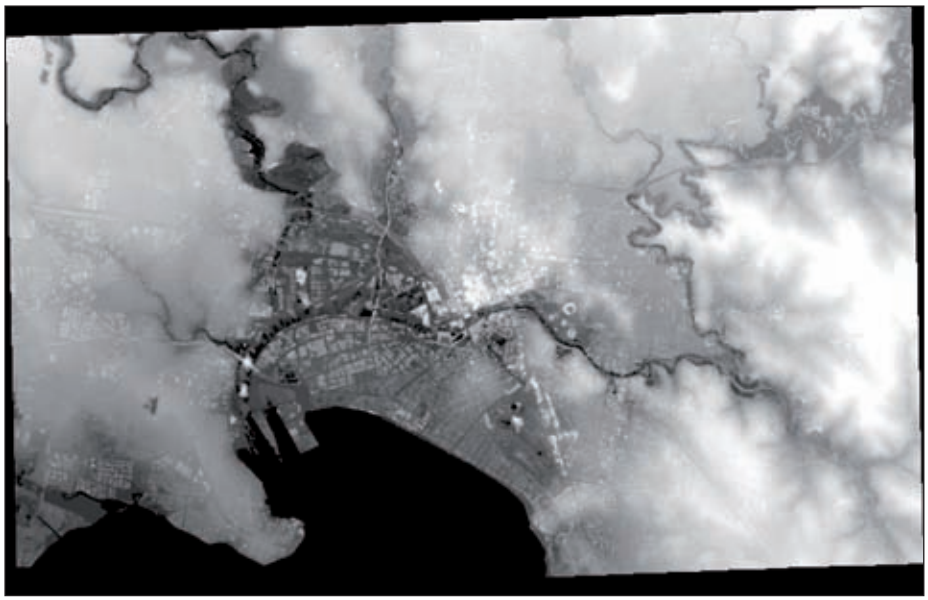


Figure 2.2 : Pleiades Melbourne extracted DSM.

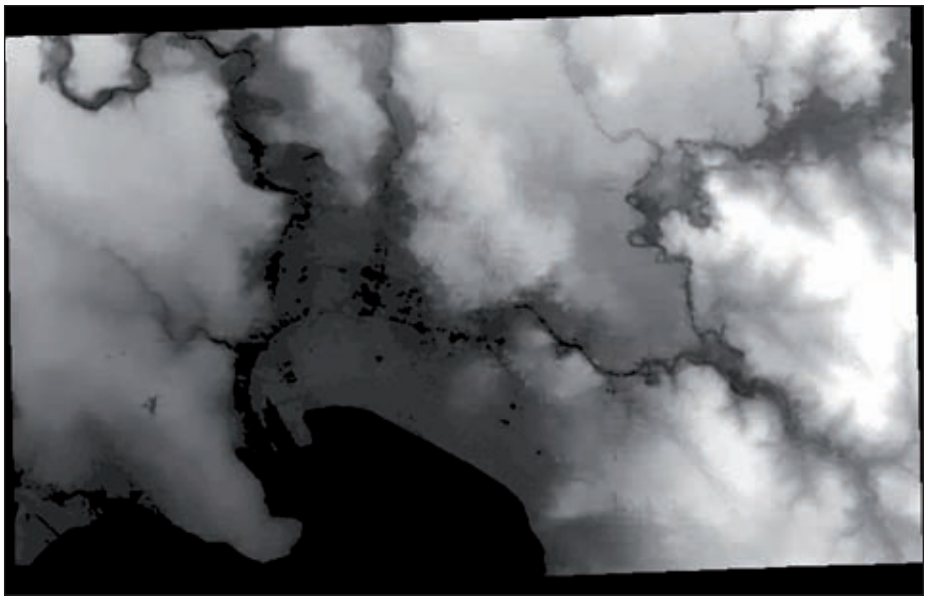


Figure 3 : Pleiades Melbourne extracted DSM converted to DTM

4.0m. Figure 2.1 and 2.2 show the image and corresponding DSM, respectively.

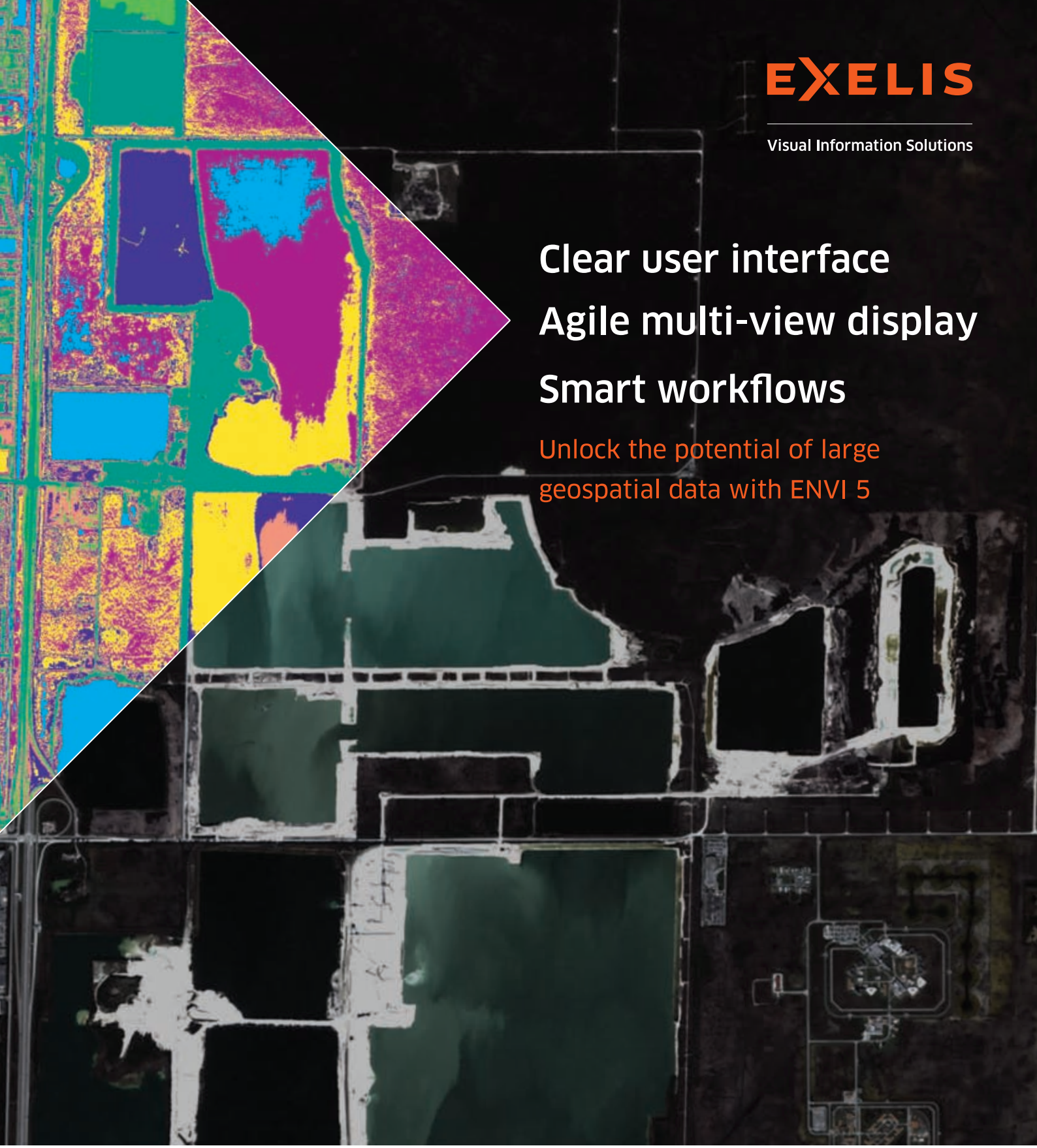
DSM to DTM

A DSM extracted from stereo images represents the earth's surface and includes all objects on it, for examples, buildings and trees. Many applications require the DTM which represents the bare ground surface without any objects. To convert a DSM to a DTM through manual editing is a very time consuming process. An automatic DSM to DTM conversion program was developed at PCI Geomatics. Figure 3 shows the automatically converted DTM of the same area. When comparing the converted DTM with a DTM provided by the University of Melbourne (with vertical discrepancy of 0.6m comparing to 25control points), the average vertical difference was approximately 0.8m.

Summary

It is possible to perform pan-sharpening before geometric correction with the Pleiades primary panchromatic and multispectral data. Using the RPCs provided with the Pleiades data and RFM, it is possible to achieve within 1m and 10m geometric correction accuracy with and without GCPs, respectively. The best accuracy is using 0 order polynomial RPC adjustment with a few GCPs. DSM extraction is possible using the stereo or tri-stereo data. DSM can be converted to DTM using an automatic program. The author would like to thank Professor Clive Frasor of University of Melbourne for providing the control points and DEM.

Dr. Philip Cheng cheng@pcigeomatics.com
is a senior scientist at PCI Geomatics.



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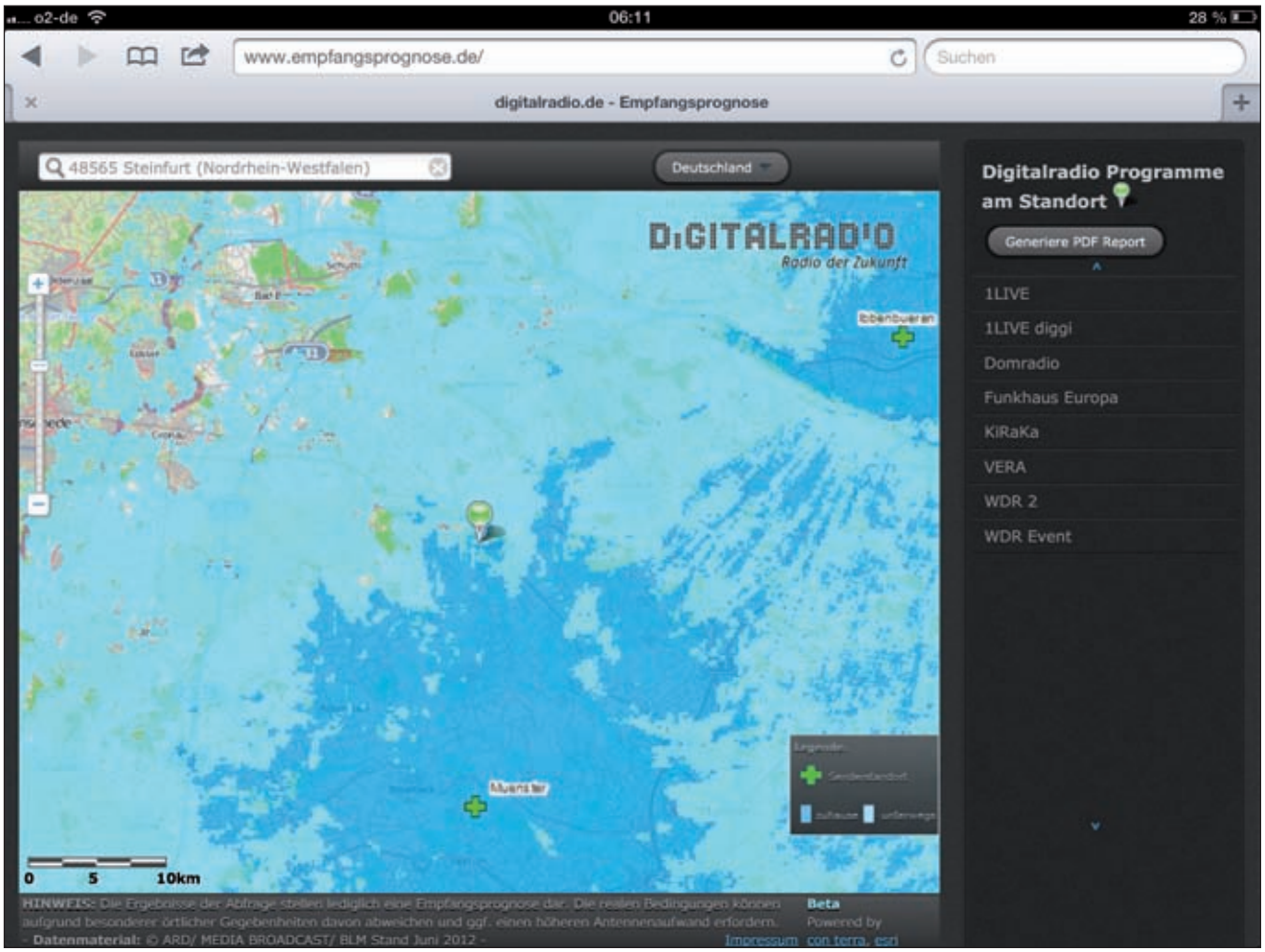
User Experience to the front

Con terra's mapApps

The evolution of information technologies requires geospatial systems and infrastructures to refocus efforts and skills in order to improve the last mile to the user: the geospatial application.

By Christian Elfers



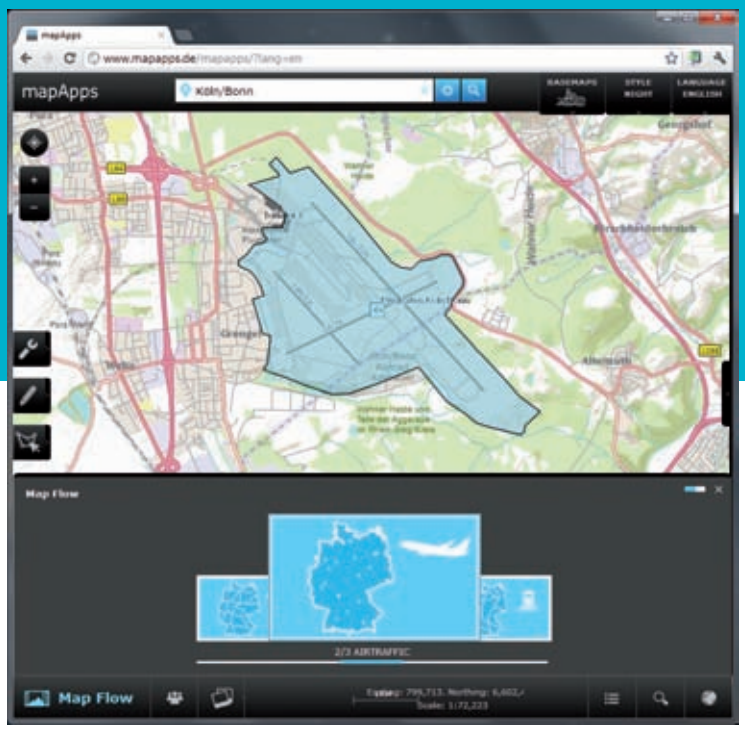
Digitalradio.de – a mapApp that answers exactly one question: " which radio stations will receive in what quality at this position?"

By building spatial data infrastructures in their various forms, the geospatial community had one major goal in mind, which is to gain knowledge for making better decisions. Knowledge is achieved through applied information, and information is a result of receiving and analyzing data. From these many components, the focus is still on data. SDI is all about services, data, metadata, portals, viewers. All these are essential for the preached message that all you need is " Publish-Find-Bind" .

Whilst this is not wrong, there is one last piece missing. This missing, underestimated and mostly undeveloped piece is the last step to addressing consumer needs. If you look at most of today's web mapping applications, they have one common problem: they do not provide a sufficient problem/solution fit. Instead they try to cover it all, with toolbars stacked with generic functionalities, lots of services, layers, feature types and other artificial concepts. In the end, they are leaving it all up to the user to find out how this could help in solving problems. In short, they are a burden to use.
How can this be done better? The geospatial community can learn a lot from other sectors, especially media, entertainment or gaming.

Learning from Apple

Companies like Apple have impressively demonstrated how essential a good user experience is. This one citation from Steve Jobs covers it pretty impressively: " When you start looking at a problem, it seems really simple—because you don't understand its complexity. And your solutions are way too oversimplified, and they don't work. Then you get into the problem and you see it's really complicated.



