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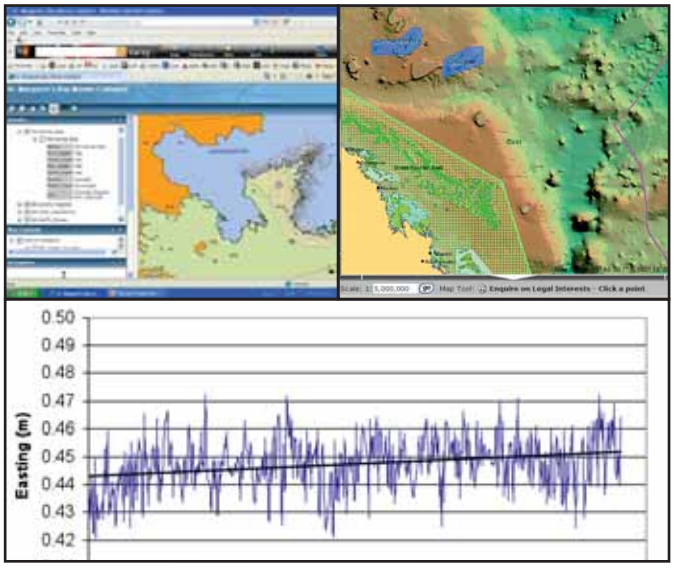

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Columns

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Mailing Address
50 A Pocket A
SFS Mayur Vihar Phase III
Delhi 110 096, India.
Phones +91 11 22632607, 98102 33422, 98107 24567
Fax +91 11 22632607

Email
[information]talktous@mycoordinates.org
[editorial]bal@mycoordinates.org
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Bal Krishna, Editor
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Geodesy: Out with the Old, In with the New

We should promote a new geodesy that does not instil fear into our students, but instead seeks to conveys the excitement of Modern Geodesy

Chris Rizos
Professor and Head of the School of Surveying & Spatial Information Systems, UNSW, Australia
President of the International Association of Geodesy

Since taking over the position of president of the International Association of Geodesy (IAG – http://www.iag-aig.org) on the 6th July 2011, I have had on occasion mused on what geodesy "is" and how to explain this arcane field to those who are not acquainted with it. For example, how do I tell the Dean of the Faculty of Engineering, at the University of New South Wales, Sydney (Australia), that I, the head of a department within his faculty which has its primary objective the education of undergraduate students in "surveying" (or more broadly in "geomatics"), now occupy an important position in the geoscience field of "Geodesy and Geophysics"? (This is not an idle exercise, as the Dean will be asked to approve my increased travel commitments over the next four years.

In order to define what geodesy "is", it is necessary to articulate what geodesy is "not". Furthermore, to explain why geodesy is important one could draw attention to its unique role in the geosciences, and to its vital services to society.

I can remember I had a disturbing "eureka" moment last year. I had given a talk to an audience of surveyors on the theme "why geodesy has a bad name". I noted that the classical topics of geodesy were no longer taught in many university surveying/geospatial/geomatics programs. I rattled off the topics, which resonated with the audience. As I listed them, many members of the audience nodded their heads… geodetic control networks, atmospheric refraction, spherical harmonic models, geodetic boundary value problem, deflections of the vertical, gravity anomalies and gravimetry, Least Squares estimation, ellipsoidal computations, map projections, reference frame transformations, positional astronomy, and so on. What I had not appreciated until that moment was that all these were "hard" topics, that few surveyors had fond memories of these subjects, and fewer would say they were better off by having studied them. Yet Modern Geodesy has progressed in the last decades in leaps and bounds, despite the shrinking number of students with a formal education in these classical geodetic topics. It struck me that we should promote a new geodesy that does not instil fear into our students, but instead seeks to conveys the excitement of Modern Geodesy.

A second revelation came to me as I participated in the centenary celebrations of the founding of the International Society of Photogrammetry & Remote Sensing (ISPRS) in Vienna by Eduard Dalezal. The IAG and the ISPRS are two of the ten "sister" organisations making up the Joint Board of Geospatial Information Societies (JBGIS). Other members of the JBGIS include the International Federation of Surveyors (FIG), the International Cartographic Association (ICA), the IEEE Geoscience & Remote Sensing Society (IGARSS), the International Geographic Union (IGU), and the Global Spatial Data Infrastructure Association (GSDI). Speakers at the ISPRS 100 year anniversary conference celebrated the history of photogrammetry and remote sensing, but also enthused about the future of satellite technologies in helping address society's environmental challenges.
I sat there and thought, "that is what Modern Geodesy also seeks to do!". The goal of Modern Geodesy is nothing less than to monitor changes in a range of physical processes in the solid earth, the atmosphere, and the oceans in order to improve our understanding of this fragile, precious and stressed planet. It was clear

to me that geodesy could be described as an Earth Observation (EO) discipline, or science. Certainly the classical definition of geodesy does not make clear that it is an EO science which has broader functions and applications, and potentially more relevance, than just as a foundation for mapping and surveying. It struck me that we must acknowledge that classical geodesy narrowly defined from this perspective of surveying and mapping needs to make way for Modern Geodesy.

So what sets geodesy (and the IAG) apart from other EO disciplines? The answer came to me some years ago. It is the fact that the IAG has fostered the establishment of "services" to provide fundamental products for many geoscientific and geospatial end-users. As president of the IAG I am especially proud to acknowledge the important work of these services. The services include the International VLBI (Very Long Baseline Interferometry) Service (IVS – http://ivscc.gsfc.nasa.gov), the International Laser Ranging Service (ILRS – http://ilrs.gsfc.nasa.gov), the International DORIS (Doppler Orbitography & Radiopositioning Integrated by Satellite) Service (IDS – http://ids.cls.fr) and the best known, the International GNSS Service (IGS – http://igs.org). Through another IAG service – the International Earth Rotation & Reference Systems Service (IERS – http://www.iers.org) – these space geodetic techniques play a critical role in defining the fundamental reference frame in relation to which changes in the location of points on (or above) the earth's surface (including satellite orbits), or the shape of the land, or level of the ocean surface, can be monitored over many years to sub-centimetre accuracy. Therefore special mention should be made of one of the IAG's "flagship" products – the International Terrestrial Reference Frame (ITRF – http://itrf.ensg.ign.fr) – which also increasingly is the basis for modern national mapping datums.

The IAG also has established the International Gravity Field Service (IGFS – http://www.igfs.net) to measure and model the earth's gravity field to high accuracy using, for example, sophisticated gravity mapping satellite missions such as CHAMP, GRACE and GOCE. Gravimetric geodesy can nowadays measure changes in gravity acceleration arising from mass transport (which changes gravity by tiny amounts) due to the global water cycle, atmospheric and ocean circulation, and solid earth processes such as volcanism and tectonics. Amazing technology!

All the IAG services generate products on a continuous basis. These products may be the primary outputs of geodetic analysis, such as precise coordinates of GNSS monitor stations, or global meteorological values of humidity, temperature and pressure, or maps of ionospheric disturbances, rate of rotation of the earth, orientation of its rotation axis, and many others. Such products can be used directly by many scientists. In addition, indirect products such as the reference frame, precise orbits of EO satellites, precise timing scales and high-accuracy GNSS-

enabled navigation capability, support many other scientific and professional users. The challenge for the surveying, and the geomatics disciplines in general, is to embrace Modern Geodesy, and to cheer its achievements. My role now is to "sell" geodesy because it is more accessible (through the increased use of GPS/GNSS) and more relevant (through its unique EO capabilities) than any time in the past.

There are a number of reasons for this transformation from esoteric geoscience to an integral part of today's geospatial industry. Firstly, Modern Geodesy relies on space technology, and enormous strides have been made in accuracy, resolution and coverage due to advances in satellite sensors and an expanding portfolio of satellite missions. Secondly, geodesy can measure earth parameters that no other remote sensing technique can, such as the position and velocity of points on the surface of the earth, changes of sea level and the shape of the earth's ocean, ice and land surfaces, and map the spatial and temporal features of the gravity field. These geodetic parameters are in effect the "fingerprints" of many dynamic earth phenomena, including those that we now associate with global change (due to anthropogenic or natural causes) as well as responsible for devastating events such as earthquakes, tsunamis and volcanoes. The challenge is to invert the outward expressions of these dynamic earth processes in order to measure and monitor over time the underlying physical causes. Finally what relentlessly drives geodesy into the future is the innovative use of signals transmitted by Global Navigation Satellite Systems (GNSS) such as the U.S.'s GPS and Russia's Glonass, E.U.'s Galileo, and China's BeiDou – the latter two constellations are incomplete, but will be deployed in the coming decade.

However, GNSS is more than just another space geodetic technology. GPS in particular is today used for an enormous range of applications, from consumer uses such as for car navigation and in mobile phones to access location-based services, to professional applications such as machine automation (guidance of farm, mining and construction vehicles), emergency services, military operations, rapid mapping, surveying, transport management, and many more. However it is the special ultra-high accuracy form that is of geodetic interest. The IGS therefore deserves special mention, and is an organisation close to my heart – having served on the IGS Governing Board for the last 7 years. The IGS was established in 1994 as the first of the IAG's geometric services, primarily by computing high accuracy GPS and Glonass satellite orbit and clock "products" as well as open (and free) access to measurements made by a global ground network of continuously operating GNSS tracking stations. These hundreds of GNSS receivers on stable pillars or solid monuments operate continuously around the world also function as precise monitoring systems for ground movement due to global effects such as continental drift, local subsidence due to fluid extraction or underground mining, uplift due to volcanism or post-glacial rebound (the land rising since the last Ice Age released the pressure of many kilometres of overbearing ice), and more.

> In order to define what geodesy "is", it is necessary to articulate what geodesy is "not".

The IGS is not resting on its laurels, and has just launched a "multi-GNSS experiment" (M-GEX), seeking to augment its tracking network with next generation multi-GNSS receivers able to track the new satellite signals. In 2013 the IGS is on track to launch a new "real-time" service. It must be pointed out however, that the representation of countries from South America, Asia and Africa, as hosts of GNSS tracking stations, as homes to product analysis centres, and on its governance body is disappointing. Nevertheless, some progress is being made with the Asia-Pacific Reference Frame Project (APREF – http://www.ga.gov.au/earth-monitoring/geodesy/asia-pacific-reference-frame.html), which aims to encourage cross-border cooperation in GNSS geodesy; and the demonstration campaigns being promoted under the auspices of the Multi-GNSS Asia Organisation (MGA – http://www.multignss.asia) to encourage regional experimentation with next generation GNSSs such as the new Japanese QZSS and Chinese BeiDou satellite signals.

What about the other services? Geodesy has set itself an ambitious agenda – striving to increase the level of accuracy in the determination of many of the geodetic parameters by a factor of ten over the coming decade. The IAG's Global Geodetic Observing System (GGOS – http://www.ggos.org) will integrate all geodetic measurements from all services in order to monitor the phenomena and processes within the earth system at far higher fidelity than at present. This integration implies the inclusion of all relevant information for parameter estimation, the combination of geometric and gravimetric data, and the common estimation of all the necessary parameters representing the solid earth, the hydrosphere (including oceans, ice-caps, continental water), and the atmosphere. GGOS is geodesy's contribution to the Global Earth Observing System of Systems (GEOSS – http://www.earthobservations.org) initiative.

Again, South America, Africa and Asia can, and should play a greater role in the IAG services, and in GGOS. The geodetic infrastructure that underpins today's IAG services needs to be upgraded and extended. Nowhere is this need greater than in the countries outside North America, Europe and Australia. My IAG presidency will treat this expansion of IAG engagement with the highest priority.

In summary, geodesy is facing an increasing demand from science, engineering applications, the earth observation community, and society at large for improved accuracy, reliability and access to geodetic services, measurements and products. All countries, and all geospatial professionals can contribute. Our slogan should be "geodesy matters, now more than ever", but it must be Modern Geodesy… out with the old, in with the new.

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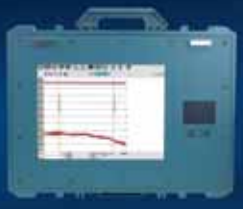

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Our focus has always been on building products that can stand up to the most demanding environmental conditions

Says Phil Gabriel, Vice President and General Manager, Precision Products, Hemisphere GPS

What are the key applications Hemisphere GPS precision products focus on?

Hemisphere GPS is focused on building rugged GNSS products for a variety of industries including surveying, marine and original equipment manufacturing (OEM).

In the surveying industry, we manufacture a wide range of products from high-accuracy GNSS receivers to geodetic grade antennas. In addition, we offer an exclusive line of Vector GNSS Compass products for professionals heading and positioning. Our customers use these unique all-in-one compasses for everything from hydrographic surveying to yachting and dredging to autonomous machine control. On the OEM side of our business, we supply system integrators with our proprietary Hemisphere GPS technology for them to integrate into their own finished products. In fact, nearly every Hemisphere GPS finished product is broken down to its core board level and offered to original equipment manufactures for integration into their custom applications.

Please highlight a key feature of Hemisphere GPS' S320 GNSS Receiver?

Our S320 GNSS Receiver offers a lot of very unique and exclusive features. In fact, Hemisphere GPS S320 is the only survey receiver on the market with SMS communication capabilities. Meaning you can remotely command your S320 by sending text messages from your cell phone. Surveyors are using this feature to power their receivers' on/off, monitor the location of their receivers and get real-time status updates such as battery life. The SMS communication feature can also be used to automatically setup base-rover pairing, self-synchronize GPRS data calls and initiate a built-in-test to help diagnose customer support issues. Our SMS Communication feature has got a great response from surveyors in the field and is a unique feature that no other receiver offers.

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surveyors, this translates into longer RTK baselines as well as more reliable RTK in congested environments. With Hemisphere GPS' exclusive SureTrack intelligence there is no longer the concern of mixing GNSS data from various manufacturers.

There is an emphasis on the 'high quality' of Hemisphere GPS' S320 GNSS receiver. Please explain its edge over other existing receivers in the market.

Hemisphere GPS is a Canadian company that has been manufacturing rugged and reliable GNSS products for more than 20 years. Our focus is, and always has been, on building products that can standup to the most demanding environmental conditions. S320 is a great example of this. The extremely tough Lexan plastic used to build the S320 is the same material used in the manufacturing of hockey helmets. We understand that test environments and real-life conditions are not always the same. That's why we built it to your specifications - Surveyor Tough.

How are the issues related to data storage and battery backups addressed in S320?

With the SD/SDHC card slot secured behind the battery door, users can safely log large amounts of monitoring data, static observations data and extended survey projects onto the factory included 2GB memory card. The SD card can also be used for much more including upgrading firmware and loading configuration files such as NTRIP. If you prefer to leave the SD card in the unit, you can wirelessly download the data by streaming it through one of the two Bluetooth ports provided.

As for battery life, Hemisphere GPS' S320 comes standard with two long-life lithium ion batteries which will give more than 10 hours of operation. The batteries are hot swappable so you can change either one without powering off the unit. Also, the batteries used by S320 are in industry standard, so you can easily buy extras at any supply store.

What makes the S320 antenna design unique?

Our proprietary "Cross Dipole" antenna design used in the new S320 is a very efficient, wideband solution with excellent phase center stability and polarization. It is specifically engineered to receive all current GNSS signals as well as all planned GNSS signals around the world. The advantage of this tall cross dipole design is its ability to maximize signal gain all the way down to the horizon, which allows it to receive weak satellite signals very low in the sky - while rejecting reflected multipath signals that can reduce receiver accuracy. The height also permits retention of right hand circular polarization for additional multipath rejection when capturing the desired low angle signals. This is an important feature in order for the antenna to function effectively in very tough environments.

Customer Speak

"The system was demoed yesterday to a number of managers from different divisions of ARA (Applied Research Associates, Inc.) and was very well received. Neither we or nor anyone else who has seen this system can find a single fault with the S320. It performs flawlessly, setup is a breeze and we have yet to run out of battery life. The ability to hot-swap batteries is fantastic. The accuracy, repeatability and speed of acquisition is superb. Nice job!"

Mark Boettcher

Senior Computer Scientist

Applied Research Associates, Inc.

Experiences from world bank development support for land reform

This paper discusses the World Bank support for sustainable land reform, focusing on the East Asia Region, with particular emphases on initiatives in land governance, land development investment, tenure security, NSDI, e-government, land tax, spatial planning, disaster response and mitigation. We have published the first part of the paper in last issue. We present here the second part of the paper

Keith Clifford Bell
World Bank, East Asia Pacific Region
Washington DC, USA

Land administration and ict

Over the past thirty years, considerable progress has been made since the initial work on first registration programs using largely analogue, methods of data capture, presentation and records management. The early adoption of total stations and electronic data recording by land surveyors, post processing using computer-aided drafting (CAD) and GIS, as well as data storage in relational database management systems have been highly successful. The usual experiences have been through the nurturing of Land Information System (LIS) pilot programs to promote the development of national inventories of land ownership and land use records in support of robust systems of land administration. Efforts towards building multipurpose cadastres (or LIS) of key national datasets for NSDI have been focused on maturing the core building blocks of appropriate institutional frameworks, technical standards, identifying fundamental national datasets, building the enabling technical ICT infrastructure, and enhancing the available skills base through training and education programs. As technology has so rapidly improved, it has also converged, with communications, positioning, measuring, processing, presentation, analysis and storage technologies now interconnected or even merged. Technology costs have markedly reduced in real terms and computing power and storage are now such that they not limiting factors.

Ongoing rapid advancements in ICT, including the construction of optic fiber networks, and improved telecommunication infrastructure across East Asia is connecting rural and urban populations. The foundations are being laid for a host of e-government services and the building of NSDI that will reach beyond cities and into the rural provinces. Improving tenure security and access to land is central to alleviating poverty and advancing rural livelihoods. A suite of innovative technologies and solutions are available to providing East Asia's poorest rural and remote communities access to land and property services.

In the East Asia Region, it is interesting to reflect on developments in the country that first received support from the World Bank some thirty years ago. In 2009, Thailand, the Cabinet approved that National ICT Strategic Master Plan 2009-2012, identifying the NSDI and land information from land registration as being one of the key pillars. In April 2011, the Thai government announced its plans to launch the country's NSDI portal by 2012 which will serve as the national gateway for spatial information and pave the way towards "Spatially Enabling" Thailand. The portal will act as a repository of metadata generated by data producers which will gradually provide services such as access to metadata of the Fundamental Geographic Data Set and well as other spatial data in Thailand. Thailand has a well established land registration system, which is largely still paper-based. But it works well, and Thailand is now about to take the next steps towards NSDI and e-governance. Other countries are also investing heavily in ICT, building their respective NSDI and pursuing e-services.

Strengthening land administration systems through building NSDI may support improving tenure, promoting social stability and reducing conflict, stimulating

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agricultural and rural productivity, encouraging land improvement and more sustainable resource management. A better cadastre, underpinning the NSDI provides a more complete and reliable basis for taxation collection and better managing state assets. Through better access to land information, transparency may be increased and there may be enhanced public disclosure of land-related matters such as land use plans and development proposals. However, the author stresses "may" in all of these benefits, as it all depends on whether good governance prevails with laws being appropriately enforced and civil servants acting ethically and in the public good.

Duplication of data capture is frequently encountered in land administration projects. For example in the management of land concessions, different agencies are all too frequently embarking on maintaining their own individual digital cadastral databases, perhaps due to a lack of protocols for data sharing, unclear institutional mandates or even organizational rivalry. Data should only be captured once, and the maintenance of data should be the responsibility of the designated custodian agency. NSDI, which encompasses not only the data, but the official designation of custodians, and the official protocols for data sharing will improve the overall efficiency of data collection and maintenance and enable government decision-making to be more consistent drawing on the authoritative data sets, with advice from the designated responsible agency.

Land-related agencies, should be adopting whole-of-government approaches to NSDI and not seeking to build silos to enshrine weak land administration systems and poor governance. It is very important that agencies act transparently and accountably, providing full disclosure of their priorities, progress and investments in land administration systems and NSDI to maintain political and public confidence and support. Accordingly, investment in NSDI should promote better land governance and not promote strengthening of government silos.

Broader utilization of geospatial information technologies

Spatial Enablement

There is an ever growing dialogue and advocacy for investing in the "spatially enabled society", the evolving concept where location, place and geospatial information provide the primary means for governments, business, communities, families and individuals to conduct their affairs and lead their lives (Rajabifard, 2010). Williamson et al (2010) suggest that spatial enablement is not just about developing and using GIS technologies, but is a concept whereby government and society draw upon the land administration system and spatial data infrastructure. However, this author would suggest that this concept may be better extended to include broader range of geospatial technologies and other related ICT. Over the past couple of decades all countries to a greater or lesser degree have been investing in their respective NSDI. Advanced economies have continued to exploit the convergence of the range of geospatial and ICT for service delivery, commerce, transportation (road, rail, maritime and air) , agriculture, natural resources, energy, national security, policing and public safety, climate change and disaster risk reduction and response. On the other hand, developing countries, with international support, have been necessarily more focused on investing in the basic systems for land and property rights and planning, which over time, will evolve into more sophisticated systems including spatial data infrstructures.

Land-related agencies, should be adopting whole-of-government approaches to NSDI and not seeking to build silos to enshrine weak land administration systems and poor governance

Over the past decade or so, cloud computing investments, especially from major players in the ICT industry like Microsoft , IBM and Google, have driven many geospatial developments and user demand to become more enabled by geospatial technology. Cloud computing, the idea of relying on web-based applications and storing data in the "cloud" of the Internet, has long been touted as a way to do business, and has been fundamental to the growth of geospatial systems development, especially with the availability of cloud geospatial data such as Google Earth.

As access to geospatial technologies such as GPS enabled cell-phones, web-based communications and the cloud grows, increasingly non-traditional data providers have emerged and are contributing geospatial data. Crowd sourced data is increasingly being seen as a vital part of the geospatial landscape especially in community-driven development and disaster response.

Therefore, putting all of the above into context, perhaps three significant trends have emerged:

- *Emergence of neo-geography and the geospatial web* is leading to many more bottom- up approaches to adoption and application of geospatial technology. Trends in this space are: user generated maps, editable public maps, online map versioning, user feedback (statistics, ratings, tags, comments), portable content, geospatial content discoverable by search engines, a more towards informal bottom up spatial data infrastructures, automatic meta-data creation.

- *Mobile geospatial applications* and the growth in location based services, incorporating citizen based data inputs from mobile phones and social media.

- *Move to Operational Earth Observation services* by means of: (i) standard satellite sensors; (ii) constellations of satellites for regular delivery of products; and (iii) creation of large institutional markets for these products to drive down costs.

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World development report findings

Successive recent annual *World Development Reports* have highlighted the ever increasing importance of geospatial information technologies in supporting development as well as disaster response and risk reduction. One reason that policy makers have found it so difficult to curb the over-exploitation of land, water and their related ecosystems is that neither the managers nor the users of the resources have had access to reliable and timely information, especially information that is spatially referenced. The number of people affected by climate-related disasters is on the rise, particularly in low- and middle-income countries where rapid urbanization is taking place. Poor households are severely affected by climate change impacts as they have less access to protective assets and face higher exposure to environmental risks. With expected shifts in rainfall patterns, melting snow-packs and glaciers, stronger tropical cyclones, and a rising sea level, climate change will be a risk multiplier for the poor. All of this raises the demand for reliable geospatial information.

Social development and poverty

Fundamental to the achievement of the MDG is poverty alleviation. However, for a long time, especially for developing countries, there has existed inadequate and unreliable poverty mapping data for both rural and urban environments. In short, basic data about the location of the poor, has either not been available or has been unreliable. Geospatial information technology now provides new opportunities to answer basic questions about the spatial distribution of the poor especially in terms of rural poverty in relation to agriculture and markets, urban populations and slums, distribution and access to basic services, employment, hazardous marginal lands prone to disasters and so on.

Natural resources and agriculture

The "World Development Report 2010" stresses the importance of accurate and timely data, especially from remote sensing and other geographic information, and the application of ICT, advising that:

"One reason that policy makers have found it so difficult to curb the overexploitation of land and water and their related ecosystems is that neither the managers nor the users of the resources have accurate and timely information. ……

….Research and development will be necessary to take full advantage of these new information technologies" and also "*More reliable information can empower communities and change the governance of natural resources*".

Although the term "NSDI" has not been used specifically in the Report, it most certainly makes a strong case for investment in NSDI. More reliable information, especially geospatial information, can empower communities and change the governance of natural resources. Natural resource management often requires governments to set and enforce laws, limits, or prices. Political and socioeconomic pressures make this very difficult, especially where formal institutions are weak, and governance is inconsistently enforced. The growing global concern regarding FDI in land concessions especially for agri-business, forestry and mining highlights the weak governance that exists in many of the countries under threat and the lack of reliable spatially-referenced inventories of land and natural resources, land use planning and monitoring systems. In 2010, the World Bank, in collaboration with partners issued "Principles for Responsible Agricultural Investment that Respects Rights, Livelihoods and Resources".

Disasters

The World Bank has been very active in responding to major disasters, especially in the areas of damage assessments and reconstruction. Both Aceh and Haiti are two significant examples. Geospatial information technologies have been increasingly used, by both the World Bank and the international community. In addition to disaster response, disaster risk reduction has become increasingly important. Established in 2006, the Global Facility for Disaster Reduction and Recovery (GFDRR) is a partnership of 36 countries and 6 international organizations committed to helping developing countries reduce their vulnerability to natural hazards and adapt to climate change. Support for disaster risk reduction, involves the GFDRR working with partners to assemble large collections of geo-referenced data in order to develop country-specific and regional catastrophe risk models. Crowd-sourced data and cloud-based data (and applications) are now a very important part of the GFDRR's work as successfully demonstrated in the Haiti response and contrast with Aceh which largely relied on traditional sources of data only.

Environmental monitoring, climate change, carbon

The Forest Carbon Partnership Facility (FCPF) is a World Bank program created to assist developing countries in their efforts to reduce emissions from deforestation and land degradation (REDD). It has the dual objectives of building capacity for REDD in developing countries, and testing a program of performance-based incentive payments in some pilot countries. Designing and, if possible, implementing accurate measurements, monitoring and verification systems to enable countries to report on emissions from deforestation and forest degradation. Satellite imagery and other geospatial information including Google Earth are being utilized for monitoring of REDD.

The Global Monitoring for Environment and Security (GMES) is a joint initiative of the European Commission and the European Space Agency, which aims at achieving an autonomous and operational Earth observation capacity. The objective is to rationalize the use of multiple-sources data to get a timely and quality information, services and knowledge, and to provide autonomous and independent access to information in relation to environment and security. In other words, it will pull together all the information obtained by environmental satellites, air and ground stations to provide a comprehensive picture of the "health" of Earth. The World Bank has a cooperative agreement with the European Space Agency to pilot services built around GMES.

To be concluded in December 2011

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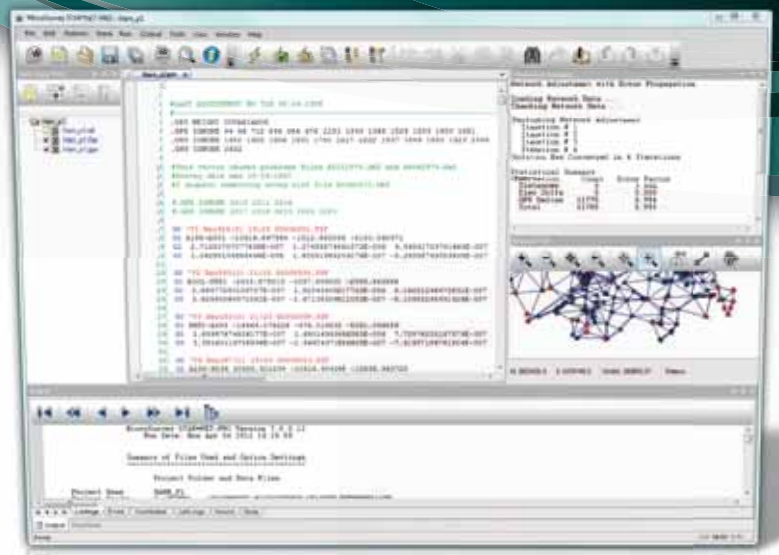

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"The United States and India have been collaborating closely in the civil aviation space"

says Leocadia I Zak, Director, USTDA in an interview with Coordinates

Could you briefly explain the mandate of USTDA?

USTDA helps countries expand economic growth by utilizing U.S. expertise, technology, and investment. The Agency's objectives are to help build the infrastructure for trade, match U.S. technological expertise with overseas development needs, and help create lasting business partnerships between the United States and emerging market economies.

USTDA advances these objectives through its two key programs, the Project Development Program and the International Business Partnership Program.

Through feasibility studies, technical assistance and pilot projects, USTDA's Project Development Program helps overseas project sponsors identify technological solutions and various sources of financing for priority infrastructure projects.

USTDA's reverse trade missions (RTM) are the mainstay of its International Business Partnership Program (IBPP). Created in 2010 in response to the Obama Administration's National Export Initiative, the IBPP is USTDA's signature program for linking the U.S. private sector to foreign buyers with upcoming procurement plans. These visits are carefully planned to enable foreign decision-makers the ability to observe the manufacture, demonstration and operation of U.S. goods and services that can help them achieve their development goals.

Of particular importance to advancing our bilateral relationship, USTDA and the Ministry of Civil Aviation, in cooperation with the U.S.-India Aviation Cooperation Program, and the Federal Aviation Administration, will sponsor the U.S.-India Aviation Summit from November 16-18, 2011, at the Taj Palace Hotel in New Delhi, India.

Recently you were the part of US India strategic dialogue. Where does the collaboration in satellite navigation fit in US India strategic alliance?

The United States and India have been collaborating closely in the civil aviation space for almost 6 years with the signing of the landmark bilateral Open Skies Agreement in mid-2005. As you may already know, collaboration in the area of satellite navigation has been identified as one of the important tools for enhancing the US-India bilateral relationship which in turn is an important pillar of the Strategic Dialogue. Since the signing of the Open Skies Agreement the two countries are now closely collaborating in the area of civil aviation and satellite based navigation. Through collaborative efforts, our two countries are promoting compatibility and inter-operability between the U.S. Global Positioning System, India's navigation systems, and those of other countries. The goal is obviously to ensure safer skies and efficient air traffic management which will help lower costs and increase bilateral trade between our countries.

The hallmark of USTDA development assistance has always involved building partnerships between U.S. companies and overseas project sponsors to bring proven private sector solutions to developmental challenges. Would you like to explain this in the context of MoU signed between USTDA and Airports Authority of India (AAI) on GAGAN?

In 2008, USTDA sponsored a reverse trade mission consisting of technical personnel from the Directorate General of Civil Aviation (DGCA), the Airports Authority of India (AAI), and the Indian Space Research Organization (ISRO) to travel to the United States to assist in developing a plan to certify GNSS technologies for use in the development of India's GPS and Geo-Augmented Navigation System (GAGAN) project. The reverse trade mission promoted increased cooperation between U.S. and Indian aviation officials with regards to the implementation of a satellite-based augmentation system (SBAS) in India and familiarized Indian officials with U.S. aviation technologies, approaches, and standards. As a result of this visit, Raytheon secured a contract for

$60 million in exports of U.S.-manufactured goods and services that was awarded by ISRO in July 2009. USTDA did not sign a grant agreement with the Airports Authority of India for GAGAN, rather we sponsored a reverse trade mission to allow officials to see the technologies in action.

According to the agreement USTDA will provide $407,325 to support the AAI's efforts to install and commission a pilot Ground Based Augmentation System (GBAS). Would USTDA also facilitate technical knowhow to this program?

Recently, USTDA provided a grant ($407,325) to the Airports Authority of India (AAI) to assist in the installation, certification, and operational commissioning of a Ground Based Augmentation System (GBAS) at Chennai airport. At the request of AAI, the USTDA assistance will fund the demonstration of a Honeywell's GBAS SmartPath system pilot at the Chennai airport, a system that is already certified with the Federal Aviation Administration. By gaining its operational service approval in India, the SmartPath system will help AAI achieve greater fuel efficiency and cost savings for air carriers, as well as safety and efficiency/capacity improvements for its many airports. Under the grant agreement, the technical assistance will support training of AAI and DGCA personnel for the installation, operational commissioning, and certification of Honeywell's GBAS and associated GPS Landing System (GLS) procedures at Chennai airport. Honeywell and FAA personnel, with the support of USTDA funds, will facilitate technical training on the GBAS technology.

Could you highlight few key initiatives supported by USTDA pertaining to GPS in the South and SE Asian region?

In addition to the Indian GAGAN and GBAS projects, USTDA has supported a number of technical symposia related to GPS technology innovations for aviation in the broader South and SE Asia region. This has included sponsoring the APEC Aviation Navigation Technologies Workshops I and II, in 2005 and 2009, in cooperation with aviation partners in SE Asia and the U.S. FAA. The first of these addressed RNAV/RNP aviation navigation technologies, and aimed to familiarize SE Asian aviation authorities with the technical capacities needed to implement and authorize these performance-enhancing navigational systems. The symposium focused on topics ranging from flight standards, aircraft certification, air traffic operational approvals, and the procedural implementation of RNAV/RNP systems. The second workshop, held in Bangkok Thailand, addressed the operational approvals of technologies such as Performance Based Navigation (PBN) procedures, as well as the implementation of other Global Navigation Satellite Systems (GNSS) approaches. This second workshop brought U.S. representatives together with aviation officials from numerous APEC economies and India to discuss the role of institutional, operational, and regulatory procedures needed to promote aviation modernization and a range of technologies related to the next generation air traffic system, also known as NextGen.

> Through collaborative efforts, our two countries are promoting compatibility and inter-operability between the U.S. GPS and India's navigation systems

Most recently, in August 2010 USTDA sponsored the Asia-Pacific Commercial Aviation Access workshop and reverse trade mission for approximately 40 senior aviation officials representing civil aviation agencies (CAAs) and airlines from Bangladesh, India, Indonesia, Malaysia, Mongolia, the Philippines, Thailand, and Vietnam, in the San Francisco, CA and Seattle, WA areas. This initiative provided a comprehensive overview of the safety and security requirements needed to gain access to U.S. airspace, and also addressed opportunities presented to airlines and CAAs from adoption of growing GPS-related safety and navigational technologies.

Shri V.P. Agarwal, Chairman, Airports Authority of India (shaking hands with Lee) Dr. Nasim Ahmad Zaidi, Secretary, Ministry of Civil Aviation (in the middle) Ms. Leocadia I. Zak, Director, U.S. Trade and Development Agency

Improving the administration of marine and coastal spaces

A marine cadastre, preferably built on the multipurpose cadastre concept, is one such instrument that ideally can provide thematic and spatial data and information to support efficient decision making with regard to coastal and marine spaces

Michael Sutherland
Department of Geomatics Engineering and Land Management, University of the West Indies
St. Augustine, Trinidad and Tobago

The concepts proffered in paper generally are in relation to developed jurisdictions that have fully embraced the Information Age and its significant investments in digital data management. Since 2001, and as a means of improving the administration of marine and coastal spaces through decision support, interested members of the international geomatics community have increased research efforts towards the development of marine cadastres in various jurisdictions. Among them are researchers from Canada, Australia and the United States of America (USA) (Collier, Leahy and Williamson, 2001; Ng'ang'a, Sutherland and Nichols, 2002; Sutherland, Wilkins, and Nichols, 2002; Barry, Elema and van der Molen, 2003; Binns et al., 2003; Ng'ang'a et al., 2004; Sutherland, 2004; Sutherland and Nichols, 2004; FGDC, 2008). The main focus of this paper is Canada but developments from the U.S. and Australia are briefly discussed.

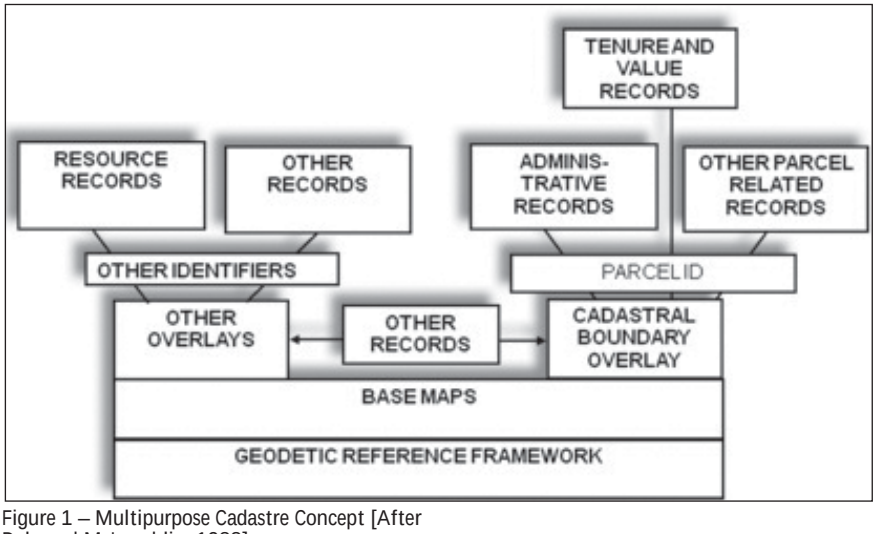

Figure 1 – Multipurpose Cadastre Concept [After Dale and McLaughlin, 1988]

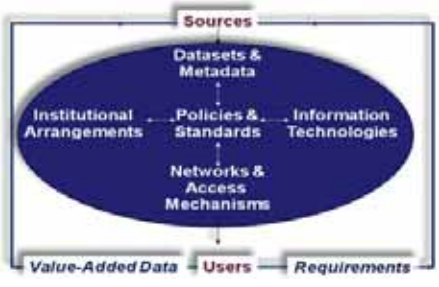

Figure 2 – Spatial Data Infrastructure [After McLaughlin and Nichols, 1994]

As with upland management, the general perception is that good governance of marine and coastal spaces, through the management of people and their activities in relation to space over time, can be achieved through the management of rights/interests, responsibilities and restrictions. A marine cadastre, built upon the multipurpose cadastre principle [Figure 1], is a system that is envisaged to be able to provide this kind of decision and management support.

The multipurpose cadastre concept envisions the linking of juridical and fiscal cadastral layers with layers of other spatial information occurring in the same space, to provide a more complete set of information about the spatial extent of interest. These other layers could include, among other things, data relating to:

- Geological and geophysical dataSoils
- Vegetation
- Wildlife
- Hydrology
- Climate
- Pollution, health and safety
- Industry and employment
- Transport
- Water and sewerage
- Gas, electricity and telephones
- Emergency services

In many jurisdictions these other datasets are managed by various organizations. There is an implication of collaborative, cooperative, or integrative governance arrangements among the stakeholders, for the multipurpose cadastre to ideally be implemented. Jurisdictions vary in their socioeconomic, environmental and institutional requirements and value systems in the management of their coastal and marine spaces. However, common among them with regard to the governance of marine and coastal spaces, is the need for laws, regulations,

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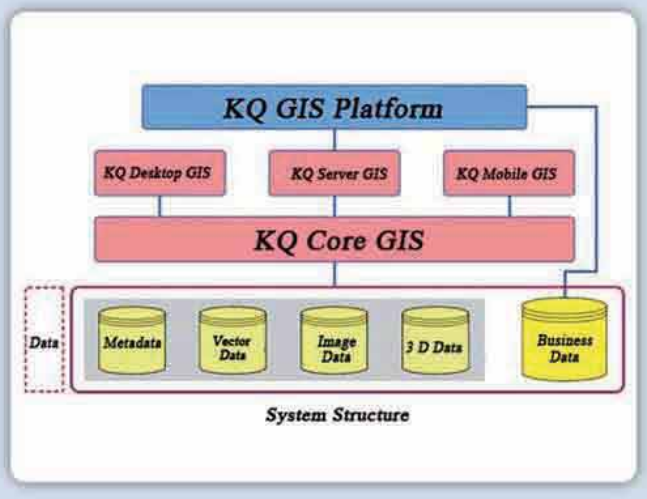

System Structure


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policies, governance structures and arrangements, personnel, data and data management, and organizations. Spatial Data Infrastructure (SDI), including national, regional and global concepts, provides for cohesive combinations of these components of governance.

Figure 2 shows a conceptualization of a SDI (McLaughlin and Nichols, 1994). A perusal of the components strongly point to collaboration, cooperation or integration of data management systems to provide information for decision support, satisfaction of user requirements, and the production of value-added products to meet the objectives of the various participating stakeholders.

A marine cadastre ought ideally to be envisioned as part of a SDI. From this perspective, and taking into consideration the multitude of overlapping rights/interests occurring in marine spaces, the 3-dimensional nature of marine spaces to be managed, the variety and number of stakeholders involved, and the traditional silo approach to governance, the development of marine cadastres as part of SDIs offer improved decision support in the management of these spaces (Ng'ang'a et al, 2004; Masser, Rajabifard and Williamson, 2008).

In consideration of the foregoing discussions, this paper outlines the latest development relating to the marine cadastre concept in Canada. Developments in the USA and Australia in terms of web applications placed in the public domain are also reviewed. Comparisons are made with a conceptualization ideal. The motivation for the paper is linked to recent developments in Canada where interest in the marine cadastre concept has been renewed outside of academe, and some support was given to the development of a prototype system. A number of interested stakeholders were contacted and a task force formed to give input on the direction in which a Canadian marine cadastre might be developed, and to seek necessary funding. Although not all stakeholders participated there is in this action a tacit recognition that collaboration, integration or cooperation among stakeholders is essential in the marine cadastre's development. From the Canadian perspective, these are considered further steps in the administration of marine spaces.

The marine cadastre ideal

The marine cadastre ideal, based upon a multipurpose cadastre principle, will include 2- and 3-dimensional graphical representations of all rights and interests occurring within the spatial extent of focus. It will include 2- and 3-dimensional graphical representations of other spatial data described above. In other words, visualizations would include volumes and not just plan views of polygons. The visualization of spatial extents of interest would make it easy to determine if rights, interests, and other spatial phenomena are related to the water surface, the water column or pelagic environment, the bed or benthic environment, or the subsoil of the bed. Also included will be all related legal, fiscal, environmental, social etc. textual information. The textual information would be complete in terms of being able determine appropriate laws, regulations, responsibilities, restrictions, stakeholders and all other pertinent multipurpose information about any point in the 3-dimensional spatial extent of interest (Ng'ang'a et al, 2004; Sutherland, 2005).

The most challenging part of the ideal marine cadastre to implement is a working 3-dimensional visualization of the rights and interests, i.e. as volumes. Apart from the technical hurdles to overcome, the spatial component of rights and interest data are not normally collected with this type of visualization in mind.

Marine cadastre developments

The U.S.A.

In the U.S. the Federal Geographic Data Committee's Marine Boundary Working Group developed a web-based marine cadastre and placed it in the public domain [Figures 3 and 4]. One is able to navigate through the datasets and to seek information about any point. The design concept is multipurpose. Background data simulates the 3-dimensinal form of the seafloor, but the visualization of rights are 2-dimensional. There have been improvements made to the interface in terms of data content (NOAA 2010).

Australia

Also online is the Australian Marine Spatial Information System [Figures 5 and 6]. This system also provides multipurpose cadastral information by clicking on a point on the displayed map.

Custom queries are possible and more information may be obtained than from the U.S. model in terms of, for instance legal interests. 3-dimensional visualization of the seafloor provides a backdrop but the visualization of the rights and interests are 2-dimensional (Geoscience Austalia, 2010).

Canada

In Canada, between 2001 and 2008, major interest in the marine cadastre was mostly from a few university researchers and even fewer Federal government officials. In 2008 the Coastal and Ocean Information Network for Atlantic Canada (COINAtlantic) (COINAtlantic 2009a), supported by Geoconnections Canada, developed a search utility that locates marine and coastal datasets and offers the user the option to add and display found datasets in a graphic map interface. A sub-component of the COINAtlantic initiative was a prototype marine cadastre proof of concept, using St. Margaret's Bay, Nova Scotia, as the case study area [Figures 7 and 8] (COINAtlantic 2009b).

This was the first time in Canada that any major funding was directed at this type of research, outside of academe. The funding was still small compared to funding received in other jurisdictions (e.g., Australia). Developed using ArcGIS Server the datasets are also 2-dimensional polygons with 3-dimensional characteristics simulated through database designs that added fields indicating whether the rights were related to sea surface, water column, seafloor, or subsurface.

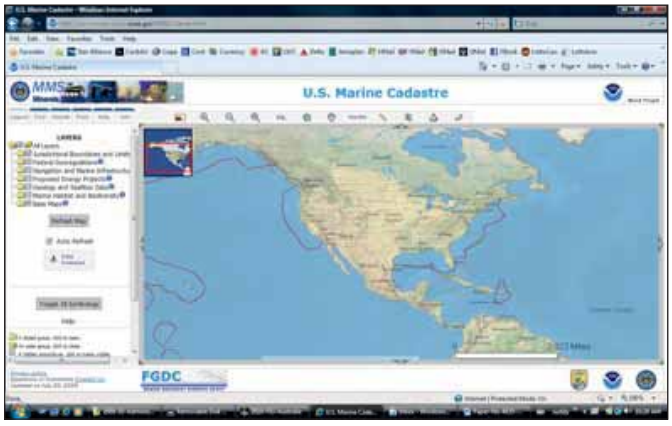

Fig 3 – U.S. Marine Cadastre Interface

Fig 4 – U.S. Marine Cadastre Interface

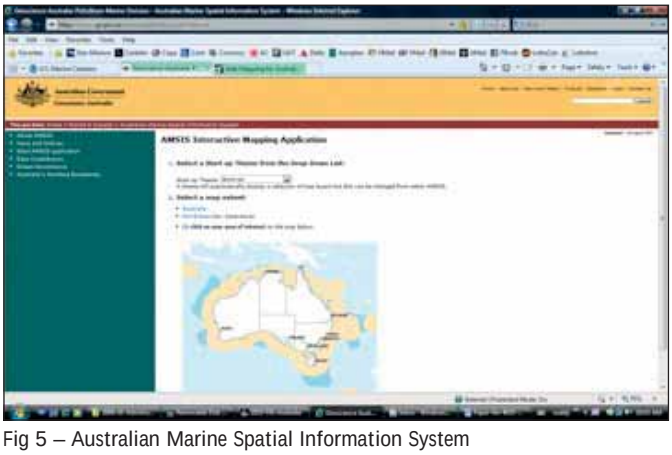

Fig 5 – Australian Marine Spatial Information System

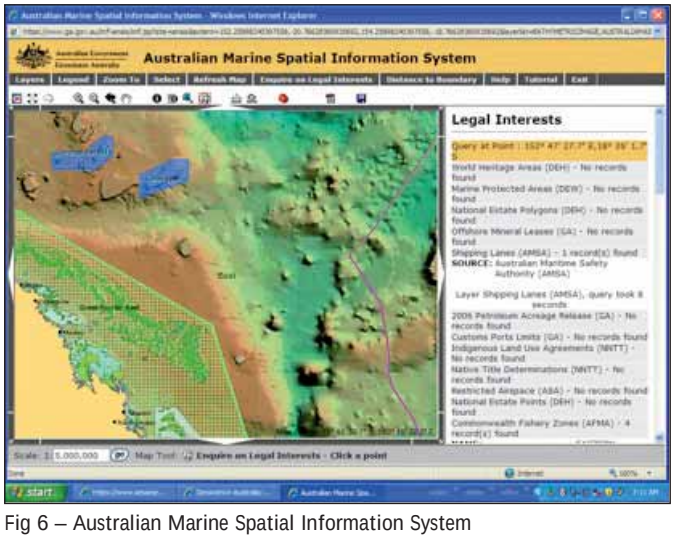

Fig 6 – Australian Marine Spatial Information System

The ArcGIS Server map interface used to develop the prototype allows participating stakeholders, who agree to supply spatial information for inclusion in this type of application, to maintain their own spatial data at their own sites, and in their own data formats, allowing datum and projection transformations to be done on the fly while dynamically incorporating all the various datasets in one interface for presentation and query [Figure 9]. The prototype was developed by storing all collected datasets on one web server, simulating dynamic data sharing possible. The level of dynamic collaborative governance that would allow the sharing of spatial data among stakeholders, in real time, is not yet in place.

A workshop was held in St. Margaret's Bay to demonstrate the prototype's functionalities to interested stakeholders. The general consensus, especially from community members, was that a marine cadastre would be a useful tool in the management of rights in their community and they would support their provincial government's involvement in further developments.

Natural Resources Canada, the Association of Canada Lands Surveyors, and the Canadian Hydrographic Association have shown interest in developing a national Canadian marine cadastre. A task force comprised some major stakeholder representatives, indicative of the recognition of the importance of collaboration, was set up to take the necessary steps to pursue funding for the effort. That initiative is in process and represents, in the Canadian perspective, a step forward in the development of a national marine cadastre.

Acknowledgement

The author acknowledges the support of COINAtlantic and Geoconnections, Canada. Also acknowledged is Mr. Daniel Jones, Department of Geomatics Engineering and Land Management, who was an important part of developing the St. Margaret's Bay prototype proof of concept marine cadastre. Also acknowledged are researchers from the Department of Geomatics Engineering, including Dr. Sue Nichols and Mr. Titus Tienaah, M.Sc.E. student in the same department.

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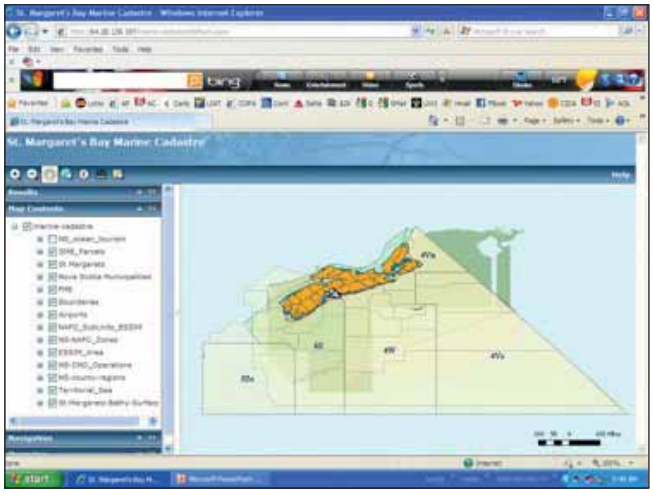


Fig 7 - COINAtlantic Marine Cadastre Prototype (Global View)

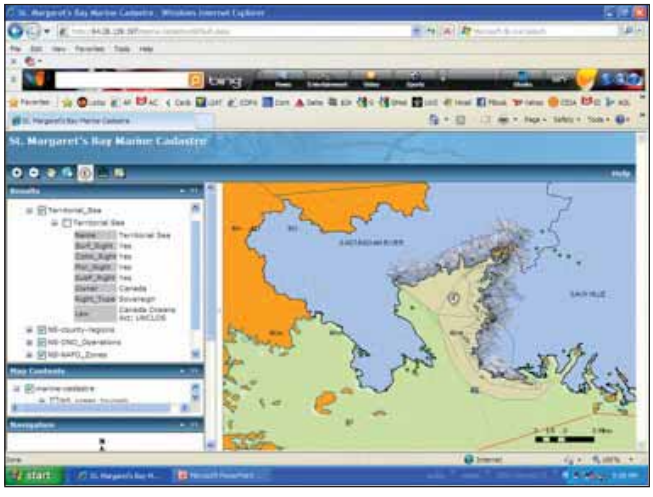


Fig 8 - COINAtlantic Marine Cadastre Prototype (Showing Detail Results)

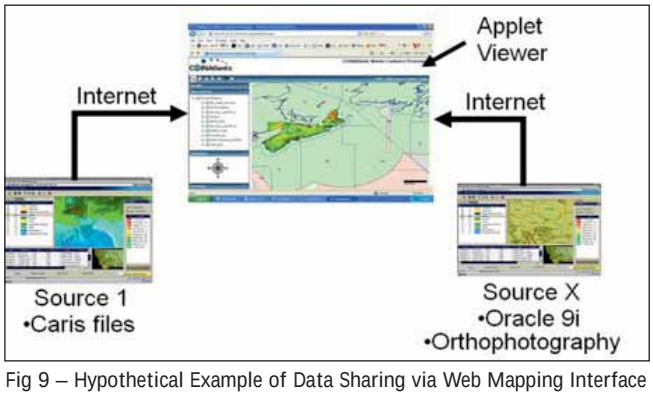


Fig 9 – Hypothetical Example of Data Sharing via Web Mapping Interface

Existing high precision GNSS receivers were not designed with LightSquared in mind and do not have protective filters. JAVAD GNSS has developed solutions to ensure your systems are compatible with LightSquared.

We have also invented a unique solution for timing applications in which we dynamically compensate for group delay variations with the accuracy of better than 100 picoseconds. We are developing techniques to reduce this to better than 10 picoseconds.

All we ship are LightSquared compatible

All we ship today are LightSquared compatible or eligible for free retrofit. We also offer to retrofit our existing receivers for $300 to $800, depending on the model.

We make competitors LightSquared compatible too!

We extend our LightSquared retrofit offer to receivers made by other manufacturers as well.

We also upgrade theirs

We offer not only to retrofit them to be LightSquared compatible; but we can also upgrade them to receive new GPS, GLONASS, and/or Galileo signals. All existing receivers that cannot track new GPS signals (L1C, L2C, L5) will soon be obsolete.

See www.javad.com

If you own a high precision GNSS receiver from another manufacturer and want to make them LightSquared compatible and/or upgrade them to receive new GPS signals, visit our website, www.javad.com, for details.

We were the first to

• Combine GPS and GLONASS • Track GLONASS-K L3 CDMA • Track Galileo E5 altBOC • Track Chinese Compass • Offer 12 (1989), 76 (1999), and 216 (2007) channel GNSS receivers.

We received highest score in Japanese CORS “GEONET” selection process and received USGS award for its high precision networks.

We are the only company who offers GNSS receivers with

• Galileo • QZSS and its L1C signal • GPS L5 • GLONASS • Mitigating SVN-49 anomaly • Best multipath reduction (German Aerospace report) • Lift & Tilt survey • Interference Analysis feature • In-band interference rejection feature • Calibrating GLONASS inter-channel biases (0.2 mm) • Fully integrated high precision GNSS RTK system • 6-pack RTK engine of up to 100 Hz.

LightSquared Inside

And Now...

Protected from ...
Compensated for ...
and Integrated with... LightSquared.

- LightSquared not only can coexist with GPS... It complements it.
- TRIUMPH-LS can benefit from LightSquared communication channels for receiving RTK corrections.
- LightSquared communication channels are much faster and less expensive than conventional channels for RTK correction transmissions.

What is LightSquared?

LightSquared is a gem! I am not only talking about its nationwide high-speed 4G capabilities and that it will be a boost to our lagging IT industry which has fallen behind 18 other nations. I am focusing on how it can beautifully complement high precision applications of GPS. It is a gem for GPS high precision users and for RTK.

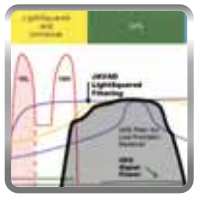
In our GPS receivers we have 6 different communication systems to transmit/receive RTK messages: 1) UHF, 2) Wi-Fi, 3) LAN, 4) GSM/GPRS, 5)Spread Spectrum, and 6) L-Band. None of them can conveniently provide a good, reliable and cost-effective RTK communication channel. I say LightSquared is a gem because of what it can do for GPS RTK applications.

Unfortunately, in the past several months so much misinformation has been published about this subject that many have been convinced that LightSquared and GPS cannot exist together. Every single GPS-related magazine is full of editorials and commentaries against LightSquared without giving substance and reason for what they write. There were even attacks on LightSquared executives for their political contributions and how they made their initial money! This is primarily the result of concentrated lobbies of two companies whose special interests might be affected if LightSquared is successful. The lucrative businesses and monopolies of OmniSTAR and StarFire are in danger! LightSquared is going to provide a better, faster, and cheaper communication channel for RTK and DGPS. LightSquared might and most probably will damage OmniSTAR and StarFire because it is a much better system; the same way e-mail damaged the facsimile business. It is the law of innovation.

They also use the scare tactics that LightSquared signals will interfere with GPS and that it costs billions of dollars to make the existing GPS receivers LightSquared compatible. It is not surprising that most of those who wrote letters to the FCC, testified in the Congress, and the supporting forces in the Congress against LightSquared, are either directly affiliated with these two companies or are influenced by them. In this article I try to address those issues that I am intimately involved and have direct knowledge.

Interference with High Precision GPS receiver

This is true. The root of the problem is us, the GPS manufacturers. We designed our receivers without paying reasonable attention to other systems that may come close to the GPS bands. The problem manifests itself in two ways: 1) Most GPS receivers do not have proper protective filters in the antenna section, and 2) The receivers don't have a means to indicate if there is any interference in the area of operation.



The first problem of inadequate filter causes our GPS receivers to "invite" LightSquared signals to arrive to our GPS receiver. This can block and/or damage the GPS signals and cause the receiver to not function properly.

We solved the first problem by adding a set of Ceramic and SAW filters in the signal entry to our GNSS receivers. The filters were all existing off-the-shelf components. The filter system works fine and does not impose any noticeable negative effect on the quality of GNSS signals and solution results. In particular in has no noticeable effect on the multipath mitigation capabilities of receivers that need intact and undisturbed GNSS signals. The cost of the additional filters is negligible.

The second problem is inadequate test and warning features inside GPS receivers. Most receivers do not give any information regarding the existence of interferences. It is exactly for the lack of such test features that caused NTIA to go through a solid month of hard work to test receivers using external means. Such external means include very expensive test equipment and sophisticated test plans which can only be carried out by highly experienced people. Interferences are not only from LightSquared. Even harmonics of a radio station signal can cause interference. GNSS receiver should have a means to alarm the user of the existing interferences in its area. It is impossible to assemble NTIA-like test setups in every area that users need to use their GNSS receivers and perform such tests ahead of each daily job.

We also have solved the second problem of “self test” by adding “interference analysis” feature to our GNSS receivers. This feature analyzes the effect of interferences in a much better way than NTIA test procedures specify and it does it in a much shorter time: It does it in 30 seconds, rather than 30 days, and it does it by a click of a button which any novice user can do easily in the field.

Why some claim technical problems exist?

The problem related to technical issues got eclipsed with political ones when some GPS manufacturers tried to wash their hands and blame everything on LightSquared, instead of focusing on solving problems that were purely technical in nature.

These manufacturers went as far as claiming that the technology to protect GPS against LightSquared does not exist today and will not exist during the next decade! This is a blatant lie, or at best it shows the technical ignorance of those who made the claim. Some prominent industry figures wrote letters to the FCC and testified before Congress. The letter of Hon. Schlesinger/Parkinson to FCC is one of these unfortunate examples. False claims and advice even misled the honorable General Shelton to deliver wrong testimony to Congress.

The Schlesinger/Parkinson letter claims that technology to filter out LightSquared signals and at the same time keep the GPS signals intact, does not exist and may not come to existence for many years. Listening to Prof. Parkinson’s “filter group delay” questions and comments in the NTIA hearing of August 26 2011, it became clear to me that Parkinson did not understand the innovation that I had explained to him two years ago. In this hearing Prof. Parkinson commented that filters to protect GPS and have “flat group delay” does not exist today. At ION 2009 I had explained him that we were able to compensate for GLONASS inter-channel biases with the accuracy of 0.2 millimeters, and because of that, our GLONASS was as good as GPS. I thought he understood the underlying principal that we compensate for group and carrier delay variations of filters, and filter group delay flatness was not an issue any more. The evening of the same day at ION, Parkinson presented a GPS history at GPS World dinner meeting and at the end he said, “And today Javad was talking about 0.2 millimeter accuracy.” He got a good laugh from the audience and I thought that it was just a joke. Later, at the NTIA conference when I heard Parkinson’s focus on group delay variations of filters and his claim that a filter to protect GPS and have flat group delay does not exist, I realized that his reference to my 0.2-millimeter compensation was not a joke and he had not really understood what I had explained to him. In any event, GPS positioning is much less sensitive to group delay variations, to the point that precision positioning users will not see any significant effect. Our empirical results confirm this as well.

It is unfortunate that Prof. Parkinson was able to entice Hon. Schlesinger to coauthor the letter that was sent to FCC Chairman Genachowski. Since my academic credentials are from the University of Iowa, it gives me special privilege to also let the distinguished senator from Iowa to know that his opposition to LightSquared is ill founded and the folks from John Deere are misleading him.

The reason why here I explain the history of this specific technical issue and give references is because it has been the erroneous foundation of letters sent to the FCC and testimonies given before the Congress. Furthermore, these letters have tilted the opinions of many people and journalists in the wrong direction. It seems to me that these wrong, biased, and unfounded reports have been used to gang up unfairly against LightSquared. The good thing about technical issues is that they can readily be demonstrated, as we have and will continue to demonstrate on any platform. Electrons do not have party affiliations and do not follow the guidance of special interest groups and lobbies.

The validity of my points is backed by the filter system that we have designed and are manufacturing today. It works well. It does not have flat “group delay” across the frequency band and it does not affect the integrity of GPS signals. In particular, the multipath mitigation features of the GPS signals are well preserved. All GPS receivers we ship today are LightSquared compatible or entitled to free retrofit to be LightSquared compatible .

Our group delay compensation technique also opens the door for time transfer applications in sub-

nanosecond level (as good as 0.1 or even 0.01 nanoseconds) without the need for temperature-controlled antennas. We plan to produce such products in a few months.

Retrofitting Existing Receivers

There has been a lot of discussion about what should be done with existing receivers in the field. I have the following points:

1. All existing receivers will be obsolete when new GPS satellites are launched. New GPS satellites will transmit “modernized signals” which, unlike P1 and P2 codes that we currently use, are not encrypted. Currently two of these modernized GPS satellites are on orbit and others will follow soon. It may take until 2020 before the constellation fully consists of all new satellites, but as soon as a few more are launched, users who have GPS receivers that receive the new signals will be able to benefit and have a competitive advantage in the marketplace.

2. All receivers that we currently ship are LightSquared compatible or are eligible for free retrofit. We have also offered to retrofit our existing receivers with cost of $300 to $800 depending on the model. Also, if customers chose to purchase these options, our receivers can track the new modernized GPS and GLONASS signals, as well as Galileo.

3. We have offered to retrofit receivers of other manufacturers to be LightSquared compatible. Details are in our website www.javad.com.

4. We also offer a better plan for the qualified existing units in the field. Instead of retrofitting the existing units to be LightSquared compatible and later buy an expensive new receiver, we offer attractive financial incentives to upgrade receivers to not only be LightSquared compatible, but also track new modernized GPS signals as well. To put this in perspective, a new modernized GPS receiver costs about $20,000, which must be purchased eventually. We offer a one-time option of discarding old receivers and purchasing new modern receivers at price of about $5,000. Existing qualified owners can select this one-time option or select to make their existing semi-obsolete receivers LightSquared compatible. One or the other, but not both! We do this for our existing receivers and receivers of other manufacturers in the field.

5. Existing old GPS receivers in the filed should not be a hindrance in the progress of this country to catch up in IT technology. We are currently behind 18 other nations in this area. It will be the shame of our generation if the next generation realizes that the existence of old GPS receivers was the reason they were deprived of LightSquared.

In summary, retrofitting the existing receivers can be win-win situations for all sides. Owners of existing GPS units may need to pay a little, but they will get a lot more in return; and they will not be stumbling blocks on the way of progress and innovations. GPS manufactures must also be not greedy and must cooperate for the win-win scenarios to materialize.

Retrofitting Military Receivers

There have been rumors that LightSquared signals affect military receivers. If this is true our military has a disaster in its hands. If military units cannot tolerate the LightSquared signals which 1) are far from the GPS band and, 2) are not coming from sophisticated jammers, how can they operate in a hostile theatre of operation? Were there not any anti-jam requirements in RFP of military GPS receivers? Has there been any anti-jam test performed on military receivers? Is LightSquared the first test?

The irony is that the filters that we have designed can tolerate LightSquared signals and track encrypted P-codes, but our military receivers cannot tolerate LightSquared while military receivers have access to un-encrypted P-codes which are up to 1,000 times stronger than the encrypted versions that we track.

Stand up and be counted!

The lobbies against LightSquared are powerful. They have wrongly convinced a lot of people that GPS and LightSquared cannot coexist. If they can stop LightSquared, the GPS high precision users will lose the opportunity to have a fast, reliable, nationwide and inexpensive RTK communication channel. Looking at the bigger picture, the U.S. will lose a chance to catch up with the rest of the worlds in IT technology. Also, respect for spectrum allocation will disappear and FCC's role will get reduced to almost nothing and special interest groups will manipulate it. Most important of all, the incentive to strive for innovation will be damaged and those who have financial interest in old technologies will prevail.

My only interest in this issue is to integrate LightSquared communication channels inside our GNSS receivers and provide fast, reliable and inexpensive RTK. I am absolutely sure that we are not up against any laws of physics. We already ship LightSquared compatible GNSS receivers. I publish this article fully on my own initiative. I have had no encouragement, direction, financial support, or incentive from LightSquared in doing so.

Please explore the facts. Stand up and be counted. Support innovation. In the GPS high precision community we have a lot to lose if LightSquared loses.

Credentials

In 1983, I co-pioneered high precision GPS at Trimble by introducing Trimble 4000-S. It was a 4-channel geodetic receiver. I single-handedly wrote its entire software. 16 hours a day, 7 days a week for several years. It was the first commercial geodetic GPS receiver and it changed the geodetic survey industry.

Later, after I founded Ashtech; in 1989 we introduced Ashtech L-12. This was the first All-in-One, All-in-View 12-channel geodetic GPS receiver. After that, we introduced Ashtech M-12 and the legendary Ashtech Z-12. These were the first truly portable geodetic GPS receivers. We were also the first to integrate GPS and GLONASS satellites. It took all other companies more than 10 years to catch up and add GLONASS to their receivers. Ashtech still is a very successful company and after changing hands several times, was recently purchased by Trimble.

In 1998 I founded JAVAD Positioning Systems (JPS) and introduced Legacy, Odyssey, and Regency products followed by HiPer. It was a 76-channel geodetic receiver. Other companies later copied HiPer. Today many of GNSS receivers look like it. I sold JPS to Topcon, who changed its name to Topcon Positioning System (TPS) and it is a very successful company.

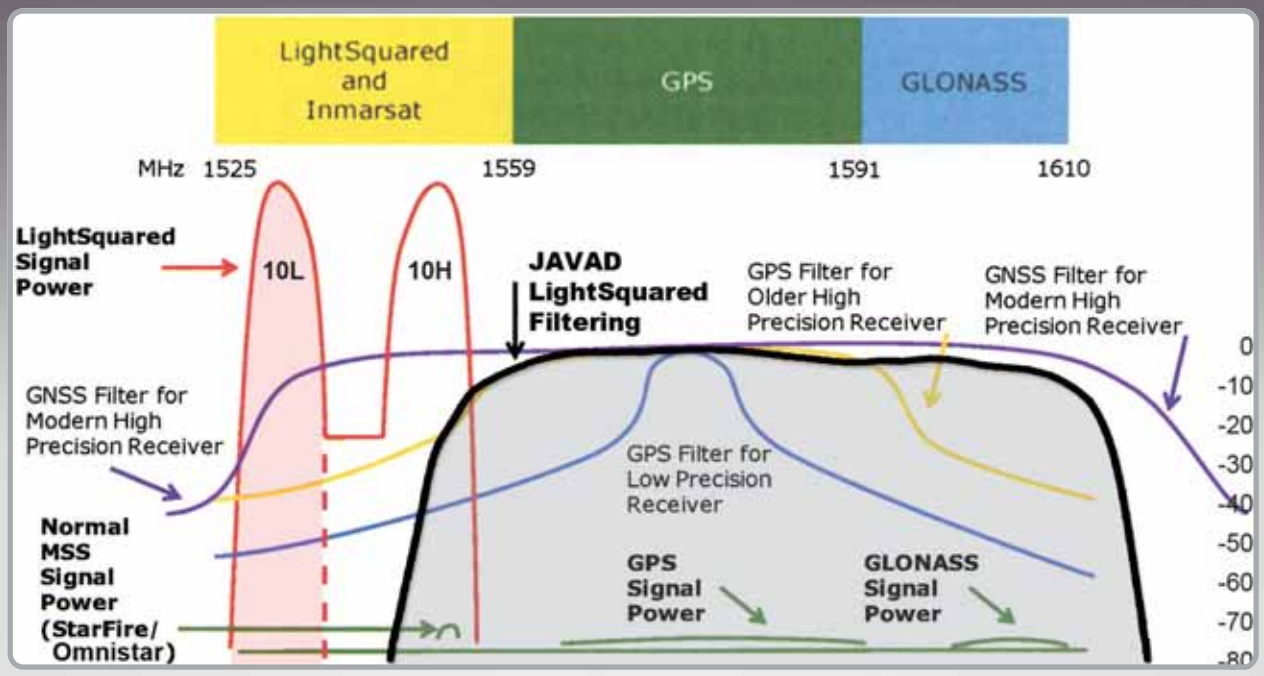
In 2007, after my obligations to Topcon ended and according to the provisions of our agreement, I founded JAVAD GNSS and introduced TRIUMPH products. These were 216-channel receivers, integrated with several communication channels. We also introduced their ALPHA, DELTA, and SIGMA versions. We were again the first to offer European Galileo and Japanese QZSS tracking in mass production. TRIUMPH technology has been shown to have the best signal quality and best multipath reduction capabilities against all others tested by the German Aerospace. We also introduced GLONASS inter-channel (group/carrier delay) calibration to 0.2 millimeter which made GLONASS FDMA as good as GPS CDMA. JAVAD GNSS is growing fast and gaining market share.

In June 2010, we introduced the revolutionary and the only fully integrated geodetic receiver in the market, TRIUMPH-VS, with features like "Lift & Tilt", "Interference Analyzer", and "Visual Stakeout". It is the most advanced high precision GNSS receiver in the market capable of tracking current and next generation signals of GPS, GLONASS, QZSS, and Galileo signals.

In October 2011, we introduced LightSquared compatible GNSS receivers and we plan to introduce LightSquared integrated GNSS receivers and sub-nanosecond (100- and 10-picoseconds) time-transfer products.

I hold B.S. degree in Electronic Physics, M.S. in Electrical Engineering, M.S. in Mathematics, and Ph.D. in Electrical Engineering from the University of Iowa, Iowa City, Iowa, U.S.A.

Javad Ashjaee



LightSquared-Protected:
Protected by the above JAVAD LNA system. For all precision positioning applications. Multipath mitigation features preserved.
November 2011

LightSquared-Compensated:
Protected by the above JAVAD LNA system and dynamically compensated for group delay variations (better than 100 picosecond). For precision timing applications.
March 2012

LightSquared-Integrated:
Same as two above plus LightSquared communication module inside.
June 2012

For the latest GNSS news and technical information visit www.javad.com

Absolute sea level rise estimation using tide records and GPS observations

The issue of re-defining the Egyptian vertical geodetic datum and the existing problem of sea level rising has attained a great attention in the geodetic community

Dr Eng Ahmed Shaker
Prof. of Surveying and Geodesy
Survey Department ,Shoubra Faculty of Engineering-Banha University
Cairo - Egypt

Dr Eng Dalal Alnaggar
Prof. of Surveying and Geodesy
National Water Research Center - Ministry of Water Resources and Irrigation
Delta Barrages – Qalyubia Governorate- Egypt

Dr Eng Abdallah A Saad
Prof. of Surveying and Geodesy
Survey Department ,Shoubra Faculty of Engineering-Banha University
Cairo - Egypt

Dr Eng H Faisel
Researcher, Survey Research Institute, National Water Research Center, Giza, Egypt

Recent geodetic and oceanographic MSL studies have shown that neither the sea levels nor the land are permanent with respect to time variations. The data analysis of tide gauges produces 'relative' sea level changes. However, using tide gauge data alone, it is impossible to distinguish between any true sea level variation and any changes in ground level at a tide gauge site. GPS monitoring can be used to decouple vertical land movements from change in relative MSL, so that tide gauge can provide estimates of changes in absolute MSL. In order to monitor "absolute" changes in sea level, the rates of any vertical land movements at a tide gauge must be determined and subtracted from the resulting rate of tide records [e.g. IPCC, 2001 and Bingley et al, 2000]. Consequently, a sea level monitoring system has been installed at Alexandria tide gauge site containing a GPS receiver as a geodetic monitoring technique to perform this task.

Methodology

Teferle [2000] and Bingley et al [2001] provide a processing approach for GPS data processing and analysis for similar situations. The computational procedures consist of the following steps:

- Obtaining GPS raw data of some stations of the International Geodynamic Service (IGS) global high-precision GPS network.
- Processing the dual-frequency GPS data of the TG GPS station with the IGS stations on a 24-hour basis to produce ionospherically-free double difference observables with integer ambiguities not fixed.
- The tropospheric delays are mitigated by using Saastamoinen model.
- Constraining the IGS stations to their precise coordinates relative to the most recent International Terrestrial Reference Frame (ITRF) definition.
- The obtained height time series of the TG GPS station is firstly fitted to a linear regression model in a least squares sense.
- From this regression model, an estimate of the linear velocity is obtained.
- The daily height estimates are differenced from the linear velocity estimates to obtain a residual time series.
- A de-trended height time series is then obtained by computing the weighted root mean square (WRMS) of the height residuals weighted by the standard errors of the daily height estimates.
- Then, any height residual found to be greater than three times the WRMS is defined as an outlier and removed from the height time series.
- Another linear regression model is fitted to the clean height time series in order to obtain a revised linear velocity estimate of the TG GPS station height.

This processing approach has been utilized in the current research study to estimate a preliminary land movement measure of the Alexandria Tide Gauge station.

The data used and their processing and implementation

A new Sea Level Observing System (SLOS) installed at the Tide Gauge station in Alexandria consists of three devices integrated together in a unified scheme: a tide gauge, a meteorological unit, and a satellite-based GPS geodetic receiver, Figure 1.

Utilized tide gauge instrument

The instrument used is called Wave and Tide Gauge WTG904 Series 3,it measures instantaneously the water column pressure, and converts it to height of water with respect to a specific user-defined location. The pressure sensor output is digitized at a 2 Hz sampling rate via a 14-bit A/D converter controlled by a 32-bit CMOS microprocessor. The tide is calculated continuously and recorded automatically every 10 minutes. The measuring depth range of the gauge is from 0 to 35 meters, with a precision of ± 0.15 % of the measuring range, and a resolution of 0.006 % of the measuring range. Knowing that the depth of the water in the steeling well in Alexandria is approximately 1.5 meter, it can be expected that the accuracy of the measurements is 0.2 cm. The apparatus has a built-in battery-backed 64KB RAM memory that can record measurements up to 90 days [InterOcean, 1999]. . A communication interface (RS485 or RS232C) is used to download the recorded data to an attached computer. There are two ASCII output files, for both tide and wave recorded data, which could be used for further analysis and plotting procedures.

The WTG904 Series 3 instrument measures instantaneously the water column pressure, and converts it to height of water with respect to a specific user-defined location. The instrument has been installed and calibrated so that its zero coincides with the zero of the staff rod fixed inside the tide well. Hence, its recorded readings represent the water level above the Egyptian vertical datum of 1906.

Utilized meteorological device

The utilized device, WMS-14 from Omega Inc., is a state-of-the-art microprocessor-based weather station. The Model WMS-14 features a combination wind vane and three-cup anemometer with 40 feet of interconnecting cable. The instrument has five accurate and reliable sensors for collecting different types of meteorological data. A wind speed sensor combines a three-cup anemometer and a wind vane on a single axis. This sensor measures, computes, and stores wind speed and wind direction. Barometric pressure is sensed using a piezoresistive sensing element, which responds to changes in pressure with a corresponding change in resistance. The resistance is converted to a voltage form, which the microprocessor calculates the pressure at the elevation at which the barometer is located. Temperature is sensed using a thermistor element whose resistance changes in response to temperature fluctuations. Relative humidity is sensed by changes in capacitance of a thin polymer film as it absorbs moisture, or sheds it to, the surrounding air. The rain gauge used with the WMS-14 is a traditional tipping bucket design. The accuracy measures of the sensors are [Omega, 1999]:

For barometric pressure:	± 5 mb
For Wind Speed:	± 3 mph
For Wind Direction:	± 2o
For Rain precipitation:	± 1 %
For Temperature:	± 2o F
For Relative Humidity:	± 3%

GPS data at the tide gauge station

Lieca GPS system 500 comprises GPS receiver, terminal and post-processing software are used. The SR520 dual-frequency GPS receiver has 12 L1 and 12 L2 continuous data tracking channels that track both codes and carrier phases of the transmitted satellite signals. It tracks up to 12 simultaneously satellites. The collected data is stored on a standard PCMCIA cards that has storage capacity up to 85MB (i.e., up to three months of measurements.

The available 24-hour data sets of the GPS receiver located at Alexandria, depicted in Table 1, consist of almost-continuous 477 days of raw data from November 2000 to July 2002. The existed few gaps in the time series are due to some minor operating problems in the installed GPS receiver.

IGS GPS data

24-hour raw data of three IGS stations have been downloaded in the Rinex format. Those stations, as depicted in Figure 2, named DRAG, RAMO, and NICO, have been selected to be the most nearest IGS stations to Alexandria in order to minimize the baseline lengths as possible. It is a matter of fact that most error sources in GPS networks, especially the tropospheric and ionospheric delays, are baseline dependant errors [e.g. Sorour, 2004].

ITRF and its role

The ITRF is realized through the global Cartesian coordinates and linear velocities of a global set of sites equipped with

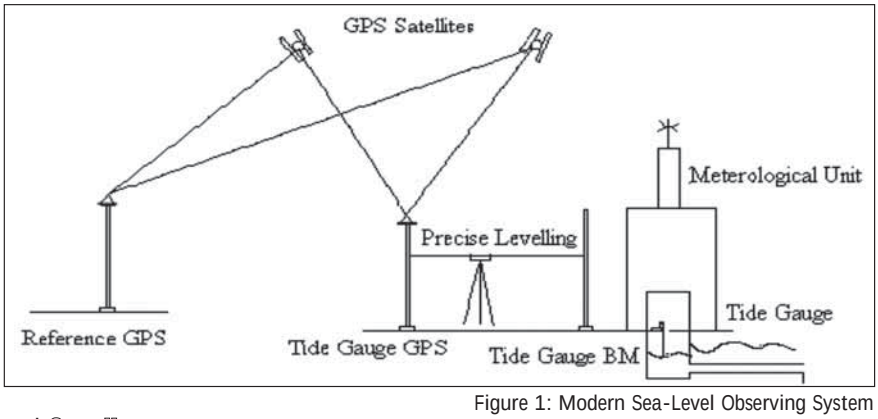


Figure 1: Modern Sea-Level Observing System

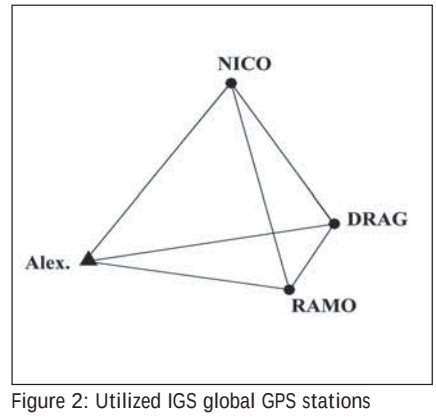


Figure 2: Utilized IGS global GPS stations

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Since 1958

Launched and Coming New Produsts:
GTA1000 series Automated Gyroscope Station
F50 GNSS/GIS Handhelds
DS03 High Precision Level
TS650 Basic series Total Station with R300/R500 EDM
TS680 Power series Total Station with R300/R500 EDM
TS680 Ultra series Total Station with R800/R1000 EDM
TS810 Power series Total Station with R500 EDM
TS810 Ultra series Total Station with R800/R1000 EDM

F50

GTA1010

DS03

TS810 Ultra series

TS650 basic series

TS680 Power series

TS680 Ultra series

SUZHOU FOIF CO., LTD.
Professional Manufacturer of Surveying Equipments

Year	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
2000												
2001												
2002												

Table 1: Available GPS observations at the installed Tide Gauge station

Station	X ± σX	Y ± σY	Z ± σZ
NICO	4359415.849 ±0.004	2874116.974 ±0.003	3650777.712 ±0.003
RAMO	4514722.017 ±0.008	3133507.725 ±0.006	3228024.574 ±0.006
DRAG	4432980.874 ±0.128	3149431.992 ±0.110	3322110.339 ±0.099

Table 2: Coordinates of utilized ITRF2000 stations (m)

Station	RX ± σRX	RY ± σRY	RZ ± σRZ
NICO	-0.1350 ± 0.0017	0.0139 ± 0.0012	0.0138 ± 0.0014
RAMO	-0.0179 ± 0.0032	0.0161 ± 0.0024	0.0148 ± 0.0023
DRAG	-0.0369 ± 0.0354	0.0104 ± 0.0305	0.0074 ± 0.0275

Table 3: Rate of velocities of utilized ITRF2000 stations (m)

	Minimum	Maximum	Mean
Height time series	30.556	30.602	30.578
Residuals time series	-0.022	0.025	0.000

Table 4: Height and residuals time series (m)

various space geodetic observing systems, and it is maintained by participating agencies. Unlike some of the older terrestrial reference frames, the ITRF allows for the relative motions of sites on the Earth's surface, due to plate tectonics as well as other local effects. In March of 2001, ITRF2000 was released and it is the most extensive and accurate terrestrial reference frame ever developed and includes positions and velocities for about 800 stations located at about 500 sites. Based on the internal consistency of the independent solutions included in ITRF2000, the global frame scale and origin stability over 10 years is estimated to be accurate in scale to better than 0.5 parts per billion [Altamimi, 2003, and Boucher et al, 2004].

Therefore, the ITRF2000 coordinates (X, Y, Z) and velocities (RX, RY, RZ) at epoch 1997.0 of the three utilized IGS stations have been obtained [http://large.ensg.ign.fr/ITRF/ITRF2000]. Those figures are shown in Table 2 and Table 3.

GPS data processing

It is known that processing GPS long baselines is affected by three main sources of errors, namely the orbital, tropospheric , and ionospheric errors. Hence, a processing strategy has been developed to account for each type of errors in order to come up with the most reliable coordinates of the GPS tide gauge station. This methodology consists of the following criteria:

- The daily final IGS precise orbit (SP3 format) is obtained, e.g. from ftp://igscb.jpl.nasa.gov/pub/product/, which is available at 12 days latency. This orbit is computed based on the analysis of all available IGS network stations, hence it estimates and gets ride of orbital errors of GPS satellites.

- The daily ionospheric estimated file is obtained from one of the IGS processing data centers, e.g. the CODE center of Bern University (ftp://aiub.unibe.ch). Such a daily solution estimates the ionospheric effects covering the area from latitude -88.32o to latitude 87.46o through the analysis of data collected from 139 global IGS stations. Thus, incorporating these ionospheric models in the processing stage for each GPS day enables the generating of iono-free double difference solutions for almost all processed GPS baselines.

- For the tropospheric errors, apply the Saastamoinen tropospheric model with a 1-hour interval for the estimation of the zenith delay. This global model, with such computation interval, produces accurate estimate of the long baselines components [Rabah, 2004].

- Since the installed GPS at the tide gauge station at Alexandria is surrounded with many obstructions especially the communication radio towers, it is preferable to increase the cut-of angle to 25 o. Even though this criterion reduces the number of the processed GPS data, it gets ride of near-ground multipath reflected signals. In the case in hand, the data processed for each event contain 24-hour continuous series, which produce a high degree of freedom even with such cut-of angle. Saad and Al-Tokhy [2001] have concluded that up to 30o musk angle is suitable in most geodetic and surveying works.

- Since the ITRF2000 coordinates of the utilized IGS stations are referenced to epoch 1997.0, a fundamental step was to compute the corresponding coordinates for each station at each processed day of the available time series. That step has been performed utilizing the next formulas [Boucher et al, 2004]:

$$X(t) = Xo + RX * (t - 1997)$$

$$Y(t) = