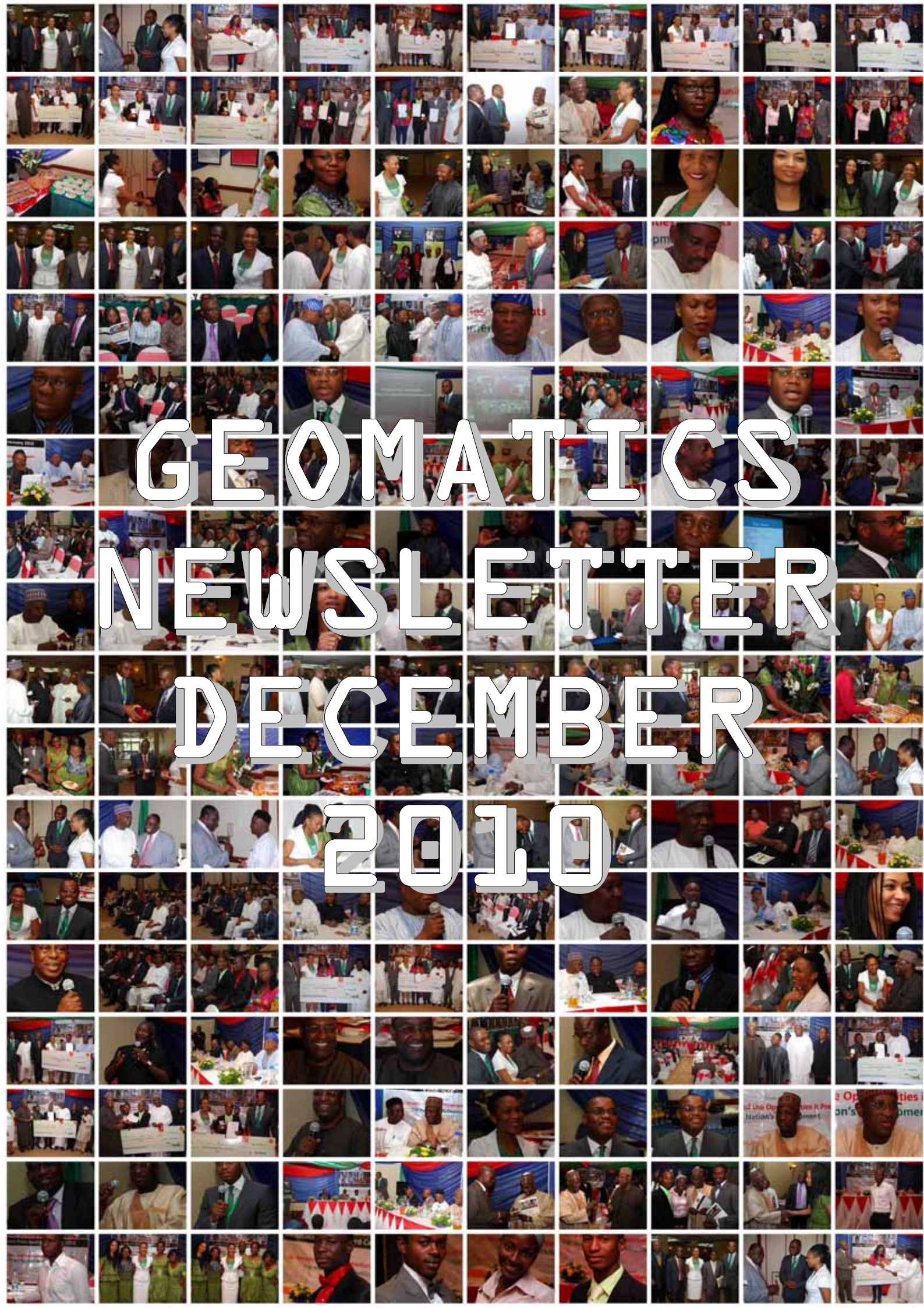

GEOMATICS NEWSLETTER DECEMBER 2010

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GEOQINETIQ GEOMATICS PRIZE GOLD MEDAL

The GEOQINETIQ GEOMATICS PRIZE GOLD MEDAL was held successfully at the Ladi Kwali Conference Centre, Abuja Sheraton Hotel & Towers, Abuja on the 25th November 2010. The occasion was held under the theme "Geomatics and the Opportunities it presents for our Nation's Development" and was graced by the august presence of the Chairman of the Occasion - **Hon. Justice S.M.A Belgore** GCON – *Retired Chief Justice of the Federation*. The Special Guest of Honour was **Alhaji Mahmud Yayale Ahmed** CFR – *Secretary to the Government of the Federation*, who was very ably represented by the *Senior Special assistant to the Secretary to the Government of the Federation* – **Dr. Shettima Abba**.

Two Guest Speakers presented papers at the event, namely: **Dr. Seidu Oneilo Mohammed** – *Director-General, National Space Research and Development Agency (NASRDA)* and **Dr. Chukwudozie Ezibalike** – *Data Management Coordinator, United Nations Economic Commission for Africa (UNECA), Addis Ababa, Ethiopia.*

Many eminent personalities and special guests from the world of Geomatics & Geoinformation graced the event, including: *Hon. Permanent Secretary, Office of the Head of Service of the Federation* - **Professor Nicholas Agiobi Damachi** FAS, OON; *The Hon. Surveyor-General of the Federation* - **Surv. Austin Pius Njepuome** (fnis); *Chairman of the Surveyors' Council of Nigeria (SURCON)* - **Surv. Clement Nwabichie** (fnis); *Special Adviser to the Governor of Lagos State on Digital Mapping* – **Surv. M.A. Durowoju**; *Immediate Past Executive Secretary, National Board for Technical Education* – **Engr. Dr. Nuru Yakubu** OON; *President, Nigerian Institution of Surveyors (NIS)* - **Surv. (Chief) Yakubu Maikano** (fnis) ably represented by *the Deputy President, Nigerian Institution of Surveyors (NIS)* - **Surv. Bode Adeaga** (fnis); *Honourable Member, Presidential Committee on Land Reform* - **Surv. Mohammed N. Yahaya** (fnis); *Distinguished Member, Geoqinetiq Geomatics Prize Gold Medal Expert Panel of Judges* – **Prof. C.U. Ezeigbo;** *Distinguished Member, Geoqinetiq Geomatics Prize Gold Medal Expert Panel of Judges* – **Prof. P.C. Nwilo**; *Immediate Past President, Nigerian Institution of Surveyors (NIS)* - **Surv. (Dr.) Olusola Atilola** (fnis); **Barrister Tony Odiadi** – *GeoQinetiq Senior Legal Counsel & Member, Vision 20:2020 Committee of the Federal Republic*;

GEOQINETIQ GEOMATICS PRIZE GOLD MEDAL PRIZE WINNERS

- **1st Prize Winner – GOLD MEDAL, GEOQINETIQ GEOMATICS PRIZE CERTIFICATE & N300,000 cash.**
  Name: Obarafo O. Emmanuel
  School: Ahmadu Bello University, Zaria
  Department: Geomatics Engineering
  Project Topic: *SHUTTLE RADAR TOPOGRAPHY MISSION (SRTM) ELEVATION DATA; A CONTEMPORARY GLOBAL ELEVATION MODEL. HOW WELL DOES IT DESCRIBE THE TOPOGRAPHY IN ZARIA AND ITS ENVIRONS?*

- **2nd Prize Winner – GEOQINETIQ GEOMATICS SILVER PRIZE CERTIFICATE & N100,000 cash.**
  Name: Maikudi Emmanuel Zakari
  School: Kaduna Polytechnic, Kaduna
  Department: Topographic Science
  Project Topic: *REMOTE SENSING AND GIS TECHNIQUES FOR MONITORING LAND USE AND LAND COVER CHANGES IN KADUNA METROPOLIS*

- **3rd Prize winner – GEOQINETIQ GEOMATICS BRONZE PRIZE CERTIFICATE & N75,000 cash.**
  Name: Ajoke Fatima Akintola
  School: Ahmadu Bello University, Zaria
  Department: Geomatics Engineering
  Project Topic: *INTEGRATING GIS AND GPS FOR THE TEMPORAL SPATIAL ANALYSIS OF THE HEALTH EFFECT OF GSM MAST IN NIGERIA: A CASE STUDY OF SAMARU, ZARIA*.

Distinguished Member, Geoqinetiq Geomatics Prize Gold Medal Expert Panel of Judges - **Professor Francis Afolabi Fajemirokun** (fnis) was unavoidable absent on other academic duties in the United States of America, but contributed immensely from there to the success of the Award, for which the Board offers him our heartfelt gratitude.

About the Prize

In November 2009, GeoQinetiq invited students in higher education institutions across the country to participate in the GeoQinetiq Geomatics Prize 2010 for the most outstanding projects in Geomatics for the preceding year (1st October 2009 to 30th September 2010). We are pleased the Awards ceremony was so successful, after a most interesting year spent trying to convince students and other stakeholders that the Prize was definitely going to be awarded, and that it was worth their while spending all the weeks and months of difficult exertions to plan, execute, document and present their various interesting, intriguing, innovative and industrious projects.

The main purpose of establishing this prize is to promote, stimulate and sustain interest in deeper understanding of the theories and practice of Geomatics in institutions of higher learning in the Federal Republic of Nigeria, as well as build awareness of the role of Geomatics in national development among the general public. Even more importantly, we expect that the prestige of the GeoQinetiq Geomatics Gold Medal and Prize will, over the comings years, draw even more talented students into the field which will in turn lead to an appreciable improvement in the standards of the practice of the sciences of Geomatics. Furthermore, the GeoQinetiq Geomatics Gold Medal and Prize will expand and deepen the understanding of senior decision-makers, both in Government and Industry, of the potential of Geomatics techniques and their application to national development.

This year marks the first award of the GeoQinetiq Geomatics Gold Medal and Prize, but already, the Board has commissioned ten Gold Medals to ensure that students and the Nigerian public are not in any doubt about the longevity and sustainability of the prize for the future. In the coming years, the Prize will no doubt attract additional sponsors from within and outside Nigeria to enable us increase the value of the award to include full scholarships for further study at the best Universities and Polytechnics around the world. The GeoQinetiq Geomatics Gold Medal and Prize board believes that this contribution to Nigeria's technological development could be a template for other prizes for other fields in the technical sciences. For us, we are committed to ensuring that the GeoQinetiq Geomatics Gold Medal and Prize will remain not just a pioneering conferment, but also an enduring Award, which will define and quicken the pace of the indigenous industrial development of Nigeria we all so desire.

LEICA'S CORS SOLUTION FOR BULGARIA

On November 23rd in Sofia, Leica SmartNet Bulgaria was launched in partnership with IPOS (owners of Bulipos), who will operate the control center and Metrisys (Leica Geosystems distributor), who will take charge of the full commercial service, including user support and subscriptions.

The agreement forms a new three-way partnership bringing the technical expertise from IPOS to operate the network infrastructure, together with Metrisys, who will manage all the commercial services, support and subscriptions. Leica Geosystems have provided the latest GNSS network software technology, in the form of Leica GNSS Spider, SpiderWeb, and SpiderQC, together with additional Leica GR10 reference station receivers and Leica AR10 antennas to densify the network, with the very latest GNSS receiver technology.

"We are very proud to announce Leica SmartNet Bulgaria, with our partners IPOS and Metrisys. GNSS users in Bulgaria can now take full advantage of the most advanced 24/7 GNSS Network RTK solution in Bulgaria. The network will offer every flavour of real time corrections, together with additional web services. No matter which type of network rover or GNSS application, we will provide the optimal corrections and subscriptions that the user desires, backed up with full local user support from Metrisys" says Mark Burbidge – SmartNet EMEA Project Manager, Leica Geosystems. Full national coverage with extra redundancy will be available from the end of December 2010, including data from EUPOS sites in neighboring countries. RTK Users can test the benefits of using the most innovative and advanced network in Bulgaria for free until January 2011. Flexible subscriptions will then be available for all types of applications and connection times.

Web services powered by Leica SpiderWeb, SpiderQC and Leica Geo Office, will include Network QC graphs, RINEX downloads and a computation service. Users can also update their profiles or order new subscriptions on-line, via the SmartNet Business Center.

For further information please visit the new SmartNet Bulgaria website. http://www.smartnet.bg

ABOUT LEICA SMARTNET

Leica SmartNet, the integrated 24/7 GNSS Network RTK service, uses the latest network software and hardware innovations from Leica Geosystems. With easy access to precise c rrection data, Network RTK users can experience best reliability and traceability using industry standards, with flexible subscription options that meet the needs of the local market.

With a broad range of real time and web products, Leica SmartNet has become the de facto standard for GNSS network services. Many professionals benefit from using Leica SmartNet to efficiently complete their daily tasks including Surveying, Engineering, Construction, Agriculture, Machine Control, Utility Surveys, Archaeology, Monitoring, Police Accident Investigation, and much more.

GeoQinetiq technical manager – Yebosoko Alao commenting on this successful rollout said that this type of public-private partnership could be a viable way to achieve the required densification of CORS networks in African countries, combining deep contractor expertise based on long-standing relationships with leading manufacturers with high-quality public service delivery obligations

SAFEGUARDING THE EVOLVING WEST AFRICAN SATELLITE SOLUTION

by, Martin Jarrold, Chief of International Program Development, GVF

Approximately one year ago, in an article entitled *Evolving New Satellite Connections for West Africa*, I wrote of West Africa's command of center-stage position in the rapid development of the African continent's telecoms arena. I pointed out that this had largely resulted from unprecedented levels of private sector demand for satellite-based voice, data and video solutions. I am pleased to be able to report one year later that the trend continues. This is the reason why the GVF will be further expanding its activities in the region during the fourth quarter of 2007.

The **3rd Annual West Africa Satellite Communications Summit (WASCS3)** has been confirmed for November 20th and 21st of this year and will take place at The Protea Hotel Oakwood Park in Lagos, the commercial capital and heart of Nigeria. WASCS3 will again be jointly organized by GVF and UK-EMP. The focus will be on the latest developments in the evolutionary deployment of satellite broadband networking to serve the leading commercial and enterprise verticals of the region. A surge of new satellite capacity has stimulated market growth on the continent. This is particularly due to the successful launch of the Nigerian owned and operated **NigComSat-1** geostationary satellite in May 2007, as well as in anticipation of the results of the recent acceleration of the RASCOM satellite program. The West Africa region is increasingly at the focus of state-of-the-art satellite-based communications, with broadband satellite services assuming an even stronger leading role in the regional socio-economic development agenda.

As the West African private sector continues to seize upon the strategic ICT efficiencies afforded by satellite-based solutions, and while the public sector has been moving to facilitate service providers' efforts through market liberalization and regulatory advances, such leading regional verticals as the oil and gas industry, the banking sector, and enterprise & distribution, will be given particular focus at WASCS3.

Taking the example of just one of these important regional verticals, and recognizing the fact that the oil & gas industry grows ever more reliant on satellite delivered ICT applications, the WASCS3 program will include a range of themed discussion on such exploration & production sector ICT imperatives as:

- Broadband Satellite: Enhancing Oil & Gas Sector Vertical Communications
- Enabling the Digital Oilfield
- Planning & Implementing Roadmap Operation Support Centers
- OSC for Drilling Operations
- Collaborative Visualization Environments
- Remote Collaboration Solutions
- Global Connectivity – Reliability for Operations Support
- Wireless Connectivity Solutions – Real World Implementation

The original commissioning of the NigComSat-1 spacecraft to service the now rapidly accelerating requirement for cost-effective connectivity within the West Africa region and the continent, as well as between Africa and Europe. Such reflects a universal recognition that access to information and knowledge through affordable communications represents a significant opportunity for social and economic development, for regional cooperation and integration, and for increasing the participation of people in the emerging global information society. Across all regions of Africa, the imperative of overcoming the barriers to, and fixing the manifold current deficiencies in, the means of access to low-cost communication services is top of the agenda. This is true for both improving the quality of life in African countries and for significantly enhancing the mission-critical, productivity capabilities of a range of African vertical markets – including, though by no means exclusively, oil and gas.

There's always a however…

Now, just as these evolutionary trends are combining to create a communications marketplace that brings satellite-based solutions even more into their own, a new and potentially damaging development has arisen – parts of the radio communications spectrum that are an essential resource in continuing to challenge Africa's digital divide, and provide its key verticals with imperative communications solutions, are under threat. All around the world, the 'standard' (3.7

to 4.2 GHz) and 'extended' (3.4 to 3.7 GHz) C-band frequencies have been identified for use by new terrestrial broadband wireless services, as well as for the deployment of next generation terrestrial mobile.

Satellite systems that operate in these frequency ranges are suffering substantial interference, sometimes to the point of system failure. This is occurring in places where national administrations are allowing Broadband Wireless Access systems such as Wi-Fi and Wi-Max to share the same spectrum bands already being used to provide satellite services. The same scenario will happen if 3G and the planned 4G mobile systems (also referred to as IMT systems) are allowed to use the frequencies used in the C-band for satellite downlink services.

Antennas, which receive satellite downlink signals in the C-band, are, by necessity, extremely sensitive devices. They are designed to receive a low-power signal emitted by small transmitters located in orbit 36,000 km above the equator. In the C-band, satellite services have co-existed with domestic microwave links and radar for many years. This is because the latter systems operate via tightly focused beams from fixed points, and de-confliction can take place when necessary.

By contrast, terrestrial wireless applications are, by definition, ubiquitous and increasingly mobile/nomadic. Mobile and base stations for terrestrial wireless applications emit simultaneous signals from many locations, in all directions. They are powerful enough to saturate the sensitive C-band satellite receiving systems, causing a potential for total loss of service. Government administrations across the African continent are in a powerful position to counter this development. They can also guarantee continued access to a multitude of satellite-based applications, the key to the continued economic advance of millions of people.

It is critical for Africa, as well as elsewhere, that governments and spectrum management authorities recognize the very real damage caused, and tremendous threat posed, to satellite services by use of the Standard C and Extended C-bands for terrestrial wireless systems. Now, in the build-up to the World Radiocommunication Conference (WRC-07) in Geneva, the satellite industry is keenly focused on influencing the opinion and positions of the governments of Africa, and elsewhere. Such will determine the future viability of satellite C-band. GVF will be in Geneva, and with many other organizations, will be lobbying the member nations of the ITU not to re-allocate C-band, thus maintaining it for essential and existing services.

Similarly, the peoples of West Africa and the African continent should right now be actively lobbying their national administrations to support the "No Change" position on C-band frequency allocation. The future of a further developing and viable communications infrastructure, based on satellite all the way across the continent, is at stake.

Martin Jarrold joined the GVF in June lf 2001 and was appointed to the position of Chief of International Programme Development. Prior to joining the GVF, Mr. Jarrold was Commissioning Editor and Head of Research for Space Business International magazine.

EUR 4.4 MILLION NEEDED FOR MAPPING UGANDA

About 4.4 million euros (sh14b) is needed for a comprehensive mapping of Uganda over the next three years. According to Alex Lwakuba, commissioner for crop production and marketing in the agriculture ministry, mapping of the whole country is a very expensive venture which requires substantial amounts of money.

"But if we use the existing information in the reconnaissance report of 1958/60 and modern technology, the exercise could be done in six months at 1.2 million euros (sh3.8b)," said Lwakuba. The commissioner was commenting on the USD 7m (sh1.6b) which was proposed to cover the National Physical Development Plan formulation during a day-long workshop on the National Land Use Policy and National Physical Development Plan implementation in Kampala, Uganda. Lwakuba regretted that Uganda's land use and land cover information is outdated and does not capture all combinations of current land use that characterise the country. He said mapping the country would help in dividing it into viable agricultural production zones for export. Participants noted that the three–year period beginning 2011, proposed for the preparation of the national physical development plan was too long.

The state minister for urban development, Urban Tibamanya, cautioned Ugandans against politicising and undermining the process of making a national land use plan. "Regardless of your political affiliation, let us join hands to give Uganda a nationally acceptable land use plan." Tibamanya called for a participatory process so that the final plan is owned by all Ugandans.

ASSESSMENT OF RURAL EMPLOYMENT IN INDIA USING GIS

The Indian government is considering using GIS to monitor a rural employment act. According to Minister for Rural Development Pradeep Jain, there is a proposal to use GIS under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). In this regard, Ministry of Rural Development has set up an expert group to prepare a strategy for nationwide rollout and to evolve parameters for standardisation with an objective to link GIS with grass root participatory planning and asset management and monitoring.

The minister said use of GIS will strengthen decentralised participatory planning, implementation, capturing and monitoring of assets and evaluation of the works under MGNREGA and also this move will help the Ministry to bring in greater transparency and accountability in the implementation of the Scheme as real time data would be available.
Source:

THE REAL VALUE OF A MAP IS IN BEING REAL-TIME

IN AN EXCLUSIVE INTERVIEW, OLA ROLLÉN SHARES HIS VISION ON FUTURE TRENDS OF GEOSPATIAL INDUSTRY AND HEXAGON'S ROADMAP FOR MARKET DEVELOPMENT AND HARNESSING ITS POTENTIAL

Hexagon is originally a scientific instrumentation company with expertise in metrology and engineering. How did it all begin?

Hexagon started as a 3D measurement company and not really as a scientific instrumentation company. When we started expanding our 3D measurement capabilities, we started off our operations in metrology and engineering. We then tossed around with ideas on what all we could do with the sophisticated 3D software capabilities we had.

We looked at this from two different perspectives - CAD world and GIS world. Looking at the CAD world, for instance in the case of design of a car, it has many components and while designing using sophisticated CAD capabilities, those components form the basis for the final product and from CAD processes we generate certain commands on how to manufacture these products. Those commands will be the basis for programming drilling machines, turning machines and other processes and from these operations, we generate several components. Hexagon has traditionally been at this stage of the industrial world to check these components and create Direct CAD Interface (DCIs) to reference the actual component against the original CAD drawing. This is the step wherein one could determine the quality of the components and accordingly decide on the next steps.
The next step is assembly process at an industrial site wherein Hexagon is heavily involved in guiding and monitoring robots and reducing cost and increasing productivity by analysing CAD files against the real world objects.

What motivated Hexagon to enter the geospatial market?
Having said that the analysis and relationship of CAD drawing with the real world is very unique to the core business of Hexagon, we realised that this is not happening in the field of civil engineering, housing and infrastructure. A few obvious questions that arose in our minds were - why don't we use these processes and methodology of DCIs to increase productivity and quality while building a large plant, bridge or motorway? Why don't we take the learning from industrial world wherein these methodologies and processes have been successfully used for more than 100 years?

Against this background, our interest in GIS and geodetic applications stems from the desire of using knowledge which could measure components and complexity of building houses and infrastructure. Building a small, traditional house may not require such a high level of measurement and processes, but today we have a variety of businesses like plant and production management wherein these measurement tools could be effectively used. These businesses have complex products and therein lies the possibility to measure their components and put them together to

create a final product. For instance, a nuclear power plant has a fairly complex set of operations and processes. Their components can be measured through CAD capabilities and further complemented by scanning technology that can capture each and every object and convert them in 3D models. That's where the combination of Intergraph and Leica Geosystems' capabilities with the existing capabilities and experiences of Hexagon makes valuable sense. In such an instance, content measurement capabilities of Hexagon are strengthened by scanning technology of Leica Geosystems and CAD/ GIS capabilities of Intergraph. In a nutshell, Hexagon still has measurement technology at its core while the acquisition of Leica Geosystems and Intergraph has strengthened its position in scanning and GIS technologies.

Having entered in geospatial market with acquisition of Leica Geosystems, Hexagon has kept on marching with its journey with many more acquisitions. But the latest acquisition of Intergraph has been the largest not only for Hexagon, but also for the core geospatial industry. What has been the rationale for the same and how does it fit into your agenda?

Having derived the value of scanning, sensors and camera capabilities to capture each and every object of business and processes, which made for an appropriate combination and extension of Hexagon's offerings of measurement tools, there still was an important missing link in the whole process, namely GIS and CAD capabilities. So the rationale is clearly visible and that is to provide the entire measurement cycle and deliver realtime information to our customers about their business and associated activities. I believe GIS is all about maps and that it is now a public commodity. There are several companies like ESRI, Google, Intergraph and Microsoft providing GIS tools and maps. But the real value of a map is in being real-time which can actually convert a map into an activity rather than just being a static map. It requires much quicker capabilities to capture the ongoing activities and update the same in a map in realtime. For customers in the business of defence, security, infrastructure and transportation, real-time information is very critical. And that's where real-time information of an activity being captured by scanners, sensors and aerial cameras could be analysed and represented by using GIS tools. So this offers a combination and synergy between the capabilities of Intergraph and Leica Geosystems. Against this background, GIS is an important component of our business. Not necessarily as standalone GIS, but as a part of the system.

What are the key business drivers for Hexagon?

The changing pattern of global economy is the major driving force for Hexagon’s business. In the past 100 years, about 90 percent of the global economy was concentrated in Europe, North America, with significant presence and purchasing power of middle class being the main engine of the economy. But in the past 10 years, Western societies lost their balance. The emergence of stronger middle class in countries like China, India and Brazil is primarily due to the fact that the cost of a middle class resource in these countries is 1/5th of that in Western economies and that determines business policies to invest in building their capabilities in emerging markets. Another significant change that is taking place is the emergence of labour arbitrage that will squeeze the western middle classes for purchasing power even more. Eventually things in the global economy will get back to equilibrium and we will see the emergence of a strong global middle class with greater purchasing power.

What has been driving this is the price and productivity comparison between, for example, engineers from emerging markets with respect to that from Western countries. Given the low prices, companies are inclined to provide salary incentives on a regular basis which motivates them to deliver better. If you look at the growth of income in the US, the top 1 percent of people grew 74 percent in the past few years while 99 percent grew about 30 percent which is equivalent to the inflation, which essentially means they had no growth. Similar situations emerged in the employment scenario wherein millions of people lost their jobs and in order to control this situation, government provided stimulation and created 10 million new jobs. But then these jobs were created in health, education, government and social sector and about 6.6 million jobs were lost in manufacturing and engineering, making them lose a competitive edge.

Typically in an economic recession causing unemployment, the government steps in with stimulus packages and invests in building infrastructure and public utilities and in the process provides employment to its citizens. But what changed in the recent economic recession is that though the government provided stimulus packages to companies, jobs were created overseas to remain competitive and profitable, resulting in a situation where unemployment continues to be a challenge.

Against this backdrop, Hexagon remains focussed on constant innovation and continues its investments in emerging markets of Asia (especially China and India) and South America. China will continue to be our top priority. Hexagon has 20 percent of its revenues from China which reduced to 15 percent with the acquisition of Intergraph but we will quickly rebound to 20 percent and are targeting at getting 30 percent of our business from China in the next five years. India shall be our second largest market in Asia and in next five years, we expect Asia to form over 50 percent of Hexagon's business revenues. This situation will likely motivate us to shift our headquarters to Asia.

Broadly speaking, we will continue to provide leadership to business opportunities in North America and Europe, but our major growth will be driven out of Asia and South America. At present, we have about 38 percent revenues being generated outside Europe and America, which is likely to grow to 60 percent in the next five years. We think that China's growth path has increased demand for nickel, copper, oil, coal and minerals. Countries like Brazil, Indonesia, Mexico, Venezuela, Kazakhstan, Chile and Middle East will benefit from this growing demand and to take advantage of the same, these countries will need to invest in cadastre, infrastructure and utilities. Interestingly, the case of India is quite different. India's growth is fuelled by developments within the country. It is more driven by the purchasing power of middle class within the country and it will be an interesting market for Hexagon. At present, India contributes 3 percent to Hexagon's business which is equal to our revenues from entire South America. Industry-wise business drivers for Hexagon are agriculture and food; infrastructure; mineral resources; utilities; power; constructions; security; and urbanisation.

It is estimated that population will grow to nearly 10 billion in the next 30 years which means greater demand for food in general. On top of this, the burgeoning middle class with better purchasing power will demand better quality of food, creating extra demand for agriculture and food processing industries. Hexagon looks at this as an opportunity to invest heavily in precision

farming and develop solutions to improve productivity. We need to be more intelligent with agriculture production. For instance, measurement companies like Leica and Trimble do provide steering equipments for tractors in the field. Leica also has airborne sensors, but there is no connection. With Intergraph's capability, we can fly over a field and colour-reference it using GIS and present it to an agronomist for improved decision making while providing an analysis on what is going on in the field. Based on standards set about 100 years ago, we normally leave 45 cm gap between seeds. The same can now be reduced to 30 cm with an application of GIS and measurement tools, leading to dense agriculture plantation requiring less water and fertiliser and yielding higher productivity. It's all about addressing deficiencies and enhancing productivity by interfacing the real world and the model world and information exchange back and forth.

Should we believe that the acquisition of Intergraph is the end of 'acquisition-journey' of Hexagon or is it just another important milestone in the ongoing process?

Acquisition is a process for Hexagon. Today, we are big enough to fund our own development, but one would wonder if that is so clever especially when advanced technologies are already available in the market. We have Erdas in our GIS portfolio but it has its own limitations and constraints. We could have gone ahead with developing and designing our own strong GIS, but we decided to acquire one of the two strong GIS technologies available in the market to save on time and begin integrating our solutions.

Though we initially made an attempt to develop more GIS components in Erdas, we soon realised that we don't need just GIS but GIS in combination with an activity. This is where Intergraph steps in, with far more sophisticated tools than ESRI as Intergraph has added computer-aided dispatch and records management tools to its portfolio. Intergraph fits into our future vision which goes beyond traditional GIS.Today, we have many consumer solution providers in GIS market like Google and Microsoft but we decided to focus on the professional market which needs more than just maps and images.

How do you propose to integrate various offerings of Intergraph and Leica Geosystems especially when there are a few competing product lines?

Integration will be done over a period of time and we will choose one or two industries to begin with. As we select the industries, we will build a team sourced from different businesses and they will form a new unit to integrate the new technologies.

Though there are a few overlapping areas of competing product lines, on a closer look we found quite complementary characteristics. Erdas is quite strong in image processing whereas Intergraph is leading in photogrammetry. Let us take the example of airborne sensors. Leica wanted to develop mid-frame camera and Intergraph has very good midframe capabilities. Similarly, Intergraph wanted to develop large-frame camera and Leica Geosystems has the same already in its existing portfolio. So we will continue to develop both these technologies to suit the requirements of our customers in each segment. We also understand that people are in love with different workflows of Intergraph and Leica and wish to stay there but I think we may combine these two in future and develop next generation technologies. Another possibility is to re-organise our business to be more

industry driven and our future technology developments could be driven out of these markets.

Let's take the case of agriculture. Future will require very high resolution, small and light weight cameras so that they can be used by UAVs which consume less energy. With Hexagon's current capabilities, we expect UAVs to become a major tool for geospatial applications. We have GNSS capabilities of Novatel for designing navigation models for UAVs; aerial borne sensors of Leica/Intergraph will help develop light weight high resolution cameras, while the image processing capabilities of Erdas and geospatial capabilities of Intergraph will provide us almost real-time information of geospatial activity.

Intergraph's addition to Hexagon Group seems to have augured a new order for the geospatial industry and is perceived to have left not many choices for large geospatial companies. Do you foresee a polarisation of geospatial industry?

I think we see it as a process of consolidation of geospatial industry. First, it is very important for us to keep open standards so that, for example, companies like Trimble and ESRI are able to connect with our sensors and software. I see Intergraph and Hexagon as a solution to move away from 'Frankenstein' type solutions wherein we borrow different systems from different suppliers which are difficult to fit together in one body. With such comprehensive offerings from Hexagon, customers may get more productive systems without having to worry about communication protocols and interface standards among different components of their geospatial system and workflows. Having said that, one should never lock anyone out of the business by shutting down communication and that's where open standards and interoperability shall be the key for the industry. At the end of the day, users will be the real winners.

A general perception is that Intergraph has not been progressing well in the last ten years as compared to its position a decade back. So, was it the right time to buy and that too at such a price?

First of all, it is not correct to say that Intergraph's progress has slowed down in the past one decade. This is more of a perception of traditional geospatial community and Intergraph has been moving away from traditional to modern geospatial business opportunities. Today, Intergraph is less of a competitor to ESRI which is focussed on traditional GIS market. With regard to timing, this was the right time but it is also true that there is not just one right time. We looked at Intergraph and Leica Geosystems at the same time in 2004. We could have combined the capabilities of the two with some other company, but it's all about timing and cost of the combination. Intergraph was available for sale in 2004 at much lower price but at the same time with much lower profits.

What would be different at Intergraph under your leadership?

Hexagon will bring in more aggressive investment and re-investment to keep customer satisfaction and belief in Intergraph intact. Process, Power and Marine (PPM) business of Intergraph has grown significantly in the last few years but I do agree that GeoMedia has not advanced as much as it should have. There is definitely an opportunity for Hexagon to turn it around. It is a great product and with capital investments of Hexagon, I am quite confident of bringing it to the required levels and Erdas will provide a great support and help in this endeavour.

Shall we presume that Erdas will get integrated with Intergraph?

Yes, we can presume that Erdas will become a part of Intergraph as it makes more sense to be integrated with Intergraph and at the same time Zeiss/Intergraph (ZI) will become a part of Leica Geosystems. There will be an exchange of technology between the two groups.

How do you intend to implement this integration and break longlived legacies of individual companies under one umbrella?

We have adequate experience in bringing in such integration. I have been involved with acquisitions and integrations since 2001. I work from London with a purpose to connect myself better with our facilities around the world. We will have four major strategic centers i.e. Heerbrugg, Hyderabad, Huntsville and Qingdao and all these locations are well connected from London. We will bring people from different centres to a common place and create common technology platforms to achieve large business objectives. Moreover, London is a neutral location away from Hexagon's major facilities and it helps to keep away biases of operations while making decisions. What we need is people with right and open attitude and clever mind to achieve the laid down business objectives.

What will be the unique value proposition for end users?

The future of technology lies not only in accurate sensors, but also in enhancing productivity of people working with the technology and helping them deliver better end products. In this case, the end product is CAD and GIS that supports civil engineering structures. We need to take that view and rationalise value and cost. Common improvement will be productivity for everyone and it will always depend on specific industry segment we are talking about.

Acquisition of Intergraph, for sure, puts Hexagon well ahead of other geospatial companies, making it the leader of the geospatial market. Such a position also puts extraordinary pressure to not just maintain the leadership position, but also to invest in market development and provide direction to the industry. What specific plans do you have to address this situation?

Hexagon is one of the leaders of the geospatial industry and we understand our responsibility well. In the short term, we have the obligation to provide a more competitive GeoMedia for traditional and loyal users who relied on it for decades. In the long term, I think it is even more important to provide a path to the GIS user to remain competitive against the large movements led by Google

and Microsoft as they begin to encroach upon the professional GIS space. I think that's where Hexagon could provide a more stable solution to professional GIS community to further their profession.

MOBILE MAPPING TO RESOLVE PROPERTY CLAIMS IN KOSOVO

Two key agencies of the Republic of Kosovo, the Kosovo Property Agency (KPA) and the Kosovo Cadastre Agency (KCA) are mapping property boundaries to help resolve private property claims. While the KPA is specialised in solving property and juridical conflicts, the KCA on the other hand needs to collect GIS attributes associated with meter-accuracy positions for the local cadastral offices. For this purpose, the agencies have purchased forty-nine Ashtech MobileMapper 6 GPS/GIS field terminals.

Following Serbian occupation, more than 20,000 property claims requiring legal confirmation have been filed by returning war refugees. The restoration of legal rights and physical possession of properties is an essential form of redress to promote more stable economic development and better conditions for Kosovo citizens.
The KPA is the main authority for properties in Kosovo and is mandated to receive, register and help resolve private property claims resulting from the armed conflict that occurred between February 1998 and June 1999. With offices in 30 townships in Kosovo, the KCA is the highest authority when it comes to surveying, cadastre and mapping.

Lorenco & Co, the Ashtech dealer headquartered in Triana, Albania, working with its partner, N.p.t Geokos in Pristina, sold, delivered and trained KPA and KSA personnel to use the MobileMapper 6 handheld receivers. According to a spokesperson for Lorenco & Co, the Ashtech units were selected by the Kosovo agencies for their easy-to-use mobile mapping software, integrated camera, excellent price to performance ratio, and Lorenco & Co's good on-site product-training support.

IMPLEMENTING A GIS-BASED CADASTRAL SYSTEM IN PAKISTAN

- **Zahir Ali**
- **Muhammad Adeel**

Abstract

The need for information, a basic necessity for carrying out any planning, development and management activity, can hardly be over-emphasised. In developing nations with inadequate resources, the need to have a reliable information base is even more important. The absence of proper land records in the real land market is another difficulty faced by many developing countries. The reasons may be unclear delimitation of individual or group rights, insecure ownership etc. Having a functioning land market opens the way not only for private development but also for public land acquisition and ensuring that land is available for dwelling and other urban needs. In this way the development and implementation of country-wide digital cadastral information system is an area that needs urgent attention. It is felt that there is a need to at least initiate efforts towards achieving this formidable task in an organised manner. These initial efforts would pave the way to achieve the desired goals in the years to come and would take us out of this status quo situation. With the above background, this paper highlights all the constraints and limitations in the process of integrating legal and geometric cadastral information to develop a new digital cadastral system.

Land information system (LIS) is a tool for legal, administrative, and economic decision making as well as an aid for planning and development. This involves, on the one hand, database containing spatially referenced land related data, and on the other hand, the procedures and techniques for systematic collection, updating, processing, and distribution of the data to the end users in an efficient manner. The base of an LIS is a uniform referencing system that could facilitate the linking of different types of data within the system and with other land related datasets.

The digital land cadastre maintains the official records pertaining to land parcels, their position, shape, size, land use and ownership. This forms the basis for property taxation that remains one of the main purposes of developing digital land cadastre. The information derived/retrieved from digital cadastral maps can serve the administration in many different ways, in addition to contributing to a comprehensive, equitable and efficient land tax system. It is however a common practice in many countries to establish databases concerning one department or organisation, without giving due consideration to the fact that some of the information/data might also be of interest to various other departments/sectors. If joint efforts are made to establish a multi-purpose cadastral database, involving all the potential departments/organisations, the system would be more efficient, productive and cost effective and there would be less duplication of efforts. This is particularly common in many Third World countries, where separate records are kept and maintained for different activities including tenure control, control of agriculture products and commodities, agricultural census, population census, social security, election, assessment and taxes, registration of deeds, etc. This results in a lot of duplications in creating and maintaining these records. Such problems can be avoided by developing a comprehensive digital cadastral database. Every department and sector involved can contribute its own specific information and be responsible for keeping the information up-to-date. If the information is open to other sectors, duplication of efforts could be radically diminished and administration could be made effective.

Without reliable registers, transaction in land is often costly, time consuming and uncertain. It is normally imperative to establish the fact that the reputed owner and trustee actually have the legal rights to deal with the property. Another difficulty being faced by many developing countries due the absence of the proper land records is the real land market. The reason may be unclear delimitation of individual or group rights, insecure ownership, etc. A cadastral database can remove such obstacles. The necessity for a functioning land market opens the way not only for private development but also for public land acquisition and ensuring that land is available for dwelling and other urban needs. The traditional/existing LIS in many developing countries is entirely based on maps and records on paper formats having no cartographic standards and quite outdated information. This restricts their operational efficacy in extracting precise information on land parcels, ownership and taxation as well as planning development activities.

1. Digital cadastral mapping - Scenario in Pakistan

Pakistan, with an area of about 804,000 sq km, has different administrative divisions. It includes four provinces, Khyber Pakhtunkhwa, Baluchistan, Punjab, and Sindh and federally administered tribal areas. Nearly 70% of the population lives in rural areas, where their livelihood mostly depends on agriculture. Access and rights to land in these areas is a significant issue. However, similar to many other developing countries, the cadastre and land registry systems are one of the weak sectors. Strengthening these systems is a basic necessity and a way of stimulating development process. Some of the more important features of these systems include better information base for planning and administration, better specification of rights in land, greater possibilities of finance development, easier implementation of policy measures and a better steering and control. For implementation of a digital cadastral database, a variety of factors can be taken into consideration as pre-requisites. These factors include data sources for different land-related information, the currently operating land information system and available spatial attribute data as well as the management structure involved in upkeep and maintenance of the land records etc.

1.1 Land information system in Pakistan

LIS in Pakistan is based on the traditional system of land registers and records that are somewhat complicated, outdated and quite incompatible with new developments. Besides being quite inefficient, this system of land information has many discrepancies that have created bottlenecks in the development process. The land registry system is under the control of provincial governments in Pakistan where no data standards are maintained by different provinces. For example, the size of 'marla,' one of the units of land parcel, is not uniform in all provinces. Measurement conventions of property/land parcels are also different in urban and rural areas. However, as far as basic data structure of cadastral and land registry is concerned, both the systems are interlinked and closely associated. The cadastral data includes division, district, tehsil/taluka, union council, mauza/goth/village/deh, patwar halqa, kanungo halqa, khasra/khewat number, land feature reference (reference with respect to left/right bank of canals in the area), size of land parcel and parcel identification (PID)/address. The land registry includes PID, land category (public/private), registration/mutation number, date of registration/mutation, lease number, area, encumbrance details, ownership, category (residential, commercial, agricultural, industrial, institutional, etc.), owner(s) name and address, land use etc.

The three types of records available are land parcel map, field book and record of ownership. The

land parcel map is the map of all the land parcels that exist in a particular village. This map shows the land ID called 'khasra' number with dimensions of each 'khasra.' The field book is another important data register, which is developed at the time of settlement of land. This information belongs to the land parcel and provides information about the dimensions of a land parcel; parcel ID ('khasra' number) as well as relation of the ID to the next record set. This record set also contains information about the type of land of that particular parcel of land. The record of ownership contains information on ownership as well as the historical record of ownership. Additionally, this record set also contains the record of the farmer who is ploughing the field.

The above-mentioned three record sets are quite compatible with each other as they are developed simultaneously. These records keep on changing with changes in ownership etc, and therefore, need to be updated from time to time. In Pakistan, these records are updated every four years. In the respective local administration, a 'patwari' (a government official) is responsible for keeping track of changes that takes place in these four years. As the 'patwari' is responsible for keeping these records, he updates the splitting and merging of parcels on a cloth map called 'lattha' which is reflection of land parcel map on a piece of cloth that is made of 'lattha.' A land parcel map of Halqa in Khyber Pakhtunkhwa province is shown in Figure 1. The change in ownership is updated in another book called 'Misal Miyadi.' The 'patwari' is also responsible for providing information about the type of crop growing in any particular parcel of land. This information is collected after every six months and is entered in 'Register Gardawari.'

1.2 Data sources

A variety of data sources dealing with different data types including topographic maps, land information, social and economic data, statistical records, satellite data/ aerial photographs and revenue records operate in the country with specific tasks. For example, Survey of Pakistan (SoP) is responsible for preparing, archiving, updating and maintaining all kinds of topographic maps at varying scales. The provincial, divisional, district and taluka boundaries are also available with SoP. The land and revenue records are maintained by the local administration of provincial departments. The federal and provincial statistical departments maintain records of statistical data pertaining to a variety of disciplines such as population, demographic information, housing, health, education, agriculture, forests, water resources, urban, rural areas, communication, public facilities, etc. The satellite data is acquired and archived by the country's national space agency, SUPARCO. The Geological Survey and Soil Survey departments are responsible for maps and records pertaining to their fields.

2. Implementing a GIS-based cadastral mapping

2.1 Feasibility study

The feasibility of establishing a countrywide cadastral GIS database stems from a thorough understanding and analysis of the needs and expected benefits/returns from such a database. Also, it involves a clear understanding of the problems being currently faced in the absence of such a system and its future repercussions. It is often observed that technology developers/vendors oversell the technologies, only highlighting its positive aspects without mentioning anything about its limitations or shortcomings. In such a situation, a user who is not quite well versed with these technologies finds it difficult to harness the real potential and/or scope of these technologies. A

deeper understanding of what GIS can or cannot accomplish is therefore critically important. An objective need analysis must be carried out in a systematic way by identifying the precise needs of the potential users. The need analysis enables determining the management approach, identifying the mapping and geographic information processing activities, inventory of mapping resources for both spatial as well as attribute data, evaluating the quality of data sources, examining the abilities of current staff members and determining if additional staffing is needed. It determines the training needs, identifies the form and content of data sharing among participants, determines the feasibility of GIS development, identifies and recommends steps for GIS development if such development is considered feasible.

Under specific situations, a more detailed analysis may be done, if needed. All the above information acquired in the process of analysing user demands may lead to planning of GIS, securing development funding, addressing the base map and hardware/software issues, determining components of the cadastral overlays, design the database, and integrating other relevant components. While gathering data and assessing users' requirements, it is always important to create a catalogue to add any new information that supports users' needs study. Based on the users' needs, the organisational capacity, manpower, GIS functionalities, data integration and database requirements may be worked out. When assessing users' requirements, many of the important questions can be answered by a thorough review of the existing LIS being used, including parcel maps, land registers etc. For example, the quantity as well as quality of the maps and their scales, the origin of the maps, geographic control, symbols, geographic entities, map updation etc. are all pertinent information that need to be gathered.

From users' perspective, the feasibility study should cover the actual needs, and therefore, the information should be sought from different levels of the users, right from the top policy makers to the functional management. All local codes, laws and policies that may have any bearing on the needs including the state codes, guidelines, and standards may be taken into consideration. The needs analysis should consider the time and funds required to train those involved in the project. Invariably, some training on GIS concepts and hardware/ software systems is needed. The level of training depends on the specific background, education and experience of each individual in the staff. In most cases, training will be required once a specific software package is selected. Training for specific applications and system management will also be required by the time the system is fully operational. An objective analysis of the precise requirements of both human resources and material is one of the most important components of feasibility study.

An experienced user can envision new and expanded applications of cadastral maps and related attribute data. It is therefore, important to identify the potential applications which the intended database can or will have to serve during the early stages of GIS planning and development to ensure that the system fulfils the requirements of all those applications.

2.2 Data inputs

One of the critical aspects in developing a GIS-based cadastral map database is evaluating the available inputs that are to be made part of the database from both technical as well as information point of view. As far as spatial data is concerned, in countries like Pakistan, the traditional maps available (a sample map shown in Figure 1) are quite old. These maps were made without any

reference grid and are usually based on some landmarks such as roads, rivers, canals, distributaries etc, wherever available. The physical condition of the maps is also not very good. Therefore, digitising such maps in their present form would not be quite feasible. However, these maps may serve as a good reference source in producing new maps, either based on high resolution satellite images from IKONOS or QuickBird, archives of old aerial photographs or through ground surveys. This would however depend upon the type of area to be mapped, the scale of the map as well as the requisite level of details. As far as information contents are concerned, it entirely depends upon the scope of the database, i.e. whether it is to serve the specific purpose of cadastral information or aimed at preparing a multi-purpose cadastral. Similar is the case for attribute information associated with each land parcel.

2.3 Database design

A database is collection of data that can be shared by different users. It is a group of records and files that are organised so that there is little or no redundancy. The database enables various methods of data access, storage of data independent of application, controls access to data, facilitates data modification and minimises data redundancy. The data consists of entities and attributes. The entity is a feature that exists and about which there is specific interest, whereas the data associated with it may consist of relationship attributes and other characteristics. The attribute is in fact a quality of an entity. The development of database usually follows a series of processes such as data analysis through which the types and quality of the data to be incorporated in the database is identified. A conceptual model of the data is built by making use of data modelling, taking into account all basic facts and constraints under which the database will have to operate, particularly the relationship between different entities and their attributes.

The content of the database plays an important role in the overall design of the system and depends upon the sources identified, users and desired applications of the database. Therefore, the size of a database is a function of its content - the more information needed, the larger the database. The database should be designed in such a manner that it takes care of future expansion and adaptability. The feature codes, symbols, and attribute definitions must be determined at the very early stage of the project. In database monitoring, the system is fine tuned and any addition and deletion is implemented. One of the important components of the entire database system is the database management system. This system is used to control the storage, retrieval and modification of the data, with file handling and file management being one of its functions. It protects the integrity of data and keeps a track of each time a system is used and provides recovery and backup procedures.

2.4 Data coding

The data layers in a cadastral database are organised according to the scope of the digital cadastral maps. For example, in a land information system in a rural area, besides land parcel identification no., the basic attribute information may include name of the owner, parcel dimension, type of crop (if agriculture), address including division, district, tehsil/taluka, union council, mauza/goth/ village/deh, patwar halqa, qanoon halqa, khasra/khewat number, land feature reference (reference with respect to left/right bank of canals in the in the area), land category (public/private) registration/ mutation number, date of registration/mutation, details, lease no., area, category (residential, commercial, agricultural, industrial, institutional, etc.), landuse etc. Table 1 highlights

some possible attributes of digital land cadastre.

Table 1: Some possible attributes of digital land cadastre

Parcel ID #	Owner name	Parcel Dimension	Type of crop	Address	Land feature Ref	Land category	Date of registry	Lease No.	Area category	Land use

The data coding can be done through data layers or data coverage, each containing different themes, such as administrative, land use, infrastructure, topography, forest, agriculture etc. The database dictionary can be organised according to coverage description, coverage name, feature class and theme. For example, the administrative theme contains political boundaries (coverage description), with 'Polybndry' or any other appropriate name as coverage name, polygon and arc as feature class. A unique naming convention can be set so as to avoid any overlapping among different coverage types within the database. The codes created should be made simple and representative of coverage types. For example, the code for water body may be WTR_BODY.

The coverage documentation is an important component of the database that contains a schema diagram as well as a table definition form. The schema diagram represents logical relationship between the feature attribute table (FAT) and corresponding data tables. The data table contains: the name of associated coverage; feature class such as polygon, arc, point; name of table, polygon attribute table (PAT) or arc attribute table (AAT); data source, the map or documents, where the attributes are stored. Variable is a common name used for variable (items) in the table.

2.5 Organisational requirements

The implementation of a GIS-based LIS may involve setting up of an institution or a body entrusted with defined tasks with all the necessary administrative powers to coordinate with different government functionaries and come up with a plan of action. This may involve a lot of structural changes in different organisations to be included in various activities in the designing GIS cadastral databases. While some new functions and responsibilities may be added, some of the traditional activities or functions would have to be abandoned or eliminated resulting in change or new responsibilities. In essence, change in procedures, responsibilities and the computing environment can have profound effects on the structure of an organisation.

Other important legal and organisational issues that may need to be addressed are:

- Devising suitable policies for easy access of all necessary datasets for preparation of digital cadastral maps.
- Establishing the role of private entities and formulating the necessary legislation for implementation.
- Involving government machinery at different levels and setting up their responsibilities in carrying out the set tasks on a regular basis.
- Devising policies for community participation in the implementation process, if required.
- Establishing a unique parcel identification system across the jurisdiction to ensure that land records are organised appropriately.
- Standardising the address conventions.
- Implementing the necessary changes in rules and regulations to pass on data among different levels of government and between departments.

- Empowering decision making at lower levels/functional management of the organisation.

The organisational restructuring would lead to establishment of various GIS/database development cells at each ministry and its associated departments, with clear definition of their goals, objectives and time frame for completing specific tasks as assigned by the main body of the frame work from time to time. Each of the GIS/ database development cell will maintain a quality control section, have people with more extensive trainings to generate the quality products conforming to the procedures and standards laid down for each task.

2.6 Human resource development

GIS requires some skills that go beyond traditional assessment and mapping skills. It is important to have people who are capable of performing systems analysis and design, databases management, network administration and computer operations. It may also be necessary to have staff that possesses skills and experience in cartography, drafting and even photo interpretation or image processing, depending on the applications planned for the system.

Embarking upon such an extensive country-wide cadastral mapping project would involve training of manpower at different levels, starting from top management including both technical and managerial, down to the working levels under a chain system. The main body of the framework would be responsible for planning and execution of each training, to be subsequently followed by refresher courses. The trainings may initially remain the responsibility of the main body of the organisational framework and later can be transferred or distributed at local level.

3. Challenges in setting up a cadastral database

The main purpose of the cadastral database is to keep record of all land parcels and their ownership, so as to form an accurate, transparent and efficient system for property taxation. The use of GIS technology offers a possibility to keep positional data in digital form and to connect them with a variety of attribute data to be used as and when needed. It includes spatial information and facilitates performing spatial analyses that provide new derivative information about the various parameters pertaining to different entities. The GIS technology has expanded to economic and social information systems that carry great potential in a host of discipline areas.

The main idea is to develop a system organised into different layers, with the same rules for each of them (the functional model is the same for all layers). The specific problems of a particular layer need further solutions. While GIS is no doubt a very flexible tool for handling land information and its management in a much efficient manner, this technology is confronted with a lot of challenges in operational utilisation, particularly in the developing nations. Of course, these challenges are not entirely related to technology; rather, there are a variety of other factors which are only relevant to local problems of the respective countries. As far as GIS technologies are concerned, these have been in operation in several countries, where all the data inputs are available and have already been converted to the requisite formats. Those countries have been drawing the benefits of this technology for the past several years. Some of the problems identified and the challenges being faced by the developing countries in operational implementation of these technologies include:

- Lack of awareness about the technology

- Absence of a framework for undertaking GIS implementation task
- A momentous task of converting traditional datasets (GIS inputs) to new forms
- Inadequate resources
- Inaccessibility to different data types
- Lack of trained manpower
- Non availability of requisite administrative structure
- Fixing of land parcel boundaries in the new system etc.

THE END -

JAPAN AIMS TO TAP EMERGING MARKETS WITH CHEAP SATELLITES

Tokyo, Japan: Japan is developing a low-cost surveillance satellite to aid disaster relief and other purposes as it looks to expand its reach into emerging markets, according to government and corporate officials. Even though the United States dominates the satellite market in terms of sales value, Japan's main competitor in emerging markets is European consortium EADS Astrium whose shareholders include French and Spanish governments as well as Germany's Daimler AG., they said.

Japan's trade ministry is collaborating with NEC Corp. and other companies to develop by 2012 a small satellite costing a fifth of current prices for conventional monitoring satellites, trade ministry official Shuichi Kato said. NEC will contribute technology it developed for the Hayabusa asteroid probe programme, whose success in being the first to collect asteroid particles during a seven-year odyssey has captured the imagination of Japan's public.

Kato said the satellite would be ready for launch in 2012 and sales would be aimed at emerging countries such as Egypt, Brazil, Indonesia and Thailand as well as Dubai and Kazakhstan. The government is also talking to Vietnam about providing the satellite as part of official development aid, he said. The ministry estimates that the satellite system would cost about 10 billion yen (120 million dollars), about one fifth of existing satellite systems developed by European and American groups, he said. NEC's spokesman Shinya Hashizume said the satellite alone would cost about 5 billion yen.

DIARY

Title: The Fifth Session of the International Conference Geotunis 2010
When: 29 November 2010 to 03 December 2010
Venue: Select Venue
Country: Tunisia
WebSite: www.geotunis.org

Title: Faro Pan-European User Meeting for Laser Scanner Customers
When: 09 December 2010 to
Venue: Amsterdam, The Netherlands
WebSite: http://www.faro.com/content.aspx?ct=uk&content=new
Description: Faro Pan-European User Meeting for Laser Scanner Customers9th December 2010, Amsterdam, The NetherlandsTime: 9:00 AM - 6:00PMFor query call: Oliver Bürkler, Senior Technical Product Manager Laser Scanning

Title: GIS & its applications to Science and Engineering
When: 13 December 2010 to 17 December 2011
Venue: Lonavla, India

Title: GeoDesign Summit
When: 06 January 2011 to 07 January 2011
Venue: Redlands, California
WebSite: http://www.geodesignsummit.com/index.html

Title: 5th Biennial Conference of the International Biogeography Society 2011
When: 07 January 2011 to 11 January 2011
Venue: Heraklion, Crete, Greece

Title: Geospatial World Forum 2011
When: 18 January 2011 to 21 January 2011
Venue: Hyderabad, India
WebSite: http://www.geospatialworldforum.org
Description: Theme: Dimensions and Directions of Geospatial Industry

Title: Defence Geospatial Intelligence
When: 24 January 2011 to 27 January 2011
Venue: QEII Centre, London
WebSite: http://www.DefenceGeospatial.com
Description: Defence Geospatial Intelligence (DGI) is Europe's largest and most international annual gathering dedicated to the high-level discussion of the importance and the major challenges of the use of geospatial technologies

Title: 11th International LiDAR Mapping Forum
When: 07 February 2011 to 09 February 2011
Venue: New Orleans, Louisiana
Country: US
WebSite: www.lidarmap.org

Title: International LiDAR Mapping Forum 2011
When: 07 February 2011 to 09 February 2011
Venue: New Orleans, USA
WebSite: http://www.lidarmap.org

Title: Analysing, mapping and evaluating spatio-temporal water scarcity problems
When: 07 February 2011 to 18 February 2011
Venue: TechnoZ, Schillerstr. 30, Gebäude 11, 3. Stock / 5
Country: Austria
WebSite: http://www.edu-zgis.net/ss/waterscarcity2011

Title: FlexiCadastre 2011 User Conference
When: 10 February 2011 to 11 February 2011
Venue: Cape Town, South Africa

Title: Joint urban remote sensing event
When: 11 April 2011 to 13 April 2011
Venue: Munich, Germany
WebSite: http://www.pf.bv.tum.de/jurse2011/

Title: 11th International Multidisciplinary Scientific Geo-Conference and Expo - SGEM 2011
When: 19 June 2011 to 25 June 2011
Venue: Albena, Bulgaria
WebSite: www.sgem.org

Title: The 2011 International Conference on Computational Science and its Applications (ICCSA 2011)
When: 20 June 2011 to 23 June 2011
Venue: University of Cantabria, Santander, Spain
WebSite: http://www.iccsa.org/

Title: Third Open Source GIS UK Conference - OSGIS 2011
When: 21 June 2011 to 22 June 2011
Venue: CGS, University of Nottingham, UK
WebSite: http://cgs.nottingham.ac.uk/~osgis11/os_home.html

Title: 25th International Cartographic Conference
When: 03 July 2011 to 08 July 2011
Venue: Palais de Congres, Paris
Country: France
WebSite: http://www.icc2011.fr/

Title: AOGS 2011 Geosciences World Community Exhibition
When: 08 August 2011 to 10 August 2011
Venue: Taipei International Convention Center, Taipei
WebSite: http://www.asiaoceania.org/

PTC'11 Connecting Life
January 16, 2011 to January 19, 2011
LOCATION: Hilton Hawaiian Village Beach Resort and Spa, Honolulu, HI, USA
CONTACT: andrew@ptc.org

February 28, 2011 to March 1, 2011
LOCATION: Marriott Prague, Prague, Czech Republic.
CONTACT: cdikecoglu@smi-online.co.uk

February 8, 2011 to February 10, 2011
LOCATION: Dubai International Convention and Exhibition Centre, UAE
CABSAT Team, Dubai World Trade Centre, P.O. Box 9292, Dubai, UAE
Email: cabsat@dwtc.com

CeBIT Hannover
March 1, 2011 to March 5, 2011
LOCATION: Hannover, Germany
CONTACT: www.messe.de

Satellite 2011
March 15, 2011 to March 17, 2011
LOCATION: Walter E. Washington Convention Center, Washington D.C.
CONTACT: http://www.satellitetoday.com/events/

Oil and Gas Telecommunications
March 23, 2011 to March 24, 2011
LOCATION: Marriott Hotel, Regents Park, London, UK
CONTACT: smyers@smi-online.co.uk

The NAB Show
April 9, 2011 to April 14, 2011
LOCATION: Las Vegas Convention Center, Las Vegas NV.
CONTACT: nab@nab.org

NSS - National Space Symposium
April 11, 2011 to April 14, 2011
LOCATION: Colorado Springs, CO at The Broadmoor Hotel
CONTACT: http://www.nationalspacesymposium.org

Global Space & Satellite Forum Forum (GSTF 2010)
May 9, 2011 to May 11, 2011
LOCATION: ADNEC, Abu Dhabi, UAE
CONTACT: http://www.gssforum.com/

SatCom 2011 Africa
May 30, 2011 to June 2, 2011
LOCATION: Sandton Convention Centre, Johannesburg, South Africa
CONTACT: tatum.willis@terrapinn.co.za

CommunicAsia / EnterpriseIT2011
June 21, 2011 to June 24, 2011
LOCATION: Marina Bay Sands, Singapore
CONTACT: Email: col@sesallworld.com

49th International Paris Air Show
June 21, 2011 to June 23, 2011
LOCATION: Salon International de l'Aéronautique et de l'Espace - Paris Le Bourget, FRANCE
CONTACT: Web: http://www.paris-air-show.com/en/

IBC 2011
September 8, 2011 to September 13, 2011
LOCATION: RAI, Amsterdam, THE NETHERLANDS
CONTACT: Email: marketing@ibc.org

SATCON 2011 - Conference & Expo

October 12, 2011 to October 13, 2011

LOCATION: Jacob K. Javits Convention Center, New York, NY, USA

CONTACT: Email: info@jdevents.com
Web: http://www.satconexpo.com/

SmartNet
powered by Leica Geosystems

Introducing SmartNet-UK, the first Leica Geosystems commercial Network RTK Correction service.

August 2006

SUMMARY

On 20th December 2005 at Ordnance Survey HQ, Leica Geosystems were pleased to announce that they are the first organisation to market and offer a commercial delivery of a GPS network solution across Great Britain, in partnership with the Ordnance Survey. This paper describes further the benefits of using the SmartNet correction service, with the latest RTCM 3.1 Network RTK messages. The reference station infrastructure is currently built on 96 stations, mainly from the Ordnance Survey reference station feed (OSNet), but supplemented with additional stations via Survey Association members, University's and Leica Geosystems UK. Nottingham University IESSG is also undertaking independent monitoring and integrity checking, to validate the "user experience".

The Network RTK process is based on state-of-the-art Leica GPS Spider software with the latest RTCM 3.1 Network RTK messages. These messages are based on the Master Auxiliary Concept – first published in 2001, jointly by Leica Geosystems and GEO++.

Leica GPS Spider software models and mitigates the distance-dependent biases for the entire SmartNet Network. Subsequently network correction messages can be formed and broadcast based on common integer ambiguity level for sub-networks of stations or clusters. The user will then be able to receive Network RTK corrections via mobile GSM or GPRS, for a multi-reference station solution consisting of the full correction and co-ordination information, of a dedicated master station and the correction differences of several local auxiliary stations.

Leica Geosystems UK strategy, is to also add further value to the network by introducing dual constellation GPS & Glonass receivers, as soon as possible, creating a full GNSS network ready solution for users, particularly in urban environments.

1.0 Single Reference (Base Station) v Network RTK

Real Time Kinematic surveying has been at the leading edge of surveying technology development since it's first inception in the mid 1990's. Significant developments have been made with RTK algorithms and the latest processing speeds, to bring us fast, reliable and accurate GPS solutions, for collecting and setting out spatial data. The limitation now for these solutions, is that with the single reference (base station) method, as the distance of the rover starts to exceed 30 kilometres, it becomes more difficult to rapidly resolve the carrier phase ambiguities. This is caused by the distance-dependent errors associated with the GPS measurement, such as ionospheric and tropospheric refraction and satellite orbit errors. However by using the reference station network technique, these errors can be mitigated and the GPS rover, when connected to the network control centre, can operate within the entire network (in our case anywhere within Great Britain) free of these distance-dependent constraints. This also means that with the latest technology developments from Leica Geosystems, the rover receivers have all the advantage of working with the modelled corrections of the entire network, together with a set of traceable multiple reference stations, in a subnet relevant to the user. So the whole solution of Network RTK becomes more robust, accurate and reliable than the standard RTK set up of obtaining corrections from a single reference station. Many other benefits exist with quality, productivity, availability and ultimately reduced costs when using a network solution, which are detailed later.

2.0 What is SmartNet?

SmartNet is basically a 24/7, accurate, reliable, robust, traceable and repeatable National GPS Network solution, based on a common datum, for the entire positioning community of Great Britain. Users of SmartNet can expect centimetre level Network RTK accuracies, through to sub-metre DGPS; or raw data for post processing.

SmartNet can be categorised into the following basic sub systems:

- Reference Station Infrastructure
- Control Centre
- Generation of Network Corrections
- Delivery of Corrections & Support
- Security & Backup
- Network QA/QC

The reference station infrastructure is built on a partnership with the Ordnance Survey. Known as OS Net, Ordnance Survey have their own internal RTK network, which is only available to internal staff. However, Ordnance Survey have made available the raw data from the OS Net reference station infrastructure to participating commercial partners, who are able to supply the necessary Network software, control centre, communications and expertise to deliver the service to end users in Great Britain. *Note: this is based on providing a national service and not just in small areas.* The most important part of any network is the reference station infrastructure. Ordnance Survey have put strong trust with Leica Geosystems for a number of years, to provide almost all of the receivers and antennas within their infrastructure, so there is a perfect synergy with the reference station network from Ordnance Survey and the Network processing Software from Leica Geosystems.

Figure 1:
Current Ordnance Survey Network of 90 Reference stations – June 06

Leica UK also intend to add further value to this network, offering a high density, high redundancy network, by adding 'Active' Leica reference stations in combination with TSA members. Leica UK are also deploying the latest GPS & Glonass reference stations receivers with choke ring antenna's into the network to create a full GNSS network system, and will operate 14 Quality Monitoring reference sites in combination with Nottingham University's Institute of Engineering Surveying & Space Geodesy.

2.2 SmartNet Control Centre

At the SmartNet control centre, Leica GPS Spider or more specifically SpiderNET, is employed as the software to handle and disseminate all the Network RTK corrections to the entire region of Great Britain. The software Architecture is based on a secured site of network servers, streaming raw data from reference stations and computing corrections to a proxy server or web server for dissemination to users by NTRIP GPRS, access router GSM or RINEX file Web downloads. Full security systems including multiple firewalls, full network redundancy and backup servers are also supported.

2.3 SpiderNet Clusters and Cells

A cluster is a sub-network of stations that are processed together to achieve a common ambiguity level. For small networks, the entire network may be contained in one cluster. For larger networks, such as SmartNet, where performance, redundancy and reliability is an issue, several clusters are used in the processing and distribution of data. Individual sites within the network may be in more than one cluster allowing overlap between clusters (see Figure 2). Each cluster in the network may or may not be on the same integer level.
A cell is a selection of sites from a cluster consisting of one master station and a number of auxiliary stations, which is used to generate master-auxiliary corrections (refer to Figure 3)

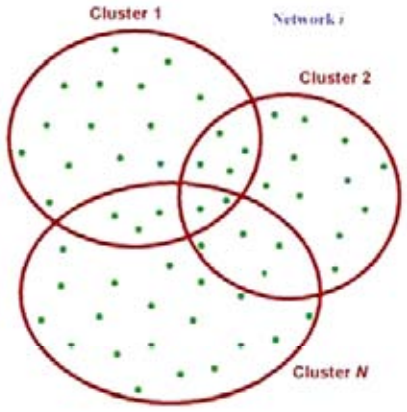

Figure 2:
A reference network comprising a number of clusters

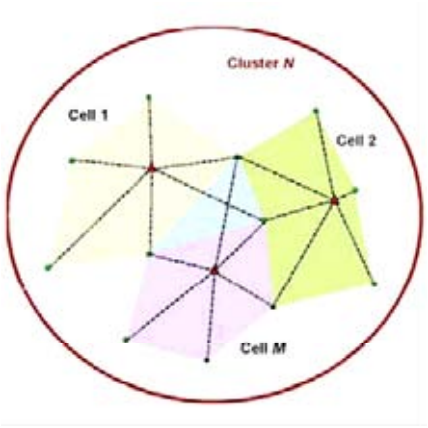

Figure 3:
A cluster providing master-auxiliary corrections to several rovers, with each rover using an appropriate cell based on its location.

Since Leica GPS Spider or SpiderNET processes all data together in a single filter, every site in the cluster is reduced to the same ambiguity level. For the user this means that there is no artificial and restrictive limit of three reference stations imposed as with other approaches, therefore easily allowing the optimum number of reference stations to be used in the determination of the network corrections for the rover. Using five or six reference stations for the network corrections can improve the network geometry for the rover and help to estimate

larger scale atmospheric effects. Also, by using more than three reference stations, the rover will not lose its fix if one reference station drops out of the solution as a result of unreliable communication links or other issues. The inherent flexibility of the Leica GPS Spider solution enables new modules to be added in the future, such as additional support for modernised GPS, Glonass and Galileo.

2.4 Network Auto cell creations

SpiderNet can also decide from the rover's location, which site or cell is best suited, using 2-way communications. For users they only need to connect to the network by automatically sending their navigated position via the NMEA GGA string, which is pre-configured in the rover sensor. SpiderNet will then return the corrections to the user with the optimum cell for their location.

How this works

- The Rover User connects to the SmartNet service and returns thier navigated position via NMEA GGA.
- SmartNet will collect all reference sites (reduced to a common ambiguty level) that are relevant for the users Geographic location.
- Reference sites are sorted for their 3D distance to the rover with the nearest site at the top.
- Typically the SpiderNET software will provide 6 stations as reference. Nearest site is given as the master station with full corrections and the next 5 sites are given as auxillary correction differences. (please refer to section 2.5)
- Corrections are delivered to the user via Nearest, MAX or iMAX products, in either RTCM 2.x, RTCM 3.x, Leica, CMR or CMR+ formats

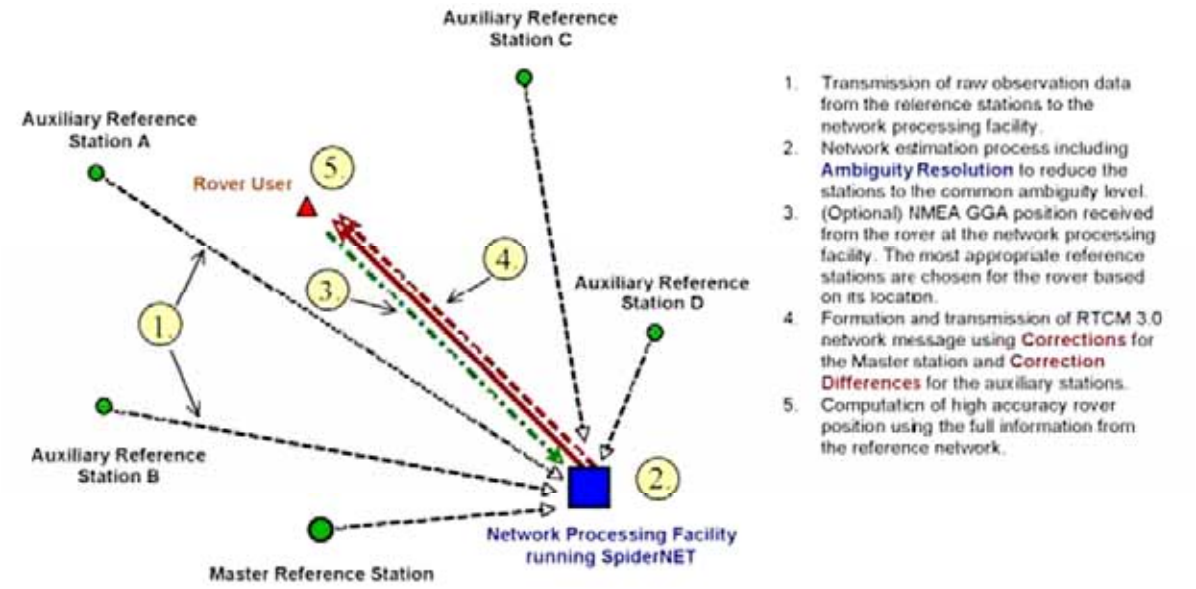

Figure 4:
Generation of master-auxiliary corrections (MAX) for a rover

Leica Geosystems has for many years been actively researching, promoting and realising Network RTK solutions and working towards an industry standard for network RTK corrections. It is in this role that Leica Geosystems, jointly with other RTCM members, has developed and driven the Master Auxiliary Concept (MAC), the future of networked RTK and the basis of the newly approved RTCM 3.1 network RTK messages. Up until now there have been no official internationally accepted standard for network RTK corrections.

On the recent May 2006 RTCM SC104 meeting the proposed new network RTK messages for RTCM V3 have been approved and decision was taken to release them with next update of RTCM in V3.1. The formal release is expected in the coming weeks and is subject to final editorial update of the RTCM V3.1 documentation.

The RTCM V3.1 network RTK messages provide an open, unambiguous and manufacturer independent standard for network RTK corrections. The new standard, in addition to promoting increased compatibility and innovation in the industry, offers some distinct advantages to the end user over the previous non-standardised methods for generation of network corrections.

Leica GPS Spider and thus SmartNet, does not restrict users of older receiver types. In order to provide access to the entire GPS community, corrections known as individualised Master-

Auxiliary Corrections are available, known as iMAX. These iMAX corrections require two-way communications and may be transmitted in RTCM 2.3 or RTCM 3.0 formats and provides the same performance as a rover that fully supports MAX.

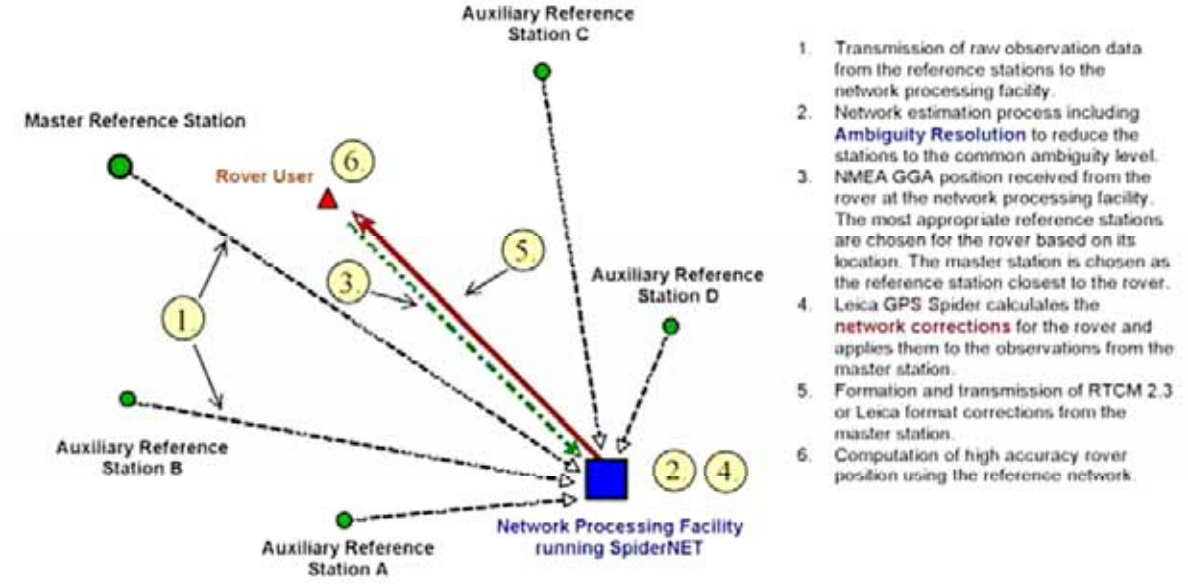

Figure 5:
Generation of individualized master-auxiliary corrections (i-MAX) for a rover.

With SmartNet's network corrections complete information on the prevailing errors sources is made available to the rover, thereby facilitating the use of more intelligent positioning algorithms by the rover. The net result is an increased robustness of the system and increased performance in terms of time to fix, reliability of the ambiguity fix and position accuracy

Leica SmartNet is already enabled with this technology and is able to bring to its users all the benefits of this leading edge technology, today.

2.6 Delivery of Corrections & Support

SmartNet will authenticate and administrate each client rover, via two main mediums of mobile phone sim cards.

- Internet GPRS (General Packet Radio Service)
- GSM Cell (Global System for Mobile communication)

The user can either negotiate their own sim card tariff from providers or obtain one from the SmartNet administration, for subscribed rovers. For the GPRS access the user will be given

an IP address, a unique user ID and password, which will normally be entered under the standard NTRIP (Networked Transport of RTCM via Internet Protocol) options, on the manufactures software. For the GSM the user will only require the user ID, password and phone number to dial.

Authentication, Authorisation, Accounting and Auditing (AAAA) are fully integrated into SmartNet software. .

Full network support is provided to users subscribed to SmartNet, with guides to setting up different types of rover receivers.

2.7 Security & Backup

The whole security concept of SmartNet separates the network operation and computation from the data dissemination, thereby protecting the key infrastructure as well as sensitive user and billing information.

For maximum security the proxy server that is used to provide the data, is situated outside of the firewall. All sensitive information such as user information and billing information is stored on a database behind the firewall and NOT on the proxy server, as is the case with some competitor systems. Therefore, any hacker who manages to gain access to the proxy server (which is normally open to the internet) would not be able to access confidential information or other parts of the system.
The whole system architecture is also situated in a high security, co-location data centre in London Docklands. Full system redundancy with backup servers is located within the data centre. Should there be a problem within the network, mechanisms to fully switch to backup systems are immediately implemented.

2.8 Network Quality Control

Leica GNSS QC software is installed at the control centre to continuously monitor the data within the network and make regular audits on station muitipath errors etc. Leica SpiderWeb software is also fully integrated with GNSS QC, enabling real time reports and statistics to be pushed to the web server. This will allow users the ability to view the network performance and statistics by way of real time live charts on the SmartNet web site.

Nottingham IESSG are also undertaking independent monitoring and integrity checking, to validate the “user experience”. Data from the reference sites and network RTK corrections will be available to IESSG, who will use their own processes to independently validate the data. Rover receivers will also be strategically placed within the network for quality measurement of the ‘users experience’. Future enhancements to the quality control will also

bring users the ability to view the network performance and statistics by way of real time live charts on the web.

3.0 SmartNet Benefits

Quality

- High-speed initialisation for RTK solutions
- Redundancy – multiple reference stations, not just one
- Reliability – full monitoring of network services
- Quality assurance – independent integrity monitoring by University of Nottingham.

Productivity

- Perform centimetre accuracy RTK surveys with one rover
- Eliminates daily base station set-up & potential errors
- Reduces dependency on ground control monuments
- Far exceeds range of conventional RTK systems
- Convert your existing base station into a productive rover

Availability

- "Always on" & 24/7 monitoring service
- Allows subscribers to easily work in various locations

Cost

- Halve the capital investment – no base station!
- Eliminates paying an employee to guard base station against theft

4.0 Conclusion

Numerous benefits exist within SmartNet, not just technically but also with new business opportunities for end users. SmartNet can be a very effective tool in many circumstances, enabling a further increase in GPS productivity and reliability with reduced hardware costs. SmartNet is built upon the leading Leica GPS Spider reference station software from Leica Geosystems. Leica Geosystems has been for many years actively researching, promoting and realising Network RTK solutions and working towards an industry standard for Network RTK corrections. It is in this role that Leica Geosystems jointly with other RTCM members, has developed and driven the Master Auxiliary Concept (MAC), the future of networked RTK and the basis of the newly approved RTCM 3.1 Network RTK messages. SmartNet is enabled with this technology bringing the future of Networked RTK, to the users today.

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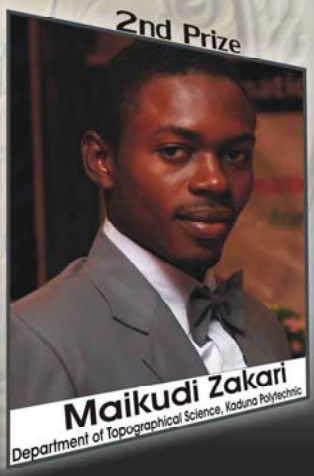
GeoQinetiq Geomatics Prize Award 2010

Theme: Geomatics and the Opputunities it presents for our Nation's Development

In November 2009, GeoQinetiq invited students in higher education Institutions across the country to participate in the GeoQinetiq Geomatics Prize 2010 for the most outstanding projects in Geomatics.
The purpose of this prize is to promote, stimulate and sustain interest in deeper understanding of the theories and practice of Geomatics in Institutions of higher learning in the Federal Republic of Nigeria, as well build awareness of the role of Geomatics in national development among the general public.
The 2010 Edition of the Award was held recently at the Ladi Kwali Conference Centre, Abuja Sheraton Hotel and Towers on 25th November, 2010.

2010 Prize Award Winners

2nd Prize



Maikudi Zakari
Department of Topographical Science, Kaduna Polytechnic

1st Prize

Obarafo Emmanuel
Department of Geomatics Engineering, A.B.U. Zaria

3rd Prize

Ajoke Fatima
Department of Geomatics Engineering, A.B.U, Zaria

Highlights from the just concluded GeoQinetiq Geomatics Award ceremony 2010, which took place on the 25th of November, 2010 at the Ladi Kwali Conference Centre, Abuja Sheraton Hotel and Towers.

From Left: Representing the SGF, Dr. Shettima Abba, SA to the SGF & Prof. Nicholas Damachi. Hon. Perm. Sec. Head of Service of the Federation

Hon. Justice S.M.A. Belgore GCON, retired Chief Justice of the Federation, flanked by finalist of the Geomatics Prize 2010.

From Left: Surv. Nwabichie (fnis), Dr. Atilola (fnis), Juliet Ezechie MD GeoQinetiq Ltd. Prof. Nwilo and Jerome Okolo EVC GeoQinetiq Ltd.

From Left: Prof. Ezeigbo, Dr. Dozie Ezibalike, Guest Speaker and Data Management Consultant, United Nations Economic Commission for Africa (UNECA) and Barrister Tony Odiadi.

1st Prize winner & Medal recipient,Obarafo Emmanuel (middle), Engr. Nuru Yakubu, National Commissioner INEC (left), Dr. Ezibalike, Dr. S. Abba and Surv. Austin Njepuome Surveyor General of the Federation.

Dr. S.O Mohammed, Guset Speaker and D.G., National Space Research & Development Agency (NASRDA).

2nd Prize winner Maikudi Zakari , flanked by Surv. Clement Nwabichie, Chairman SURCON (Left) and Surv. M.A. Durowujo (fnis) SA to Lagos State Government on Digital Mapping.

Award Finalist pose for a photograph (From Left) Moses Mefe, Atta Zenabu, Obarafo Emmanuel, Ajoke Fatima & Maikudi Zakari.

3rd Prize winner, Ajoke Fatima, recieving a cheque of N75,000 from Surv. M. Yahaya (right) and Surv. B. Adeaga (fnis), Dep. President NIS.

Details of **Geomatics Gold Medal & Prize 2011** and modalities for application can be found at www.geoqinetiq.com/awards from 10th December 2010

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