Example of a mapApp that provides information on different transportation means through a series of preconfigured transportation maps.

And you come up with all these convoluted solutions. That's where most people stop, and the solutions tend to work for a while. But the really great person will keep going and find the key underlying principle of the problem and sort of come full circle with a beautiful, elegant solution that works."

This introduces important concepts that need to be addressed: the problem/solution fit, elegance and aesthetics, ease and efficiency. The German software company con terra implemented a lot of these concepts in mapApps, a new software solution for geo web applications based on Esri technology. Also in customized solutions using mapApps within their teams, with partners, customers and universities. The following will share the experiences in more detail.

The problem/solution fit means investigating the underlying principle of the problem to find out what is needed to solve it. This includes the data, functionality and context. One key to success is to focus on this, and only this. A good fit provides not more, but also not less, than what is required. Consequently, this means a focus on single problems or tasks. The resulting solutions are normally small, preconfigured and called apps instead of applications. There is a reason why this started on the mobile sector: the limitations of a mobile device forces focus. So rather than providing one application that tries to do and provide everything, provide small apps that solve just one task.

Ease and efficiency: a MapFlow

Another key is to combine these ingredients in such a way that support the flow of work, and do not require additional user selection. A simple example: instead of providing a generic identify tool that works on solar sites as well as on running routes, resulting a clumsy table of feature data, provide a tool " Solar Site Information" and a second one " Running Route Details" , each of which is preconfigured on a specific data source and has a prebuilt pop-up display that is specific for the content it represents. Link the tool to the content and provide it only if the content is in the users focus. As such you could even skip a tool-button and simply make the one or the other the default " on-click" tool. This will allow users to see the content, just click on it and easily receive information.

Zuers-public.de – a mapApp providing a one-click assessment on natural hazard risks to the public.

Ease and efficiency: The above-described approach of preconfigured, concrete tools is already one important means to make it easy and efficient for users. Another one is to use natural and/or known concepts and apply them to geospatial content and workflows where a majority of the concepts are artificial and not known to non-geo-experts. One example is working with maps which can be really difficult if there is more than one to choose from. Now apply something known: to some extent the concept of a map is similar to the concept of an audio album. An album is a combination of content that makes sense, that belongs together; you can consume an album as a whole or select tracks. Well, a map is a combination of layers and features. You can load a map as a whole and/or select single layers. Albums have booklets, maps have metadata. Albums have a cover, a single picture of the nature of the theme, maps can benefit from the same. If this is the case, provide maps as if they were albums. A known navigation concept is Coverflow from iTunes; so why not use a Mapflow?

Joy of use

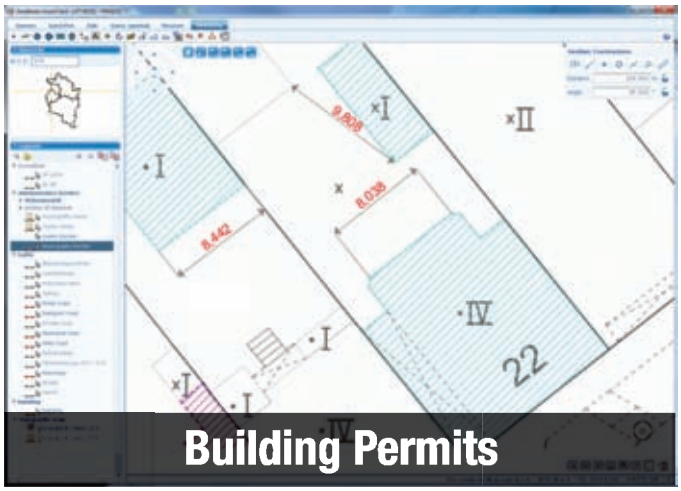
Other examples of known concepts are a working desk to make it easy to work with intermediate results, store them when you leave and restore them when you come back: just like you do with your working desk when you go home in the evening and come back next day. Stacks for working with reports, Post-Its, Mailboxes for visual workflow-support, the app as a result of work and the like.
Elegance and aesthetics: The look and feel of an app is the only thing that influences the first impression on the users, and the first impression matters. The way the human brain works is that an unfavorable first impression will cause a person to lose interest, not looking deeper into what functionality or how good something is under the packaging. The " Look" can be applied through consistent layouts, attractive color schemes, beautifully styled maps, etc. But there is also the " feel" , with aspects like ease and efficiency, but also the fun factor. Make working with an app entertaining. This can be done by providing excitement features, the simplest of which are animations. Move, bounce and fade tools and widget (but with care, as animations can be easily over-exaggerated). Another example for an excitement feature we have created is " Follow Me" , that allows users to invite others users to share their map. The organizer can steer the map app, explaining meeting points, holiday experiences, etc., and all participants follow in real-time. They can also sketch and make plans together, for the next joint biking tour or for business workforce management.

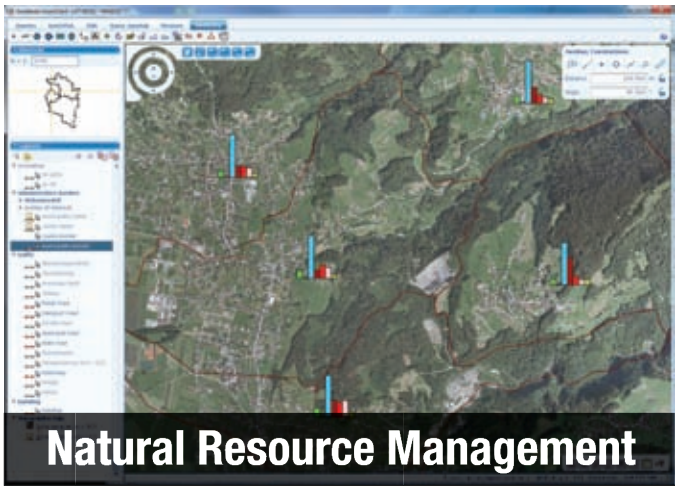
When all these aspects are properly addressed and well balanced, the app gains another characteristic: the user will experience the app as being a " joy of use" . An enjoyable feeling is derived from the sum of the user experience that the implementation of the different concepts provide. This also includes non-visual concepts like performance. " Enjoyable" is the most hard to achieve, but also the most valuable asset for an app. It motivates users, helps build long-standing relations and helps " spreading the word" .

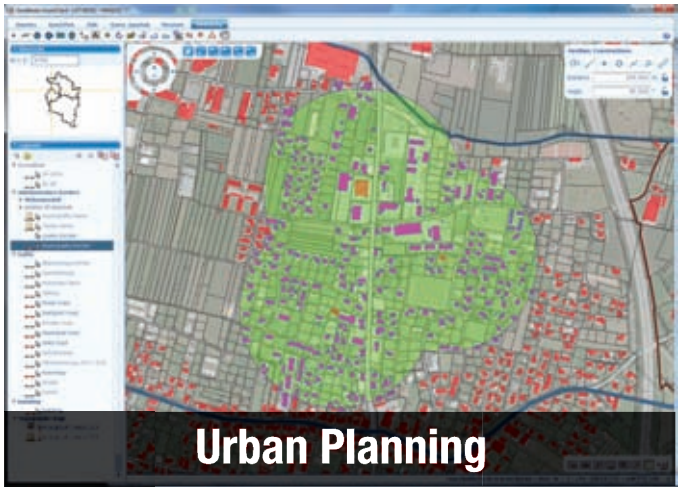
The given are just some examples, but the positive feedback received so far shows clearly that the right combination of these concepts provides major improvements and a lot of user acceptance. But it is also a lot of work and requires changes in the way we work. Preconfiguration shifts work to the operator, so providing good tools eases that. Also new skills are required: user experience design, design, empathy and a consequent change of focus – it is not our data, systems, services or the infrastructure, they are simply a means to an end. It is the user and his problems that we need to focus on.

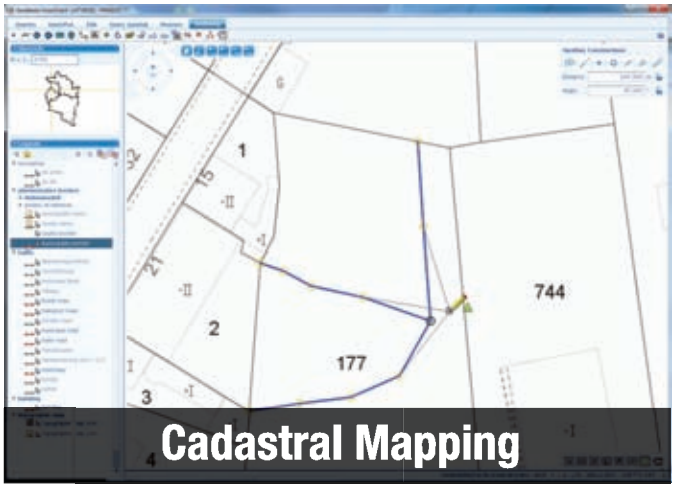
Christian Elfers is leading con terra's product developement team and the product line manager of mapapps & sdi.suite.
For more information: www.conterra.de

DYNAMICALLY JUMPSTART YOUR GIS









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One System, Multiple Apps

Geography as a Platform

By integrating cloud technology in its core platform, Esri's latest ArcGIS 10.1 release is now fully cloud-enabled. 'Geography is now pervasive in the whole organization', says Esri CEO Jack Dangermond. A look at a new way of working, managing and sharing geographical information.

By Eric van Rees

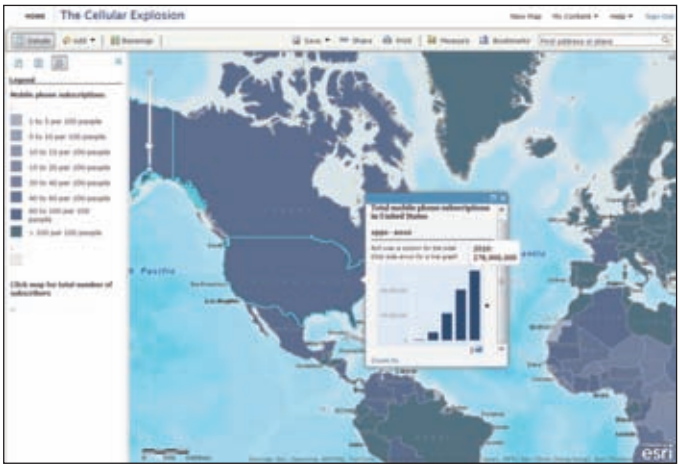

Figure 1a and 1b: ArcGIS Online has a variety of basemaps demographic maps, image services, commercial data, and other ready-to-use content.

The cloud: a new technical and business pattern

Once a backend-technology, but now available to the whole organization, GIS and geography have become pervasive within the whole organization. With Esri's latest ArcGIS 10.1 release, cloud technology is now part of its core platform. This means that desktop users can have access to cloud infrastructure for computational work, for storage and also for publishing and making maps available to users across the organization.

This new approach is a big change from a technical standpoint, as well as a commercial standpoint. First, the technology: " we're selling them the software, as well as services, through subscriptions. Through doing that, ArcGIS is making its capabilities available across the organization, through thin apps that can be configured for different kinds of audiences in the organization, such as Microsoft Office users."

Figure 2: GIS professionals can use ArcGIS Online and Location Analytics to add mapping visualization and geographic intelligence to business analytic systems for better insight and decision-making.

Basically, Esri supports a number of patterns: there's the desktop pattern, the device/mobile pattern and server pattern. It's the cloud that brings together all different patterns, says Dangermond: " all these patterns can fall back on to the shared computational environment that not only allows people to share their own organization's data, maps and models, but also lets other people in the organization access and use them."

At a higher level, multiple organizations are now starting to share their data and use each other's data, meaning the Esri cloud, via ArcGIS Online. Again, this is not only a new technological frontier, computing with geo in the cloud, but also a new way to collaborate for the Esri's user base, through agencies or departments.

Finally, the cloud also means a new business pattern for Esri, says Dangermond: " to make this all happen, we had to invent a way to adopt the Software as a Service (SaaS) business model so that people could acquire this shared infrastructure, which comprises not only the computational space using for instance Amazon and Microsoft, but also the shared software environment, data sharing and content space."

'Hockey stick' effect

The reason the platforms and techniques are coming together now has a lot to do with technology, says Dangermond: " twenty years ago the infrastructure wasn't there and neither was our software, but now it is. ArcGIS Online is different than just our server in the cloud; it's actually a new version of the ArcGIS Server in the cloud which can deal with scaling up for very large volumes of use and the management of content across the organization. This combination created a technical challenge."

Figure 3: ArcGIS Online for Organizations is a cloud-based, collaborative content management system, for sharing geographic information within and outside an organization.

Figure 4: In ArcGIS 10.1 users can share their work with colleagues in a work group, between departments in an organization, or with other ArcGIS users via ArcGIS Online's cloud based infrastructure.

Esri has been building ArcGIS Online (Figure 1a and 1b) for three years and is receiving an interesting response, says Dangermond: " in the first years it was free access, and after that period Esri added the ability to put in other kinds of content and support the API's. It wasn't until the summer when it was put into a subscription business model, because then we were able to round it out with hosting and online analytics." In December, the system counted about 22,000 maps in the system, but when Esri released an open beta for the next generation at the beginning of June, it had almost a 100,000 and now it has over half a million. Dangermond: " we hadn't really promoted it until the most recent Esri User Conference, so there's kind of a hockey stick effect of interest by our users, them sharing their data and participating in larger communities."

Geoanalytics

ArcGIS Online is primarily designed for Esri's user base, but also for performing geoanalytics and web developers (Figure 2). How do these two groups fit into Esri's platform? Dangermond: " as we got into designing ArcGIS Online, we realized it's a platform for geospatial analytics as well." Last year Esri bought SpotOn, which merges ArcGIS Server technology into the Cognos environment for Business Intelligence (BI). Dangermond noticed that after this acquisition, people very much wanted to be not just in Cognos but also in Sharepoint, SAP, etc.. " That's relatively straightforward for us to do," says Dangermond, " as it supports that at the same foundation work that we have done to support our users. And there's some synergy between those two: often a GIS department of organizations wants to feed an analytics division and vice versa."

Developers

During a press meeting at the last Esri User Conference, Dangermond announced his intention to open an office in Silicon Valley, to support software developers. What's the reason behind this? Dangermond: " we've never addressed the developer market as such, but we know our API's are stronger than simple consumer mapping API's that have some analytics behind them. When looking at the content that our users are sharing, there's a certain dynamic between the developer market which has been left to sell their applications back to the GIS people and business analytics market and the organization as a whole– one way to think of it is that these are three separate markets, but in fact it's one system and there's three apps."

GIS in the organization: the GIS professional

With the new software and service offerings, the road ahead is clearer. In a way, cloud technology is a lot about IT – but how does it alter the way in which a GIS professional works? Dangermond states that the GIS profession is healthier than ever, especially since Google introduced maps to their developer community, causing a growing interest in true GIS. On a technological level, with respect to GIS, things are getting easier to do, admits Dangermond: " but this doesn't mean that this will obsolete the GIS profession, since GIS professionals have huge knowledge about geospatial content and they're some of the only people that know how to do (spatial) information integration, modeling and analytics." See Figure 3.

IT departments and the cloud

The cloud also causes challenges for IT departments. They are being confronted with new user demands for working in the cloud, and for making use of the technology itself. What can they do to address these challenges? Dangermond admits that there's a tension between the public cloud and the private cloud behind a firewall, but they will have to come to their own conclusions: " as their own infrastructure gets written off from a cost perspective, IT departments have to look at alternatives. If internal IT departments are not cheap enough for the department of users, they'll go around that and use external services. So smart IT organizations are going to buy their own cloud and will develop a cloud architecture with back-end cloudservices. We already see that happening in a number of the federal agencies who have taken our ArcGIS Online and put it behind their firewall, partly because of security and partly because they want to use it themselves."

With ArcGIS Online (Figure 4), Esri handles a dual strategy, says Dangermond: " you can either put it in on premise, or you can use the public cloud that we piggy-back on. We're not saying we're building our own cloud, but we're just using the existing infrastructure. We are technologically supporting implementation in both ways."

Internet: www.arcgisonline.com

Real-time Construction Monitoring with GIS

North/South metro-line

The development and construction of the North/South metro line in Amsterdam, the Netherlands, called for an ambitious monitoring effort. To be able to limit or prevent damage to the historic inner city, over 1400 buildings, surface and sub-surface, are being monitored on a real-time basis. An information system, based on GIS, has been developed to manage and provide access to the monitoring data. The information system contains numerous tailor-made functionalities to provide real-time answers to real-time questions from project managers, construction engineers and contractors. The information system, therefore, plays an important role in the dynamic construction process of the metro-line.

By Steven Braakman

Figure 2: Tunnel Boring Machine Victoria entering station 'De Pijp' at 28 meters below street level (Photo by Gé Dubbelman).

Figure 1: Part of the alignment of the North/South metro-line in map view and longitudinal section, south end on the left. Red arrows indicate the direction of tunnelling by tunnel boring machines. A total number of eight separate tunnels are being constructed.

North/South metro-line

In the late 90's of the previous century, the city of Amsterdam decided to develop a new metro-line. The new metro-line would accommodate the growing number of people travelling by public transport, as well as establish a new infrastructure that would connect the historic centre of Amsterdam with the parts of the city located north of the IJ river. The line, total length about 10 km, will run underground across the historic inner city of Amsterdam for about 3,8 km, from Damrak to Scheldeplein, see Figure 1.

Amsterdam

This part of the alignment will consist of a number of deep underground stations, connected by twin tunnels. The stations will be constructed by excavation. To minimise impact on everyday life on the streets, the tunnels are constructed by tunnel boring machines, see Figure 2.

The conditions for construction of the tunnel in the inner city called for an optimised design to minimise effects. In the **design phase** geographic information systems (GIS) were used to minimise the anticipated effects of construction on the surroundings. Using GIS technology, the subsurface was mapped by creating a three dimensional geotechnical model. GIS also played an important role in subsequent risk assessment, calculation of ground volumes, cost calculations, effects of vibrations and communication and visualisation of technical solutions in two, three and even four dimensions.
In the construction phase it was necessary to measure the effects on the surroundings. This called for the monitoring of the buildings and subsurface on an unprecedented scale. The biggest monitoring endeavour in history so far was in the making: in addition to geotechnical sub-surface monitoring (i.e. extensometers, inclinometers), over 1400 buildings in the construction zone have been monitored since 2002. In addition, as tunnel construction commenced, it was decided that the surface was to be monitored by means of reflector less readings by robotic total stations. This resulted in over 20,000 (virtual) sensors producing readings at a frequency that varies from daily to hourly (during construction). At its peak, about 200,000 readings are produced per day. The monitoring is performed by contractor Soldata-Grontmij V.O.F.

Challenge

In the period 2002-2010 the monitoring information was accessible through a desktop based GIS. The desktop based system sufficed for the construction of the stations, but as tunnel construction commenced in 2010, the municipality of Amsterdam was faced with a number of new challenges. Project manager tunnel construction for the municipality of Amsterdam, Joost Joustra: " Tunnelling is a twenty-four hour, seven days a week operation. As a consequence, the automated monitoring of this process has to be continuously operational and its results accessible for all persons involved. The ability to access all information, regardless of location, was going to be essential" .
The information needs, within the project team, changed accordingly. New functionality was needed and the demands for system availability increased to match the tunnelling process's around-the-clock nature. The new information system was to provide real-time access to construction and monitoring data to a growing number of users. Some 70 people from different organisations within the project now had to access the information: e.g. designers, managers, contractors, supervisors, surveyors and the communications department.

Web-based

This called for a web-based information system. The new system that was developed was named Mobonz (Monitoring system Boring phase Noord/Zuidlijn). The system was implemented in 2010. The main processes concerned with the IS are shown in figure 2. The processes can be subdivided into Extract, Transform and Load ('ETL'), 'information processing' and 'visualisation and reporting'. The system is accessible through role-based authorisation only.

Extract, Transform and Load (ETL)

Of course the system contains basic GIS functionality and more or less static geo-data to fulfil basic information needs: topography, cadastre, infrastructure (such as locations of buildings, tram lines, canals, underground cables and pipes) but also information on subsurface conditions and surveys.
The data on the tunnelling process is dynamic: every five minutes the status of the active TBM(s) and progress of tunnelling is imported into the system. Another dynamic and more or less constant data stream are the monitoring readings of the 20,000 sensors spread across (and under) the city. In addition it is also possible to upload files manually through the web-based interface; this offers flexibility in the dynamic project.
The data streams are automatically processed. Part of this processing is data validation. The data is validated according to both format and content. This is a process that is essential to the successful use of the information system. If this filter is not performed correctly, the information that the system delivers can be inaccurate or false.
With these numbers (currently 300 million readings), database management and, more specific, the performance of the database management system, is crucial.

Information processing

The data stored in the system needs to be combined to derive business information on the construction processes based on business rules. Keep

in mind that the tunnel boring machine is a mobile factory (it can even be thought of as a submarine as it operates below the ground water table) moving about 20 meters per day. Joustra:" When monitoring a tunnel boring machine, slowly advancing underneath the city streets, it is essential to correlate the observed settlements to the exact position of the machine. Only when measured settlements are visualised and supervised relative to the geometrically passing TBM, does it become useful information for process control. The Mobonz system reliably combines TBM data and monitoring data which allowed us to plot settlement relative to TBM position. This creates a uniform criterion to assess TBM settlement performance. As far as we know, the North/South metro-line project was the first time this was done on such a large scale and in an automated way" .

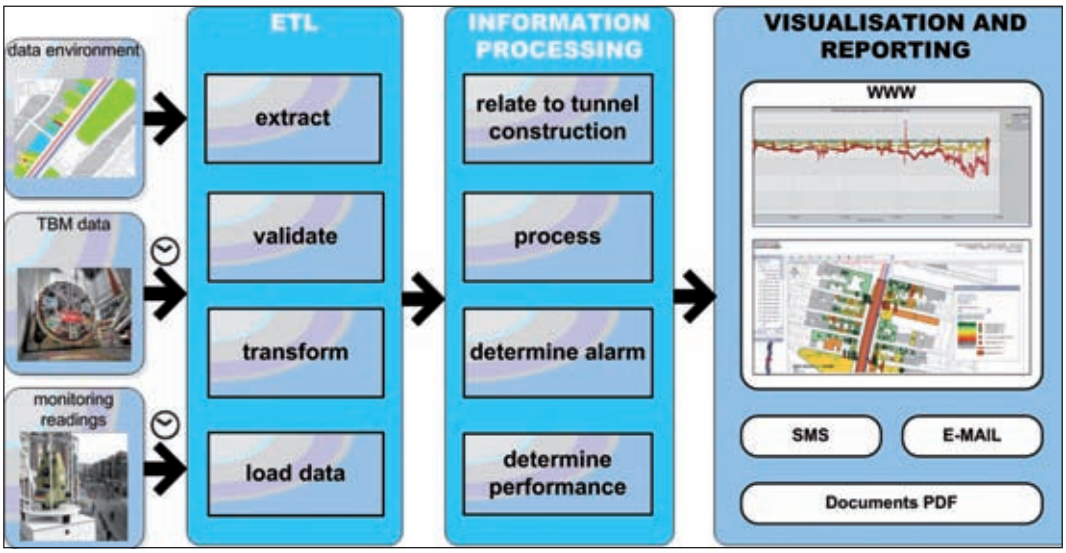

Figure 3: Processing chain of the Mobonz information system.

Keeping track of deformations is supported by an early warning module that determines an alarm status for a monitoring sensor, based on the monitoring reading value and a set of trigger levels. This entails a coding comparable to a traffic light system: the status can be green, yellow, amber or red, in ascending order of magnitude.

Reporting and visualisation

The Mobonz system is equipped with various means of reporting and visualisation. Monitoring data can be visualised by means of charts and tables through the Mobonz web-based interface. The system also contains functionality for maintenance of content, configuration and system applications.

Accessing information through maps is essential to this project. Most, if not all, of the information has a spatial component (or at least a spatial context). Using maps then offers a good accessing point to the monitoring information, as depicted in figure 4.

The construction processes take place on a large scale, so that reporting by means of a map creates an overview of the project status at any point in time. To this end Esri's ArcGIS Server was implemented.

The role-based authorisation and secure authentication allow different types of users to only access those pages relevant to their role. For instance, the tunnelling contractor had a connection via the Internet showing the GIS on

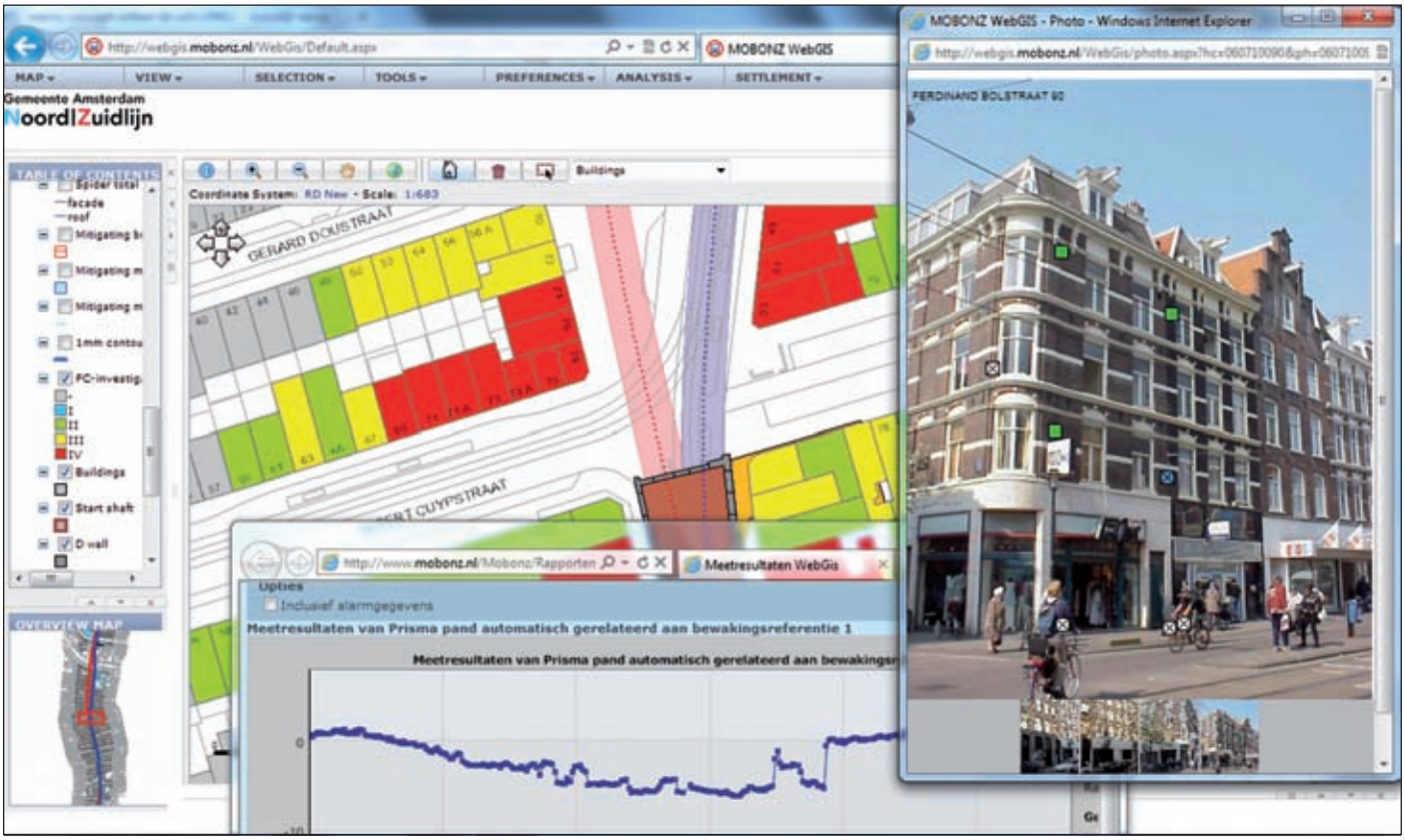

Figure 4. GUI of the Mobonz GIS: access to environmental data and monitoring data.

their own " dashboard" inside the TBM.
Another example is the monitoring contractor. He has access to Mobonz-pages to verify that his information has been handled correctly. It is also possible for him to determine where the TBMs are at a specific moment (see figure 5), so that he can determine where to focus his efforts for maintenance of sensors
However, neither contractor will be able to access pages with analyses and information not relevant to their processes.

Challenges

On developing and maintaining the system a number of challenging circumstances had to be dealt with:
1) Changing scope and conditions. During the design and development of the IS, the scope and conditions were changing rapidly. Initially the system would only serve the tunnel construction process. But as the construction of station pits was delayed, it became clear that the information system also had to serve the station construction processes with its distinct functionalities. Besides, the interference between the processes introduced new challenges that had to be dealt with. Tight collaboration with and co-ordination between stakeholders (management, users) and stringent handling of functionality requests (effective change management) proved to be essential in overcoming these challenges. The modular framework used for the system enabled accommodating a large number of the change requests.

2) 24/7 availability. As tunnel construction is a continuous process, the system has to be available 24/7. If, at any time, information on settlements was not available, the TBM might have to be stopped. This would bring about enormous costs as the project would be delayed. Therefore, the robustness (availability, security and integrity) of the system was paramount and was focussed on. A lot of effort was put into the development and testing process: a Development Testing Acceptance and Production (DTAP) roadmap was followed. Extensive testing on the functionalities was done in order to minimise the number of bugs. Availability of the system is now kept high (> 99.9%) with a redundant infrastructure and pro-active service management. Of course the maintenance of the system takes place in a 24 hr environment. Service management for the system in the form of user support (using the Kayako SupportSuite) and application and database management are provided and for technical management an IT services hosting company is contracted.

3) Functional and technical challenges. The requirements for the system were challenging in both functional and non-functional dimensions. Examples of functional challenges are the geospatial analysis of the monitoring readings (relative distance of static sensor to dynamic TBM) and the implementation of the " time-of interest" principle. This principle states that users of the system always have to be able to go back to any point in time and reproduce the information as it

was known at that particular point in time. Note that in this way it is always possible to reproduce and reconstruct certain actions.
Technically challenging are the 300 M readings that have been collected over a period of 10 years. The user has to be able to retrieve the readings of any sensor, a considerable amount of data, at any time. Joustra: " With a measurement programme as extensive as that in Amsterdam, the huge amount of data only becomes meaningful if one has quick and easy access to it. The Mobonz system provided exactly that."
The system has been successfully operational now for over two years, with high availability and robust performance.

Figure 5. Keeping track of the mobile factory: TBM Noortje passes the Dam square. The point symbols represent the sensors; the symbology reflects the alarm status of the sensors.

Future

The Mobonz system was implemented in 2010. With the end of construction of the tunnels and stations expected in about six months, the phase of the possibility of influencing the surroundings ends in 2013. The added value of the Mobonz system will then decrease and eventually it will end with a black screen. This is the fate of any information system that supports a construction process that is by definition temporary: it will be turned off as soon as construction is finished. Or will it? The expertise of the developers, of course, will be put to use in other projects and components of the monitoring system are being reused for other monitoring projects. These projects are not limited to the geotechnical domain, as the monitoring information framework is a universal framework not restricted to the monitoring of settlements.

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For more information on the North/Southline, please visit www.amsterdam.nl/metro

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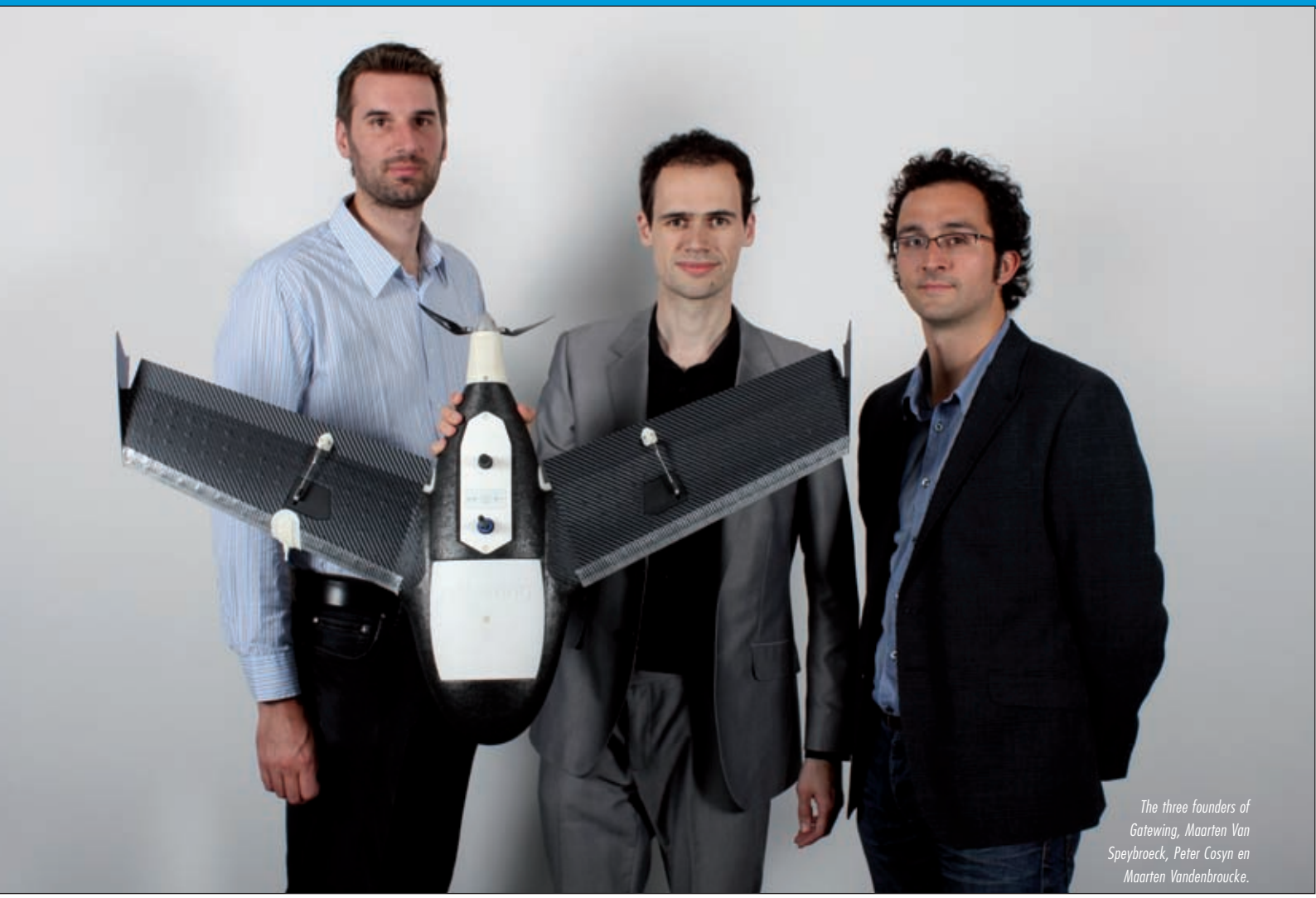
Gatewing's Unmanned Aerial

Gatewing is a Belgium-based company that develops and produces Unmanned Aerial Systems (UAS). The company was bought by Trimble in April 2012. President Maarten Vandenbroucke talks about the recent acquisition, the company's flagship product, the Gatewing X100, an unmanned aerial mapping system and interesting new market areas that are rapidly adopting their technology.

By Eric van Rees



The three founders of Gatewing, Maarten Van Speybroeck, Peter Cosyn en Maarten Vandenbroucke.

Gatewing originated from the idea of developing an unmanned aerial mapping system from Peter Cosyn, now Director of R&D at Gatewing. His thesis about the aerodynamics of small unmanned systems sparked this idea. The company was started in 2008 by Cosyn, together with Maarten Van Speybroeck (Director of Finance and Operations) and Maarten Vandenbroucke (President of the company) and now has a total of 25 employees. The company's flagship product is the Gatewing X100, an unmanned rapid aerial mapping system.

The company's focus is on mapping and surveying professionals that use the X100 for a number of different applications, such as topographic surveying, mapping for construction sites, compliance and planning, volume calculations of the potential of open mines, as well as compliance of vegetation; an industry that holds large potential.

Trimble and Gatewing

Earlier in 2012, the company was bought by Trimble. Why did Trimble choose this particular company, since there are many providers of UAV's on the market? Vandenbroucke: " an important reason for this acquisition was that Gatewing is mainly focused on a specific market, namely surveying professionals, and has a UAS tool that has been developed as an add-on for surveyor's current surveying tools, such as total stations and GNSS receivers and the like. In fact, they were looking for a rapid unmanned mapping system for some time, and the Gatewing X100 fits perfectly in the product line of Trimble as a high-end sur-

Systems

Gatewing X100 flying over a quarry.

veying tool."

The use of UAS can be seen as filling the gap between traditional surveying and photogrammetry: some projects are very large for surveyors and, therefore, take a lot of time to complete, and can be very dangerous. " Take for example surveying in mines, near dangerous machinery or surveying along dangerous roads" says Vandenbroucke. " For these type of projects, the Gatewing X100 is an ideal solution and can do the work in an hour and safely, since nobody has to enter a dangerous site. Surveyors can do their work more easily and more safely, which means that they are happy with this new technology rather than skeptical" .

Popular

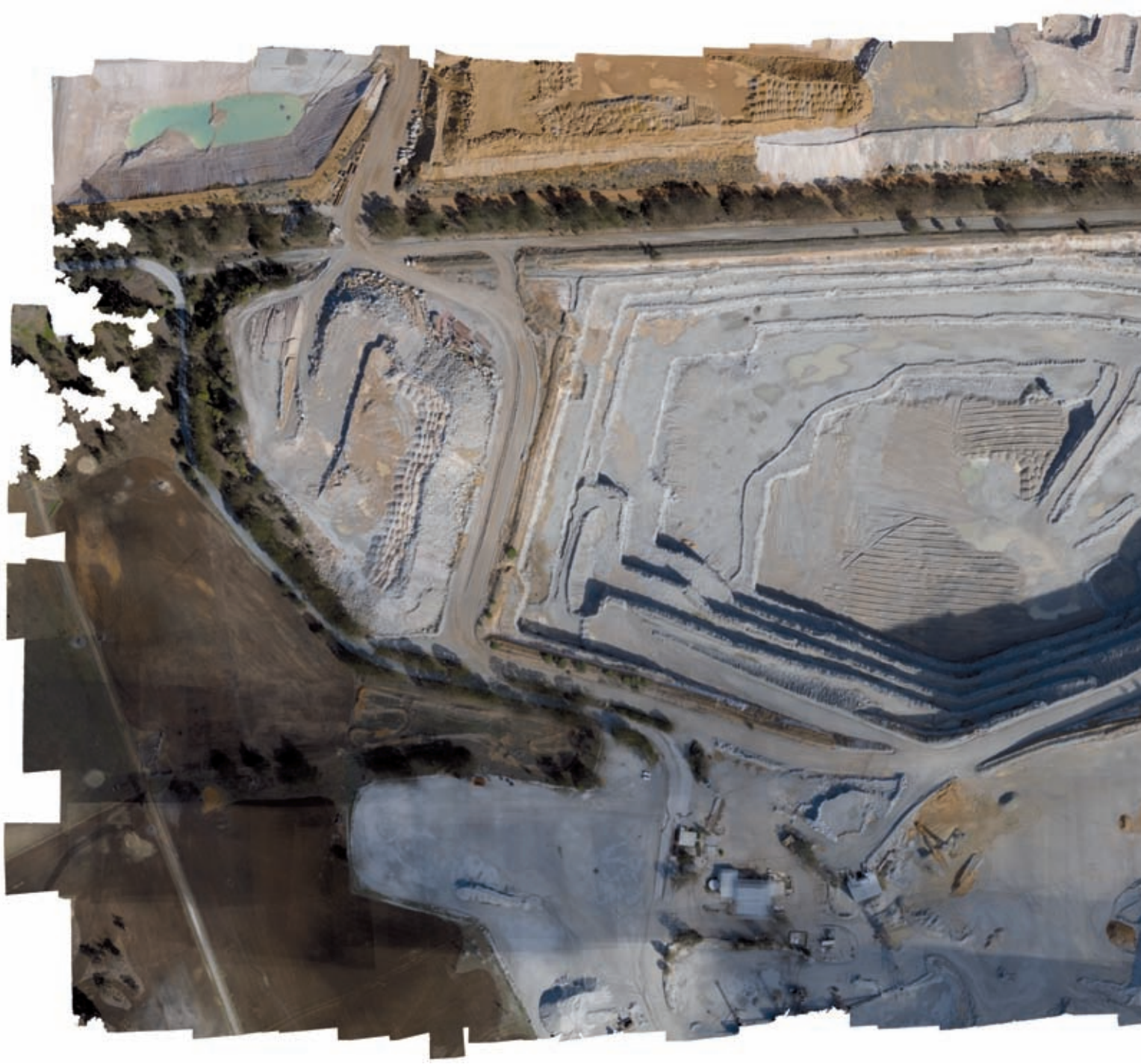
UAV's are popular nowadays. There are many providers and the technology is updated incrementally. Why is the interest so big and growing? " The UAV-technology is relatively young but one that is developing rapidly. Many systems for civil use have been developed from the military or academic world and are now being produced by professional companies such as Gatewing. Now that most countries have created clear legislation for UAV's and unmanned systems for different applications and proven their value and return on investment, we have seen that not only the early adopters buy these systems but also that mainstream companies invest in the technology" says Vandenbroucke.

" The big advantage is that you are in control for a mapping project: you can take aerial photos at any given moment and even during bad weather circumstances because you can fly underneath the clouds. As for a comparison with satellite imagery, you are fully dependent on others for acquisition. Satellite images are expensive and sometimes you have to wait for a long time for the results since a satellite has to be in the right position and there shouldn't be any cloud coverage."

When looking at the use of laser scanners in comparison with aerial pictures, the last ones have the advantage that for all points and colour information is also available. Also, aerial images make DSMs (Digital Service Model), point clouds or orthophotos, whereas laser scanners only produce in point clouds.

Workflow

Since our foremost target audience consists of surveyors who have little or no knowledge of operating the planes, the company has developed the X100 in a way that makes the operating process very easy. A project that needs to be mapped is programmed beforehand through an easy software wizard where the mapping area is shown on the digital map. The flying altitude is set, the desired overlap of the imagery (which is by default a 75%) and the take-off and landing location. This flight plan is then loaded in the plane that is launched with a catapult. Once the plane is in the air, you don't have



Orthophoto of a quarry

to do anything and the X100 starts to fly in parallel lines and map the area. Once the project has been finished, the X100 will land at the designated place. At this point, the image processing can start by using Gatewing Stretchout or other image processing software. The digital camera of the X100 is a Ricoh GRD IV that has been chosen because of its compactness, durability, and navigability through USB and the low lens-distortion.

Gatewing Stretchout is a highly automatic image processing software that processes, with only a few clicks, the imagery data of the X100 in high resolution orthophotos (up to 3.3 cm GSD) and dense DMSs. The solution is based on new stitching software; the so-called vision software that in overlapping images searches for tens of tie-points to join the photos. Vandenbroucke: " we like to compare the accuracy with LiDAR, since LiDAR yields accurate data and after testing we came to the conclusion that our DSMs have LiDAR-like accuracy. DSMs that have been generated through Stretchout are very dense because for almost every pixel you have a height value. LiDAR is still more expensive because these sensors are produced in less higher quantities than the digital cameras that we use in the X100."

Gatewing has its own cloud solution, called Gatewing cloud, which allows its users to load their image data on to its cloud server that will then handle the image processing for this project. After a few hours, the orthophoto and DSM can be downloaded. " The advantage of Gatewing cloud is that one doesn't need any knowledge of image processing, the price is per project and you don't have to invest in a powerful computer for processing the data" , says Vandenbroucke.

Potential

Precision farming is an application that holds a large potential for mapping with

Orthophoto of countryside

UAV's, especially in regions with large farming parcels, such as in South America. The crops are overflown with a Near-Infrared (NIR) camera so that afterwards one can see perfectly which crops show stress because of drought or disease. Using this system, farmers can respond appropriately by applying water or pesticides where needed, which, in turn, results in a saving in time and irrigation resources.

In the US, legislation is underway for the use of UAS, says Vandenbroucke: " although it is already possible to fly in the US with a UAS for non-commercial ends, such as for university study projects, for commercial use the FAA is still working on legislation. Once these rules are in place and commercial use is possible, the US will be a very large market for the Gatewing X100 because of the size of the country, the acceptance of the technology and the many open mines" .

A recent project for Gatewing took place on Easter Island, where an archeological project was performed with the Gatewing X100 by National Geographic Channel in cooperation with the University of Long Beach. A volcano in high-resolution was mapped to establish which way the known images that were hollowed out by the volcano were transported to the coast. The documentary will be broadcasted by National Geographic Channel in November.

Internet: www.gatewing.com

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Microsoft

From capture to marketplace in a few easy clicks

The Third Industrial Revolution

This article examines the Third Industrial Revolution. Used to describe a major paradigm shift in product design and manufacture, it is impacting on the way information is gathered and used also. Smart technology applications like Theodolite Droid, open sourced hardware, crowd funding, non-linear workflows and affordable camera solutions like Hedcam are discussed. Digital designs made on everyday mobile devices can be transformed into real life usable or ornamental products. The Cornwall and West Devon Mining Landscapes World Heritage Site was used to generate examples.

By Adam P. Spring

Figure 1: Even with distortion caused by field of view, it is possible to use products like Hedcam to generate 3D data

Figure 2: Processing stills from Hedcam in software like 123D Catch will contain evidence of the 135 degree view of the lens

The Third Industrial Revolution

The Third Industrial Revolution is a concept first outlined by the American Economist Jeremy Rifkin. It is currently used to describe the way digital technologies are affecting design and manufacture processes. It is deemed the 'Third' because it is seen to follow the factory based model that came out of Victorian Britain and the assembly line approach to manufacture championed by Henry Ford. Wired editor in chief and joint owner of diydrones.com Chris Anderson cites Thingiverse.com - a website where predominately Trimble SketchUp drawn designs are readily downloadable for 3D printing - as the example of the Third Industrial Revolution in action.

Internet of things

It is no coincidence the Internet of Things, and later the Thingiverse, have become popular terms used to explain such phenomena. By presenting humans and objects as independent agents in the distribution and communication of knowledge, the idea sits well with products designed for general media consumption. The role of the smartphone or tablet in the collection of spatial information - as well as the relationship between the user and the technology - is well defined at an application stage. So too is the data narrative, which documents information collection as a process.

Theodolite Pro and Droid

Such mobile technologies as the iPad have indeed made general audiences more familiar with spatial information. The Application Programming Interface - more commonly known as the app - allows the user to access the different functionalities of a smartphone or tablet. App's like Hunter Theodolite Pro for iOS or Theodolite Droid for Android even go so far as to turn them into effective and versatile prospection tools.

Theodolite Pro and Droid access the inbuilt camera, GPS and motion orientation technology of a smartphone or tablet - turning them into an all in one inclinometer, optical rangefinder and GPS receiver. Accuracies obtained from the inbuilt GPS of most mobile devices are between 1.5 to 3 meters depending on location and satellite fix. As Theodolite Pro developer Dr. Craig Hunter points outs, using an iPad or iPhone as an optical rangefinder can: 'On a tripod, with a clear view of the target, generally give range to within 2% or so.' To ensure the latter, capture should include orthographic shots of an object or surface.

Linear and non-linear workflows

A key thing to note about the app market is the way it presents a shifting trend in the way technology is used to collect and interact with information. Smartphone and tablet use is centred around the solution provided as opposed to processor power - something that has been a staple part of most digital workflows since the meteoric rise of the personal computer in the late 1990s. A progression from the client server to the cloud, this has ironically taken data processing back to an approach reminiscent of mainframe computing. A ubiquitous form of terminal based computing through smart technology has become en vogue and multidimensional workflows part of everyday life.

Specialist applications

The same can be said for specialist applications where the flow of information no longer has a clearly defined beginning or end point. Paradigm changing activities like crowd-sourced data logging through geo tagging - even design and manufacture apps - are increasingly explained through guru compliant terms like the Internet of Thing and a Third Industrial Revolution. Terms ambiguous enough to bring order, or give ownership to, activities that are otherwise tangible and in a constant state of change. With a watchful eye gazing over companies like Google and Apple, even large precision measurement companies like Hexagon AB are advocating the only restrictions now placed on digital information come from the user themselves. Though consumer products like the tablet did not lead to the development of the non-linear workflow they have made them difficult to ignore.

Applications like Theodolite Droid access the inbuilt GPS, camera and motion sensor in handheld devices to gather spatial information

Open source hardware

Further optimization of applications can occur through open sourced hardware. Such hardware promotes the use of digital devices through physically mobile hardware. An example that continues to gain momentum in spatial sectors is the unmanned vehicle. UAV and drone projects like diydrones.com and mikrokopter.de have matured and are making aerial photo and video capture easier, cheaper and achievable by one person in the field. There is even the Arduino driven Arducopter, which married the UAV and open hardware movement to create what is essentially a flying robot. UAVs can be used to generate photo based Digital Terrain Models or videos that represent the experiential - the sights, sounds and sense of a place. Even additive

The Rhino Slider is ideal for stereo image capture and can be extended to any length

printing a landscape, building model, artefact or the UAV itself has become affordable to casual users.

Unmanned vehicles

Unmanned vehicles have widely been associated with the capture of aerial photographs and video in recent times. It is important to note, however, that unmanned data capture is not solely the preserve of the UAV or drone. Applications extend to underwater photogrammetry using Autonomous Underwater Vehicles (AUVs), for instance, or computer vision inspired laser scanning solutions, such as that offered by Pittsburgh based company Allpoint Systems. It is a shift in design and manufacture practices - the Third Industrial Revolution - that have made the UAV the most accessible unmanned vehicle to date.

Crowd sourced innovation

Crowdsourcing is driving a range of open sourced hardware. Even the crowdfunding site Kickstarter is changing the way products are developed. Described in the New York Times as the peoples National Endowment for the Arts, it is having a noticeable, impact on cultures based around innovation and the production of ideas. A prime example is the Washington based company Rhino Camera Gear who used Kickstarter to develop the Slider tripod system.

The Rhino Slider

The Rhino Slider is a tripod designed for shooting motion video. Intended for movie makers using DSLR cameras, its intuitive design makes it an ideal tool for stereo pair image capture also. Much like UAVs, it can be used in conjunction with any camera system, tablet or smartphone. In fact, it would even be well placed alongside a gigapan. Include an app like Theodolite Pro or a GPS attachment for a camera (Canon and Nikon now produce their own) into a Slider assisted workflow and a quick, effective way to take georeferenced stereo photographs is created.

Shifting design and manufacture culture

Finally, there is a further significant element to the Third Industrial Revolution, which is that the design and manufacture of a product does not have to occur in the same place. These processes can happen anywhere and independent to one another. In fact it is this - combined with the connectivity made possible by digital technologies - that is seen to have driven costs of manufacture down as well as liberate processes from the factory as a physical entity. Even 3D printing can be achieved in numerous ways. For instance, the University of Bath created reprap.org - a project used to design and develop open source 3D printers that are self-replicating and affordable to a mass market. Point and click solutions like shapeways.com even offer a mail order approach to rapid prototyping. The only decision the user need make is whether they want to know how 3D printing works.

123D example

Offered by Autodesk for free, the 123D software range is the most apparent example of the Third Industrial Revolution currently in play in the spatial sector. Following Rifkin's line of thinking, the 123D toolbox can be used to print out parts for a UAV that, once assembled, can be operated by a tablet through open sourced software like phonedrone. A smartphone can be mounted to the UAV too - serving as a sensor used to collect photographs, video and GNSS data. Any images generated can then be processed in 123D Catch and the data sent off for 3D printing. This is achievable for under USD $1000. In the examples outlined a Hedcam video camera - a waterproof system designed for extreme sports enthusiasts - has been used for data capture.

Summary

The changing face of production and manufacture processes continues to impact on the geospatial sector, making the Third Industrial Revolution a reality. The development of apps, especially free or low cost apps for mobile devices, along with open sourced hardware is making digital capture and modelling easier and cheaper. Crowdsourced funding and distribution models are taking 3D image capture into new territory by enabling an individual with an idea turn it into a reality. The final element is that rapid prototyping can readily turn these digital products into hard copy in a range of materials from plastics to metals to wood - anywhere in the world where they are required at low cost and without international transport costs.

Aerial mapping using a UAV, a digital SLR camera and Adam Technology 3DM Analyst
www.youtube.com/watch?v=8BqAr3ap3WU&feature=g-all-u

Automated laser scanning using Allpoint Systems Scan-time solution:
www.youtube.com/watch?v=rDZUGlQqsHo

Using a smartphone on a UAV:
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XXXIX-B4/349/2012/isprsarchives-XXXIX-B4-349-2012.pdf

The Vampire UAV designed in Trimble SketchUp and available at Thingiverse.com:
www.youtube.com/watch?v=DLrN-IrLtUs

Open sourced hardware Arduino: www.arduino.cc

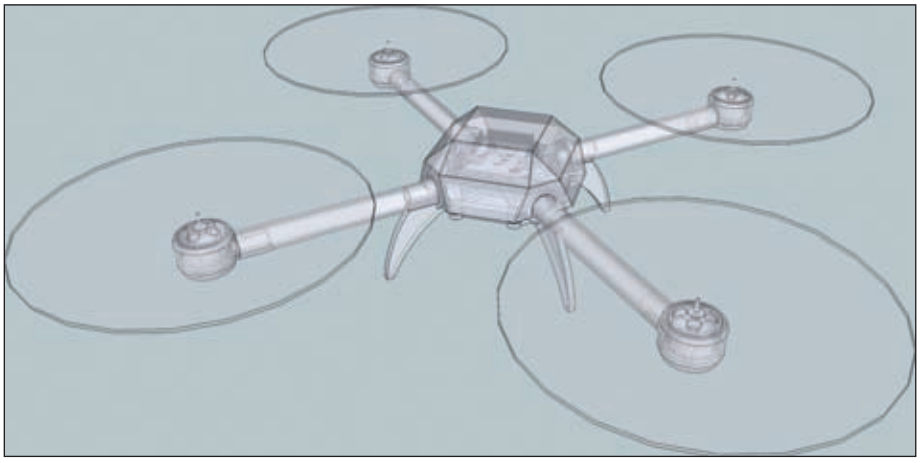
Using the Arduino to create a flying robot:
http://code.google.com/p/arducopter

Parrot designed drone that can be operated using a smartphone or tablet:
http://ardrone2.parrot.com

Phonedrone open source UAV operating application:
www.youtube.com/watch?v=qdZokmVdroc

The Rhino Slider has great potential in stereo pair capture:
http://rhinocameragear.com

Lightweight, durable video cameras, such as GoPro and Hedcam, continue to play an increased role in 3D image capture and DTM production: www.hedcamz.com



The Vampire UAV was designed in Trimble SketchUp and can be downloaded for printing from Thingiverse.com

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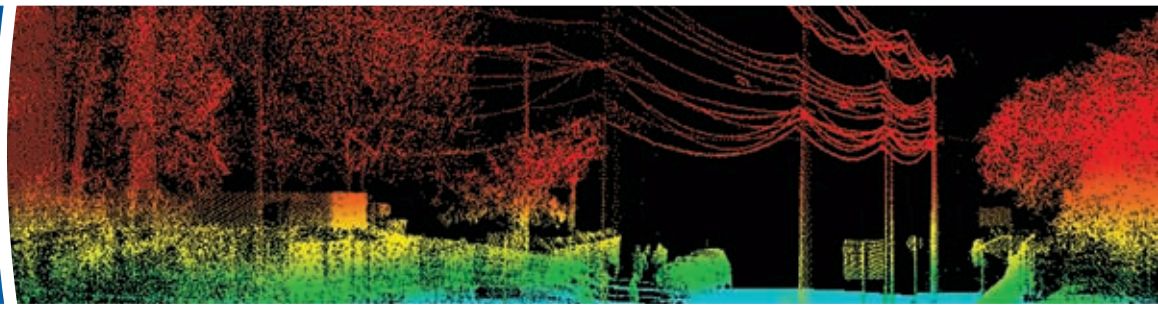

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Digital Photogrammetric Technologies

Racurs Conference

The latest edition of the annual Racurs International Conference offered three days of seminars, workshops and group meetings exploring state-of-the-art photogrammetric and remote sensing technologies. Participants shared the latest news in digital airborne and space cameras, remote sensing data and innovations in software development, as well as practical methods for using digital photogrammetry and remote sensing for different economic activities and integrated geoinformatic solutions.

By Eric van Rees

Group Photo

Introduction

The twelfth International Scientific and Technical conference entitled 'From imagery to map: digital photogrammetric technologies' took place from September 24-27 in the town of Alvor on the Algarve, Portugal. Once again, the event was organized by Racurs, the company from Moscow, renowned for its photogrammetric software product Photomod. The event was sponsored by Meridian, DigitalGlobe, GeoEye, VisionMap, CTT Group and GIA Innoter, and was supported by ISPRS and the Russian GIS association. For the first time, the event was broadcast live on the internet by Zemel'nye Resursy from Russia, which drew an audience of several hundreds of people, as was reported during the event.

The programme consisted of three days of presentations and software master-classes, covering a number of inter-related themes, such as photogrammetric processing of digital aerial imagery and remote sensing data usage, as well as methods and software for space remote sensing data processing, photogrammetry and 3D modeling, to name but a few.

Although the event is dominated by Russian participants (who are mostly Photomod users as well), there are always a number of local (European) partners, as well as contributions from the international scientific community, making this event truly international. The size of the event is not too big and not too small, although the amount of papers submitted is growing, leading to a larger number of presentations. This is not a problem as long as the presentations are good, which was certainly the case. The same goes for the questions and discussions after the presentations.

Conference opening

Every year, the conference is opened by Victor Androv, Managing Director at Racurs. The company has been in business since 1993, and not only sells Photomod software, but also promotes supplementary geoinformatics software products and distributes satellite imagery. The company has sold 1497 licenses worldwide for Photomod, of which 794 were sold in Russia. The software is available in Spanish, English and Russian. His speech was followed by a word of welcome by Carlos Rodrigues from the General Directorate of Territory from Portugal.

Geodesy, mapping and geospatial information management

Gottfried Konecny from Leibnitz University in Hannover, Germany spoke about the history of geodesy, how it is used for mapping the earth's surface and how to manage it for sustainable development. After a short course about the history of geodesy; the art and science which determines the size and shape of the earth, Konecny stated that the combination with GNSS and geodesy made it an indispensable earth science tool. Mapping from space was covered briefly with a slide of today's high-resolution satellites: WorldView-2, Pleiades 1, GeoEye 1 and TerraSar X. These satellites yield data, which is processed and used, leading to web portals, use of smartphones as data capture devices and navigation devices and internet browsers. I was surprised Konecny didn't speak about the cloud as a substitute for geoportals. Afterwards he clearly expressed his reservations about the popular embracement of the cloud, especially in the US. He said a few words about geospatial companies not listed on the stock market which, therefore, keep their independence. This enables them to remain sustainable in economic terms. Companies in point are Esri and Racurs.

The second part of his presentation was spent on a joint project between ISPRS and the United Nations about a study on the status of mapping on the world. In particular, what parts

Conference audience

of the world are mapped by official mapping agencies, when they are updated and what scales are used for the paper maps etc. etc. A survey with a questionnaire has been repeated every six or seven years from 1968 until now. The results are interesting. Included in it are industrial mapping results, but it is not known how accurate the results are. For example, one commercial map vendor offers maps of North Korea, but it is not known how this vendor acquires the data and, therefore, casts doubt on whether it is correct. Another interesting example is a radar mapping program in Alaska; the accuracy of which is also in doubt due to heavy cloud coverage. One participant remarked that maps shouldn't be updated at all, but be treated as a by-product from a 3D landscape model. This mapping paradigm change is heard more and more often these days, but the traditional 2D is still currently in use and not only by national mapping agencies. Konecny's second talk about the relationship between governments as partners for progress in geoinformation, industry and academia was met with enthusiasm and yielded lots of input for discussion later that day.

SMART Cities, 3D city models and UAV's

Armin Grün from the Institute of Conservation and Building Research (Switzerland) held a presentation on the next generation of SMART cities and the role of geomatics in this. His view on modelling and mapping lies more in the 3D-realm than in the 2D realm. This is understandable as he has been working in Asia with the latest technology in progressive scientific projects on urban modelling. As he has noticed a changing perception in the world regarding mapping, he has asked for a new concept for 3D mapping and modelling, including consideration of the time-factor as a fourth dimension.

During his presentation he showed many examples of how different data sources can be used for managing the urban environment, whether it's for capacity planning or for homeland security, 3D car navigation, smart homes or risk transports. Grün did not to try to hide the general shortcomings of city modelling nor those of UAV's; a technology he has been involved with for a while now. Maybe the biggest gain in the use of UAV's has been that official government agencies have finally been won over, as they have been using UAV for a broad range of applications and, therefore, are more eager to give permission to fly in public space. This has led to a number of new applications, such as building models for property developers, real-time detection and the tracking of oil spills and micro-climate modelling.

VisionMap, Leica Geosystems and Vexcel

There were a number of commercial presentations from the event's sponsors. Yuri Raizman from VisionMap (Israel) held a presentation about the further development of the A3 family of digital mapping systems. VisionMap A3 system is comprised of the A3 digital airborne camera and LightSpeed fully automated ground processing system. A new feature is A3 Edge, which promises an even larger footprint than the current one of 60,000; namely 80,000 pixels. There will be a pixel size of 5.5 micron, which will yield 29 megapixels/frame, the highest resolution per altitude and the latest generation of CCDs and electronics, providing the highest dynamic range imagery.

For the first time, there was a joint presentation of how the merging of both Leica Geosystems and Z/I Imaging aerial equipment worked out. Valentin Zaytcev of Leica Geosystems AG (Switzerland) presented a complementary product portfolio, where both product lines are developed further in a way that they can complement each other. The airborne sensor portfolio discussed consists of the Leica ADS Pushbroom, the Z/I DMC II Frame, the Leica RCD Frame (all three for imaging) and the Leica ALS for LiDAR. Together they form part of Hexagon's airborne system design of tomorrow.

Engelbert Breg from Microsoft/Vexcel spoke about how multiray photogrammetry is used for Bing Maps, where cities are flown and mapped for city models inside of Bing Maps. The aim is to make a global ortho consisting of the US and Western Europe with 30 cm GSD, for10,400,000 square kilometers – good for 24 months of initial acquisition and a refresh in the next two years. Breg spent the remainder of the presentation giving an explanation of how the UltraMap 3.0 workflow works and yields orthos, true-orthos, point clouds and DSM's.

Photomod

Racurs themselves were also present during the event with a number of presentations on Photomod. Dmitry Kochergin from Racurs held a presentation about the basic functionality capabilities and future development of the Photomod product line. The module can be used to transform radar, aerial and satellite images into a number of geospatially referenced maps and images and as output formats used by other software vendors. Main functions of the software are image processing, aerial triangulation and block adjustment, as well as 3D feature extraction, ortho-mosaicing and the creation of digital maps, to name but a few. For this coming year, a number of major changes for the software have been announced, as well as a number of upcoming features, such as a full 64-bit system version and integration of all system modules into one environment. Other presentations from Racurs addressed the topic of 3D modelling in Photomod and modern DSM creation algorithms in DPW's.

For more information, have a look at www.racurs.ru

GNSS Update

First Galileo results

Researchers at the University of New Brunswick (Canada) have published the first positioning results for Galileo. Using both GIOVE A and B (which are now decommissioned), as well as the first two In Orbit Validation satellites, three different positioning modes were evaluated.

By Huibert-Jan Lekkerkerk

Solution	Latitude [m]	Longitude [m]	Height [m]
Code only	3.084	0.658	1.617
Code and phase (PPP)	0.422	0.150	0.389
Phase only (from known point)	0.041	0.009	0.045

Figure 1: Achieved positioning accuracies for all three positioning solutions (source: www.gpsworld.com)

Though GIOVE A and B were never intended for positioning, but for the testing of system aspects, the researchers used their positioning signals. The four satellites were together for just a few days and for a few hours on these days, giving the minimum requirements of four satellites for positioning. Using all the available signals, a code-phase, carrier phase and precise point positioning solutions were calculated. Though the results should not be compared to the future results, they are a good indication of the achievable accuracies. With the availability of the next In Orbit Validation satellites the results should improve.

The final results of the measurements are given in table 1. For surveyors and those involved in precise positioning the carrier phase results are probably the most relevant as they give an indication of achievable accuracies using RTK systems. A graph of the obtained results is given in figure 1.

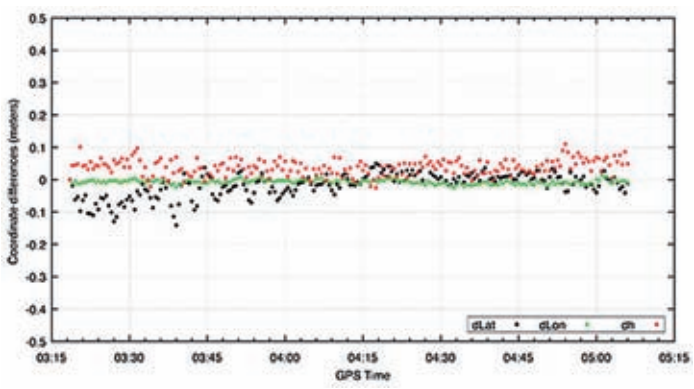


Figure 2: RMS plot for the carrier phase solution (source: www.gpsworld.com)

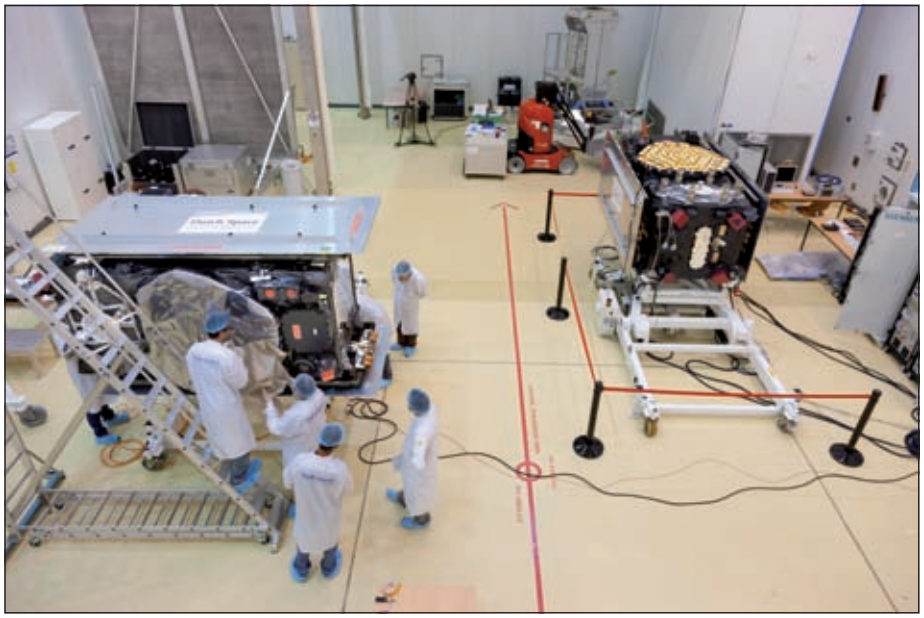


Figure 3: Galileo IOV satellites being prepared for launch (source: www.esa.eu)

Major issues with the results obtained were inconsistencies in the measured ranges, poor geometry of the four satellites and biases in the code observations. All in all, the results demonstrate that cm level positioning is well within the possibilities of Galileo and that it is to be considered at least on a par to GPS based carrier phase measurements.

GIOVE A and B retired

The two Galileo test bed satellites, GIOVE A and B, have recently been decommissioned. GIOVE A was launched in December 2005 and has lasted almost 7 years, giving useful results up to the end of its operational life. Originally it was designed to operate for no more than 27 months and was built on a tight deadline to allow Galileo to secure the radio frequencies it had claimed at the International Telecommunications Union (ITU).

GIOVE B, which was launched in April 2008, has also been decommissioned. This is to allow space for the next two In Orbit Validation satellites that are to be launched in October 2012 from Kourou in French Guyana. The first two satellites have now started the transmission of dummy signals for the final modulation scheme. This scheme, which is designed to allow full interoperability with GPS, is important for the operational services.

GPS and Compass

The next GPS satellite (SVN65) to be launched will be a Block IIF satellite and is scheduled for October 4. It will be positioned in a slot currently used by an older Block IIA satellite (SVN39) which has been operational since June 1993. This will be the third Block IIF satellite out of a scheduled total of 12. Meanwhile the first GPS Block

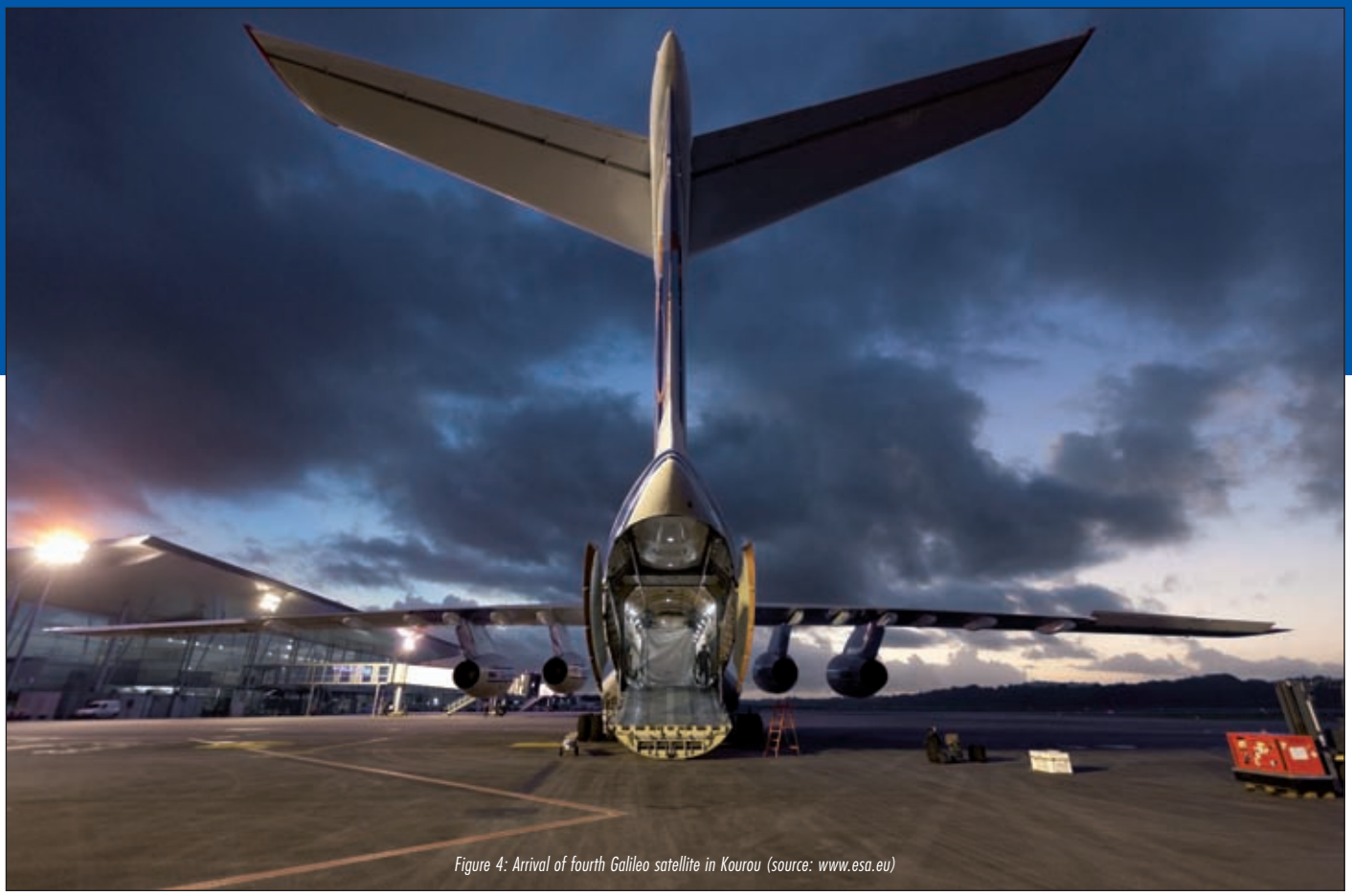


Figure 4: Arrival of fourth Galileo satellite in Kourou (source: www.esa.eu)

III satellites are currently being tested and designed by Lockheed Martin and should be ready for launch in 2014.

Two compass/beidou satellites are (at the time of writing) scheduled for launch on September 18. Originally set for launch in August, it was postponed due to unknown problems. A third satellite is scheduled for launch in early October.

Augmentation systems

The year 2012 seems to have become the year of space based augmentation systems. The first augmentation satellite launched was the SES-5 satellite in July. SES-5 transmits EGNOS signals on both L1 and L5 frequencies (PRN 136), as well as functioning as a communications satellite. This means that the signals are now completely compatible with the United States WAAS satellites. A second SES satellite is under construction and should be launched in 2013.

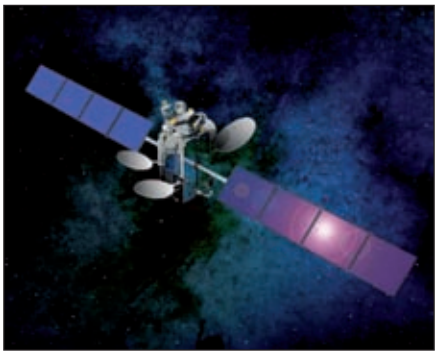


Figure 5: Artist impression of EGNOS SES-5 satellite (source: www.esa.eu)

By the time you read this, the second Indian SBAS satellite should have been launched, namely GSAT-10. This satellite has a GAGAN (GPS and GEO-Augmentation) transponder. The satellite should be positioned at 83° E and will be using PRN 128. The first satellite (GSAT-8) was launched last year and is now transmitting GPS L1 corrections on PRN 127. Although GSAT-8 should also have L5 capabilities, no corrections have been detected so far.

Those using GNSS systems in Russia and waiting for free SBAS correction signals need to exercise a bit more patience. The launch of the next satellite, Luch-5B has been postponed from the scheduled date of October 15 to at least November. This is the result of an issue with the Briz-M upper stage. Meanwhile the first of the two satellites, Luch-5A, started its transmissions on July 12 (PRN 140). So far Luch-5A is only transmitting GPS L1 corrections, but no Glonass corrections, although this was expected.

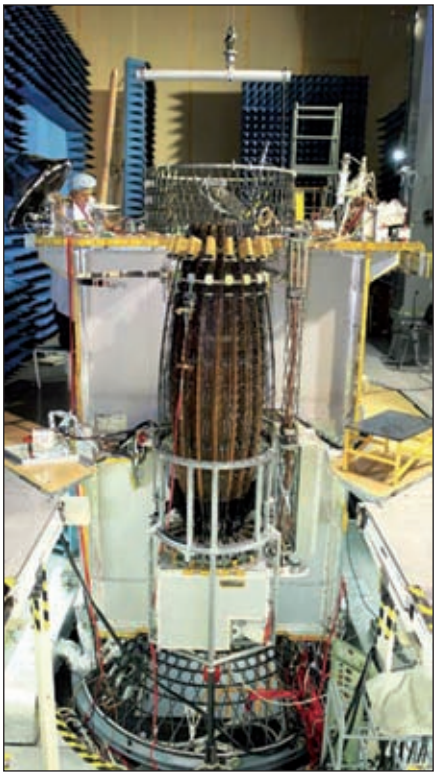
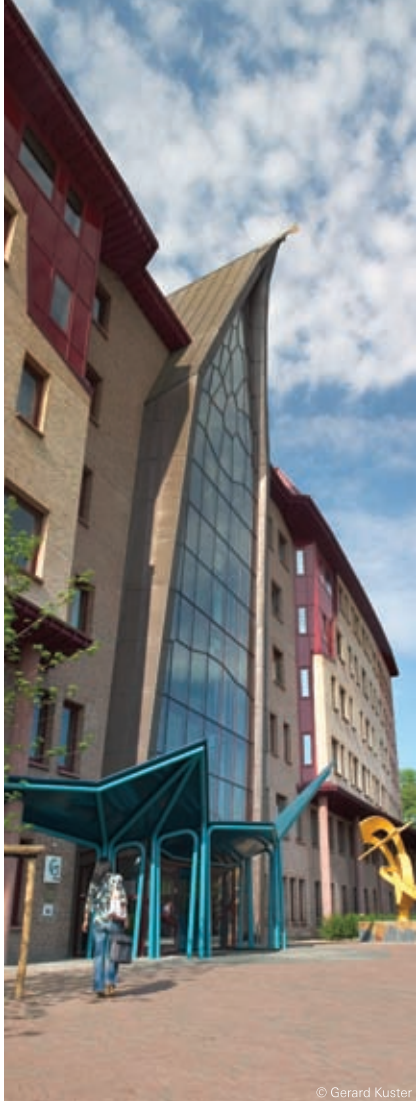


Figure 6: Luch 5-B satellite being prepared for launch (source: www.gpsworld.com)

Huibert-Jan Lekkerkerk hlekkerkerk@geoinformatics.com is a freelance writer and trainer in the fields of positioning and hydrography.

SPACE FOR GLOBAL DEVELOPMENT



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Matt Sheehan is Principal and Senior Developer at WebmapSolutions. The company build location focused mobile applications for GIS, mapping and location based services (LBS). Matt can be reached at matt@webmapsolutions.com.

COLUMN

Mobile Geolocation Technology and Services

Geo-location technology and related services are much discussed but less well understood. Let's have a look at this ever more popular technology, and its potential use in the oil and gas pipeline sector.

Mobile Geo-Location Apps

As with the Internet, mobile computing has been adopted quickly by consumers. So called Location Based Services (LBS) are being developed by a new breed of geo-marketing companies to influence buyer behavior at the point of sale. Google have made Web Mapping very popular. With Apple and others entering this space, we are seeing a broadening and deepening of the services provided. Geographic Information Systems (GIS), historically a niche technology popular in the public sector, has become increasingly more popular. New GIS platforms have been launched, such as Esri's ArcGIS Online. These have made both publishing and accessing location based data considerably easier.

Oil and Gas Pipeline Sector

Mobile location technology and services could play a key part in improving operations in the pipeline industry. A spate of recent accidents has focused attention on pipeline operators. There are increasing demands on changes in internal processes. Key issues include:

- Problems with data accuracy - Investigations into the PG&E Corp natural-gas pipeline explosion in San Bruno, California in 2011, highlighted data discrepancies as a key causal factor.
- Increased regulations and drive to improve safety – There are now far greater demands on operators to increase both the quantity and quality of data collected, and increased scrutiny by regulatory agencies.
- Demands to reduce risk and improve efficiency – There is greater focus on incident prevention. Also, should an incident occur, how quickly can the organization react and how effective were the measures which were put in place? Mobile computing and location technology and services bring potential solutions to many of these issues. These include:
- Maps – Using interactive maps which include base maps and feature layers of interest, field workers can view information about assets near their current location.
- Data collection – Updating the attributes of specific features, and adding new features to a dataset is made considerably easier with mobile. This will be a key factor in improving data accuracy.
- Discovery – From simple queries such as show me all pipes laid before a specific date in an area, to which valves need to be closed to stop the flow of oil or gas to this particular break in the pipe?
- Collaboration – Not only uploading and sharing quickly field data using mobiles, but also using the mobile communication tools; texting, video conferencing, voice.
- Organization – Managers can track the location of field workers, and help coordinate projects.

Geo-Location and Mobile GIS Services – The Future

The mobile sector is rapidly evolving. New products and services are being launched almost daily. Within this evolution a number of trends are emerging:

a) New Geo Platforms and Services – The cloud has brought with it a slew of new location based products. Foremost among these in the geo-space is ArcGIS Online. Allowing for easy data publishing, and access. This we will discuss in our next column.

b) Offline Solutions – For mobile devices, areas outside of cellular (3G,4G) or Wi-Fi coverage remain a challenge. How does one interact with maps, and edit features without network connectivity? It now possible to access both map tiles and FeatureLayers (or equivalent) locally on mobile devices.

c) Geo-Location Technology System Integration – The GIS sector have historically tried to solve problems using location as the starting point. To continue the adoption and use of this location technology, particularly within the Enterprise, there need be a change in emphasis. Location data is part of a bigger whole. Starting from the perspective of solving business problems, location data will most effectively be used in conjunction with other business data to provide solutions.

Conclusion

Within the Enterprise mobile adoption is proving a slow process. The challenge remains persuading senior managers that mobile technology brings real benefits to the Enterprise. The key is to demonstrate, using real world examples, how mobile location technology, in conjunction with other business technology and data, can both improve decision making and reduce costs. In the pipeline sector improving safety and reducing risk are hugely important, and should provide a strong argument for wide-scale mobile adoption.

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Hands-on Experiences

Migration to ArcGIS for Server 10.1

The latest release of ArcGIS for Server has major changes in architecture and functioning. This article focuses on upgrading to ArcGIS for Server 10.1, with hands-on experiences from the work field.

By Gerben Tiemens

Figure 1: ArcGIS for Server Web Manager - This is how the interface looks after a fresh install. It will contain a sample map service. The interface is totally different than the previous versions.

The Desktop part of ArcGIS software, version 10.0, was given a new look and feel with several new features and major changes as compared to the 9.3.1. However, the ArcGIS server version 10.0 didn't contain many major changes compared to the previous version. This summer ArcGIS 10.1 was released by Esri. The 10.1 release of ArcGIS for Desktop (notice the change of name) contained some new features, but the principal changes this time are for the ArcGIS for Server (another name change!). These major changes in architecture and functioning are the main reason for this article about upgrading. Described below are some of the issues experienced when upgrading from an ArcGIS Server 10.0. For users with earlier versions (most likely 9.3.1), the upgrading experience will be pretty similar.

What is new and important?

The first thing to notice is the change to 64bit software. This means, you need 64bit hardware and operating system (Windows or Linux) to run ArcGIS for Server 10.1. In this case, a Windows 2008 R2 system was used to upgrade. The second big change is the included dedicated web server application. During installation it will install a separate server by default on port 6080. And the third modification is the use of a single system account (" ArcGIS"). The SOM-SOC model is no longer used. Not all of these changes will be described in detail. If you require more detail, you can find this on Esri's website. It is more important to know how to deal with it.

Figure 2: Registering Web Adaptor - The Web Adaptor can be installed on a different hosting system. After installation you are requested to connect the Web Adapter to the ArcGIS for Server using its 6080 port number. To enhance security, you can use a shared key for the communication.

Preparing

So, what do we basically need to upgrade and run the ArcGIS for Server 10.1?

- The ArcGIS for Server software DVD or ISO
- Database drivers for your specific (enterprise) geodatabase in both 64bit and 32bit if you have your data in a geodatabase.
- The ArcGIS for Desktop software DVD or ISO (not necessarily installed on the same system, but for my upgrade it was)
- License for the ArcGIS for Server 10.1
- License for either a standalone Desktop or a License Manager file (if you use floating licenses)

Backing up and de-installation

Esri didn't provide an upgrade system for the existing software and services on your ArcGIS Server. Therefore, you will need to backup all your existing MXD files and also copy the configuration files of your services. You can find the latter in your install folder for Esri applications: \server 10.0\server\user\cfg\. The configuration files contain the necessary information about the settings you made for pooling, processes, capabilities and recycle times. You will need the names of these service files and open these .cfg files with a text editor while creating the new 10.1 services. Eventually backup or move your mapservice cache folders. These can be imported later on (not tried here) with the Toolbox. But users are advised to recreate these caches. It will only cost you a little processor time.
After the careful backup of these very important files, the de-installation can start. You can use the Esri de-installer that is provided on the 10.1 DVD's for Desktop and Server. In general, that de-installer is faster than doing it via the Windows control panel and also checks that there is no remaining old software left. De-install both ArcGIS Desktop and ArcGIS Server. If you use the same server as the License Manager server, de-install that software too, but do it as the last of the three items.

Installation

The license manager is the first thing to upgrade. You would not want to have your users waiting to work with their Desktop clients for too long. The installation, the de-installation and installation and upgrading of the License manager took less than 15 minutes. Esri have made this process really easy. After the de-installation, the licenses remain on the system. So, after installing the new license manager you can just click the " Upgrade Now" button. The new licenses are there within a few minutes. How to start the installation of your ArcGIS for Server software; the

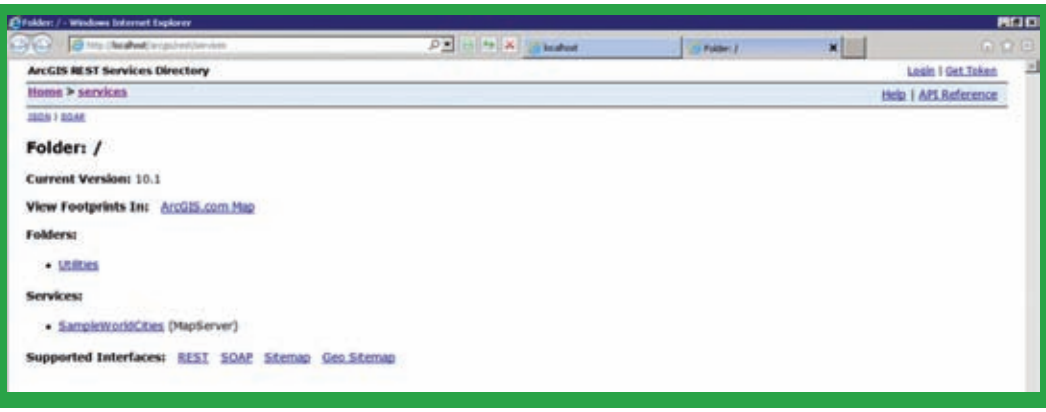

Figure 3: RESTService Directory Via Web Adaptor - When the Web Adaptor is properly installed, you can reach the REST service Endpoint of ArcGIS for Server using its default format http://<servername>/arcgis/rest/

installation is fairly easy and fast. Choose the components and location of the software. Then make or reuse a Windows account. For 10.1 you will only need one account. The default from Esri is a new account named " ArcGIS" . In this case, the existing ArcGISSOC account on my domain was reused. Why the SOC account? This account is an existing domain account, so the IT staff didn't have to be asked to make a new domain account, which made things easier. Adding to that, it already had the specific read and write access to the fileserver and folders with my geodata, so it took no extra time.

After this, the Desktop software was also installed, but that is fairly simple, since nothing has really changed since the previous version.

Configuration

Esri writes that this installation has no post-installation. In fact, it is now incorporated in setting up your ArcGIS Server site web manager. After the installation is finished, you start the web manager through the Windows Start Menu. You will be guided through a wizard. An account will be created for the Administrator of the ArcGIS for Server. This account is not Operating System related, but it will be the most important account for administering the server. So write the account name and password somewhere safe so that you or any future personnel can find it again. In addition, you will need to set the directories onto which ArcGIS for server will write all configuration, data and caches.

One thing that was immediately apparent was that this web manager is available on an address that ends with: 6080. This is the default installation port for the new internal server that ArcGIS for server uses. Announce to your IT staff that you will use this port for HTTP and be aware that some firewalls can block it by default. Esri delivers some adaptors to install on your default HTTP Webserver (most likely on default port 80). In this case, the Web Adaptor for IIS was installed. Ensure that you eventually remove the old folders of ArcGIS in the www-root before installing the Adaptor. It may conflict. After installing the Web Adaptor you have to link it to your installation. You will need the previously made administrative account for the web manager. The Web Adaptor does not necessarily have to be on the same host system. In this case, it was installed on the separate server where my web applications were also installed. The resulting web addresses will look like the following: ArcGIS for Server http://server1:6080/arcgis/rest and Web Application Server: http://server2/arcgis/rest/ and http://server2/webapplications.

Recreating Services

Now comes the repetitive part. If you had a lot of MapServices and other services on your old installation, you will need to invest a good deal of time to recreate these. If you have web applications depending on these services, you must be very precise when naming and placing these in the correct folders again.

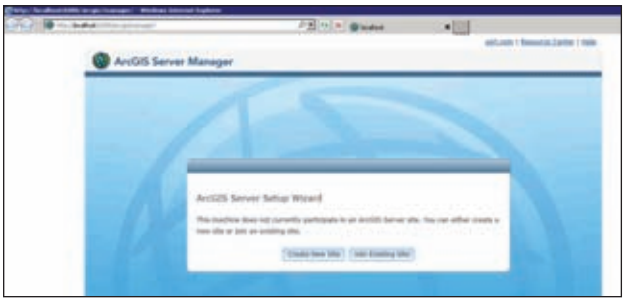

Figure 4: Webmanager Setup - After installing the ArcGIS for Server there is no post-installation wizard. Instead, you have to complete a web-wizard for the webmanager. When installing a new single server, you must choose to create a new Site. When having multiple ArcGIS for Server machines you can join an existing Site.

The first thing to do is to make new spatial connections to your database. It is important to note that the Desktop still runs 32 bit, so for Direct Connections you need a 32bit driver. The Server, however, runs 64bit, so that will need a 64bit driver. This can cause a lot of headaches if you are not aware of this. After creating the connection you need to register that connection with the ArcGIS for Server. This step is new, but ensures that the database can connect to the database with your geodata. It is likely to fail if you have a driver problem. This registering process has to be repeated for every data source you have: geodatabases and geodata folder locations.

Now pick up your backed-up MXD files and copy them to a folder you will maintain as MXD folder for services. In ArcCatalog point to these files and open them in ArcMap. Restore any lost connection for layers if needed. The publishing toolbar you are used to from 9.3.1 and 10.0 is gone. From now on, you will use the function " Share As Service" in the File menu of ArcMap. Slightly above this is also the " Analyze" button.

The Share As Service wizard is completely new. In short, to ensure the exact requirements for your data, mxd and settings in the new ArcGIS 10.1, the best way to proceed is this: choose your capabilities and press the analyze button on top of the wizard. You will see immediately some high priority errors in the ArcMap screen below the wizard, depending directly on the chosen capabilities. This is exactly why Esri wants you to recreate all the services. The requirements are stricter and you will also see if the data source is registered properly with the ArcGIS for Server. One extra requirement is the " Summary" , " Tags" and " Description" . Esri marks these as low severity warnings, but in some cases they are required before going to the next step. You can add them on the Map document properties or during publishing on the service.

Since we are upgrading, we will need to have the exact names of the services and folders we used in the old installation, so the existing web applications can pick up the services immediately. Refer to your " configuration file" backup for this. Eventually you will need to open the old .cfg files to see the specific settings and capabilities for your services to set them in the new publishing wizard.

The " share as service" will generate Service Definition (.SD) files. These files are new compared to the old MXD/MSD system. The SD files can contain an 'all in one' package. This means that the wizard will copy all settings (MXD/MSD), data and, if applicable, geo-processing into this file. This will become handy when you have a separate ArcGIS for Server with no administrative connection from the computer you are working on. In this case, there was an administrative connection, so all SD files were without data and directly copied to the server folders.

Tip: If you have lost your MXD file for a certain mapservice you can recover it from the .SD file. Use a ZIP/UNZIP program to open the SD file (it is just a zip file) and browse for the MXD. You will find it in one of the subfolders. You can also find the .MSD file. For those of you who are curious, yes indeed, this is also a zip-file, but with an xml configuration in it. In older ArcGIS versions this looks like the old .AXL files.

Experiences

While busy creating services, some positive differences for the mapservices were noticed almost immediately. All the problems related with IIS are gone. For example, REST cache (no refresh needed after change to mapservices) and" sleeping" services (now a fast response when first time opening a service via REST). Esri mentioned a lot more improvements to performance. As the installation used for this article was the one in production (apart from all the development and pre-release installations), there wasn't enough time to test all of the 'improvements'. I suspect these upgrades will be apparent after longer usage. In fact, I'm certain a lot more improvements will come to light when using the system for longer.

Another important thing to note is the REST service based manager. Every action you can do in the webmanager or from ArcCatalog to your ArcGIS for Server can now be scripted. This greatly enhances the administrative part. Examples of this are: stopping and starting services from script to update or backup geodata during nighttimes, checking the services and restarting if needed, reading log files and changing user permissions, etcetera.

Conclusion

The installation part of the upgrading process is not the hardest. In fact, with single server architecture, it is simpler than ever before. Seeing the plans and installation parts of a multi-server environment, this should also be a lot easier than before.

If you have a lot of (map)services on your 10.0 or older server, you will most likely need to recreate the vast majority of them and invest several hours republishing your services. You will, however, be rewarded with a better performing server afterwards.

There are also some changes for web applications. The REST interface of ArcGIS for Server has changed. Most functions are still the same, but some have more options and there are a lot more functions. Our own product GeoWeb 4.0, was 99% compatible without changing the code. We have enhanced the product now to be fully compatible and to ensure we get the best experience out of the new ArcGIS for Server.

Gerben Tiemens, Consultant at Grontmij Netherlands B.V.

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Mark Reichardt, President and CEO Open Geospatial Consortium (OGC)

COLUMN

New OGC standard supports "GeoSynchronization"

Limited bandwidth? Uncertain connectivity? Diversity of data sources? Sharing data is still possible.

In many situations, distributors of data need to repeatedly collect data from multiple data producers, validate the data, and make it available to others. Having many local practitioners provide data that gets rolled up into a regional database is a good way to make lots of current and detailed data available to many users from one centralized source; however, validating and synchronizing the data layers across distributed systems presents a challenge. This is a particularly significant challenge in emergency and disaster management and defense and intelligence applications.

The problems mount when the scenario involves frequent updates at random times from lightweight clients operated by people with limited training in geospatial data collection. This is yet more difficult when those client devices are only intermittently connected to the Internet, or when physical media are the only option. This can occur when data is being crowdsourced by Volunteer Geographic Information providers after the occurrence of a disaster.

What's needed is a GeoSynchronization service, deployed by a data provider, that enables data collectors to submit new data or make modifications to existing features. This must be done in an efficient manner, without directly affecting the features in the provider's data store(s) until validation has been applied, thus ensuring that the data published by the provider is of high quality.

A prototype standard interface for GeoSynchronization services and a related approach to bulk data transfer were developed during the OGC's Canadian Geospatial Data Infrastructure (CGDI) Interoperability Pilot (CGDI-IP) project in 2007. The CGDI-IP project was developed by GeoConnections Canada in the OGC's Interoperability Program to test the feasibility of using open, standards-based technology to improve the management and dissemination of geospatial data across Canada, from local to national level government organizations. The CGDI pilot demonstrated that multiple vendors' services implementing the OGC Web Feature Service (WFS) Interface Standard could interoperate to provide access to the most current and authoritative data, thereby maintaining currency, avoiding unnecessary versioning and minimizing duplication of the data.

The initial concept was further enhanced during the OGC Web Service Phase 5 (OWS-5) project, which involved the Ministries of Natural Resources Québec and Transport Québec and US Army Geospatial Center (AGC). The GeoSynchronization work continued last year in OWS-8 and this year in OWS-9. All the projects have tested and extended the concepts of a federated GeoSynchronization and Bulk Data Transfer system.
The OGC GeoSynchronization 1.0 Standards Working Group is working to produce an implementation standard based on the work that has been done.

An OGC Best Practice document describes the steps in setting up a federated GeoSynchronization and Geospatial Bulk Data Transfer (GBT) system.
The steps are basically:

1. Initialization of a target WFS implementation with the desired feature types, over a network or via physical media.

2. Conversion of data to an open standards based Geodata Bulk Transfer format or GBT. The data (both spatial and non-spatial) for each feature type is encoded using GML, and the metadata, if available, is encoded using ISO19115. All these files are packed into a zip archive that also includes a manifest of what feature types are contained in the GBT file.

The candidate OGC Best Practice describes how to use the OGC's open interface and encoding standards to implement services that mediate interaction between geospatial data providers, the content repositories, and the external entities acting as data collectors. Such services support data entry with validation, notification of changes to interested parties and replication of the data content submitted to multiple repositories.

Geosynchronization and Bulk Data Transfer are two significant standards-based capabilities that will aid in data collection, updates and maintenance in environments with no access to a network or limited access. More often than not, in disaster and emergency response worldwide, limited network access is a major obstacle.

One outgrowth of the GeoSynchronization work is a GeoPackage standard that is being proposed to the OGC membership by the US Army Geospatial Center. GeoPackage is a format for geospatial data (vectors, tiles and full rasters) that is suitable for use in offline scenarios.

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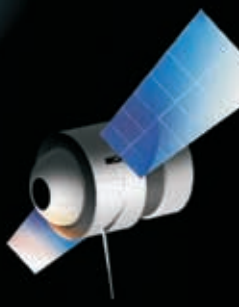

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Exchanging Information, Ideas and Inspiration

EuroGeographics Newsletter

Ingrid Vanden Berghe, General Administrator of the National Geographic Institute, Belgium was re-elected President of EuroGeographics at its recent General Assembly. The event was hosted by the National Land Survey of Finland which recently marked its 200th anniversary. The meeting was attended by 140 Chief Executives and geo-information experts from more than 40 countries, and included keynote speeches from Esko Aho, Executive Vice President of Nokia and Professor Paul Cheung, United Nations Director of Statistics.

By the editors

Delegates heard how their data is being used by customers such as the European Environment Agency and Eurostat, and learnt more about EuroGeographics' close work with EuroSDR. The Association also welcomed the Italian Military Geographic Institute as a full Member and elected Tomas Petek, Surveying and Mapping Authority of the Republic of Slovenia; Elita Baklāne-Ansberga, The State Land Service, Latvia to join Ingrid Vanden Berghe, General Administrator, National Geographic Institute, Belgium on the EuroGeographics Management Board.

Opportunities to exchange information, ideas and inspiration with like-minded professionals are a major benefit of EuroGeographics' membership and the annual General Assembly is a key part of this. Hosted each year by a different member, it enables delegates to review the previous 12 months. In addition they can renew and form new friendships, and hear about current and future trends from a wide range of experts, including those who rely on the geo-information provided by Eurogeographics' members, the European National Mapping, Cadastral and Land Registry Authorities.

This year we were welcomed to Helsinki by Arvo Kokkonen, Director General, National Land Survey Finland and by Risto Artjoki, Secretary of State, Ministry of Agriculture and Forestry, Finland. Discussions focused on EuroGeographics' role in connecting people to the definitive geo-information framework for Europe, the European Location Framework (E.L.F). This will link data to a common, maintained location framework of definitive, reliable public sector reference data and is at the heart of the Association's commitment to further the development of the European Spatial Data Infrastructure (SDI) and will achieve interoperability of members' national land and geographic information assets. Key to this is the integration and unification of dense national Global Navigation Satellite System network solutions and the availability of reliable cadastre and mapping data.

EuroGeographics General Assembly Helsinki 2012

The business of location

The importance of accessible, accurate location-based data was the central theme of Esko Aho's presentation which also reflected on the challenges of creating integrated cross-border data sets. As Executive Vice President of Nokia, Mr Aho has first-hand experience of integrating location-based data from local sources to create successful global business solutions that meet customer needs. EuroGeographics faces similar challenges in creating its pan-European products and services and his insights generated much debate among delegates.

We were also delighted to welcome Professor Paul Cheung, United Nations Director of Statistics who told members why their support and contributions are crucial to the United Nations Global Geospatial Information Management initiative (UN-GGIM). He underlined the role of the UN-GGIM Expert Committee. As a result of this initiative, the UN has drawn political attention to its Member States' authoritative, reliable and maintained geospatial information.

EuroGeographics has been involved in meetings and consultations which culminated in the first World Forum on UN-GGIM. The 2nd meeting of the UN Committee of Experts on Global Geospatial Information Management, which I attended, was held in New York last August. On behalf of our members, I presented the written report of the state of SDI in Europe. With the help of the Co-Chair of the UN Committee of Experts on Global Geospatial Information Management, Dr Vanessa Lawrence CB, we discussed future reporting arrangements with the European Commission (Eurostat) to ensure that the activities on geographic information management in (geographic) Europe are coordinated and well reported to the UN.

The first UN-GGIM committee of experts decided it would be helpful to document the future direction of the geospatial information industry with the vision of having a shared global view of geospatial management. The paper, presented to members by Dr Lawrence, is one of the first main deliverables of UN-GGIM and will be finalised in early 2013. As EuroGeographics is currently working on its future strategy, it provides extremely useful input to our deliberations.

For more information about EuroGeographics and the work of its members, please visit www.eurogeographics.org. Alternatively, you can contact me by emailing president@eurogeographics.org.

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www.chcnav.com

Gary Gale is Director of Places for the Location & Commerce group of Nokia. He is co-founder of the WhereCamp EU unconference, the chair of the W3G conference and sits on the UK's AGI Council. In his spare time he writes WordPress plugins themed around maps and contributes to the Mapstraction JavaScript mapping API. You can find him online at www.garygale.com, he blogs at www.vicchi.org, mainly on maps and location and Tweets too much as @vicchi.

COLUMN

Big Data vs. My Data

We all produce a staggering amount of data. Whether it's Facebook or Twitter status updates, Instagram or Flickr photos or Foursquare checkins, this data is both immensely personal and is often geotagged. But what happens when a service you've used dies or gets acquired? What happens when you want your data back? Maybe your data isn't really yours at all.

Today's geo-social networks are finite. They get born, if they're lucky they grow and then at some time or other they ... stop. If it's a social network you don't use then it doesn't really bother you much. But if it's a network you've shared a lot of content through, what happens then? A lot of people, myself included, immediately think I want my data back.

But is it your data? Of course it is. You made it. You composed that Tweet. You took that photo. You were at that place you checked-in at. Of course it's your data and it's your online history as Aaron Cope of the Smithsonian points out; anything you do for any significant amount of time, no matter how dumb or trivial it seems at first, becomes a part of your history.

But there's a point to be made here. You may have created that data, you may own that data, but the copy of that data in that social network is just that. It's a copy. It's not necessarily your data and because most of us don't preserve what we send on its way to our social networks. You may have created it, but the copy in the cloud isn't necessarily yours.

It's an easy mistake to make. Most of us aren't lawyers but we think we're educated enough in matters legal to look at the terms of service of a social network. We see phrases like you retain your rights, you own the content and you always own your information and immediately the subtleties and complexities of ownership, licensing, copyright and intellectual property are cast aside. We say to ourselves, it's my data, I own it, I want it.

And it's this belief that we really are lawyers in our spare time that us think that somehow the data we've shared via a social network is physically ours, rather than a bit for bit perfect copy that we've licensed to that social network. We forget for a moment that we're using that social network as a cloud backup, in some cases the only backup, of our creations. We mutter darkly about holding our data hostage.

The blunt, and often harsh reality, is the age old adage that you get what you pay for. If you pay, you're probably a customer. If you're using something for free then you're probably, unknowingly or unwittingly, the product. It's our content that the social networks monetize and that allows them to keep their servers and disk storage up and running.

So it's not my data, it's a copy of my data. But I created the original, it's important to me, so can I get a copy of it back? Sort of. Facebook will give me back all my data since I enabled Timeline on my account, which is some but not all my data. Twitter will only give me back a theoretical maximum of 3,200 Tweets, not the 14,000 I have created and only through writing some code via their API. Foursquare, Flickr and Instagram fare slightly better; I can get everything I've created but I still need to write code and use their API.

If we can't get all of our data back, then maybe we should make a backup of it before it goes into the Cloud? Thd notion of personal digital archiving has been slowly growing in recent years. You can now freely download code to do this for you. Projects such as Aaron Cope's parallel-flickr, parallelo-gram and private-square can maintain archives of Flickr, Instagram and Foursquare for you and synch them with their social networks in the sky. Preserving your Tweet-stream is still problematic and for now, sticking your account's feed into an RSS reader is the next best thing.

Your online history may not be that important in the grand scheme of things, but it's your online history, it's personal, you made it. When social networks go the place where software goes to die, you might just want to preserve that personal history before the servers get powered off forever.

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November

05-07 November **Trimble Dimensions International User Conference**
The Mirage Hotel, Las Vegas, NV, U.S.A.
Internet: www.trimbledimensions.com

06-07 November **MapInfo Professional Advanced Level Training Course**
CDR Group, Hope, Derbyshire, U.K.
E-mail: sales@cdrgroup.co.uk
Internet: www.cdrgroup.co.uk/train_mi3info.htm

08-09 November **GEO Huntsville**
Davidson Center for Space Exploration, Huntsville, AL, U.S.A.
E-mail: info@geohuntsville.com
Internet: www.geohuntsville.com/conference

08-10 November **CAMUSS, the International Symposium on Cellular Automata Modeling for Urban and Spatial Systems**
Oporto, Portugal
Internet: www.camuss.dec.uc.pt

06-09 November **20th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems**
Redondo Beach, CA, U.S.A.
Internet: http://acmgis2012.cs.umd.edu

12-14 November **SPAR Europe Conference on End-to-End 3D**
World Forum, The Hague, The Netherlands
Internet: www.SPARPointGroup.com/Europe

12-16 November **6th URISA Caribbean GIS Conference**
Montego Bay, Jamaica
E-mail: wnelson@urisa.org
Internet: www.urisa.org/conferences/caribbean/info

13-14 November **Be Inspired - Thought Leadership in Infrastructure Event**
Hotel Krasnapolsky, Amsterdam, The Netherlands
Internet: www.bentley.com/nl-NL/Community/BE+Awards

20-21 November **MapInfo Professional Foundation Level Training Course**
CDR Group, Hope, Derbyshire, U.K.
E-mail: sales@cdrgroup.co.uk
Internet: www.cdrgroup.co.uk/train_mi2info.htm

22-23 November **ICA symposium Service-Oriented Mapping (SOMAP) 2012**
Vienna, Austria
Internet: http://somap.cartography.at

20-22 November **spatial@gov Conference and Exhibition 2012**
National Convention Centre Canberra, Canberra, Australia
E-mail: spatial@cebit.com.au
Internet: www.cebit.com.au/spatial

26-29 November **8th FIG Regional Conference**
Montevideo, Uruguay
Internet: www.fig.net/uruguay

27-30 November **Pacific Islands GIS&RS User Conference**
Holiday Inn, Suva, Fiji Islands
Internet: http://picgisrs.appspot.com

30 November-05 December **LiDAR Intensive Programme**
University of Salzburg, Salzburg, Austria
E-mail: lidar2012@edu-zgis.net
Internet: www.zgis.at/IntensiveProgrammes

December

03-05 December **European Space Solutions 'Discover what space brings to your life'**
Central Hall Westminster, London, U.K.
Internet: www.space-solutions.eu

04-05 December **European LiDAR Mapping Forum 2012**
Salzburg, Austria
Internet: www.lidarmap.org/ELMF

10-14 December **FIG Commission 3 Workshop 'Spatial Information, Informal Development, Property and Housing'**
Athens, Greece
E-mail: sagi.dalyot@ikg.uni-hannover.de
Internet: http://bit.ly/FIG3_Athens2012

11-12 December **MapInfo Professional Foundation Level Training Course**
CDR Group, Hope, Derbyshire, U.K.
E-mail: sales@cdrgroup.co.uk
Internet: www.cdrgroup.co.uk/train_mi2info.htm

13-16 December **Gi4DM 2012**
UT, Enschede, The Netherlands
E-mail: info@gi4dm.net
Internet: www.gi4dm.net/2012

2013

2013 Unmanned **Aerial Vehicles in Geomatics (UAV-g)**
Rostock, Germany
Internet: www.uav-g.org

21-23 January **Defence Geospatial Intelligence (DGI) 2013**
London, U.K.
E-mail: dgi@wbr.co.uk
Internet: www.wbresearch.com/dgieurope/home.aspx

24-25 January **GeoDesign Summit**
Esri, Redlands, CA, U.S.A.
Internet: www.geodesignsummit.com

06-08 February **CEGeoIC Conference 2013**
Bogota, Colombia
Internet: http://CEGeoIC.net

11-13 February **International LiDAR Mapping Forum 2013**
Denver, CO, U.S.A.
Internet: www.lidarmap.org/ILMF.aspx

07-08 March **EUROGI Conference 2013**
Dublin, Ireland
Internet: www.eurogi.org/conference-2013.html

24-28 March **ASPRS 2013 Annual Conference**
Baltimore Marriott Waterfront Hotel, Baltimore, MD, U.S.A.
Internet: www.asprs.org

21-23 April Joint Urban Remote Sensing Event (JURSE 2013)
Sao Paulo, Brazil
Internet: www.inpe.br/jurse2013

13-16 May **Geospatial World Forum**
Beurs/ World Trade Center, Rotterdam, The Netherlands
E-mail: info@geospatialworldforum.org
Internet: www.geospatialworldforum.org

29-31 May **UDMS 2013, 29TH Urban Data Management Symposium**
University College London, London, U.K.
E-mail: info@udms.net
Internet: www.udms.net

03-06 June **Hexagon 2013 (ERDAS, Intergraph, Leica, Metrology)**
Las Vegas, NV, U.S.A.
Internet: http://2012.hexagonconference.com

16-22 June **13th International Multidisciplinary Scientific GeoConference & EXPO SGEM2013**
Albena Resort & SPA, Bulgaria
E-mail: sgem@sgem.org
Internet: www.sgem.org

18-20 June **MundoGEO#Connect LatinAmerica 2013**
São Paulo, Brasil
Internet: http://mundogeoconnect.com

25-27 June **RIEGL International Airborne, Mobile, Terrestrial, and Industrial User Conference 2013**
Marriott, Vienna, Austria
E-mail: userconference2013@rieglusa.com
Internet: www.riegl.com

25-30 August **26th International Cartographic Conference**
Dresden, Germany
E-mail: manfred.buchroithner@tu-dresden.de
Internet: www.icc2013.org

17-22 September **FOSS4G 2013 Conference**
East Midlands Conference Centre, Nottingham, U.K.
Internet: http://foss4g4uk.posterous.com

29-31 October **ASPRS/ CaGIS 2013 Falll Conference**
Crowne Plaza San Antonio Riverwalk, San Antonio, TX, U.S.A.
Internet: www.asprs.org

2014

23-27 March **ASPRS 2014 Annual Conference**
Galt House Hotel, Louisville, KY, U.S.A.
Internet: www.asprs.org

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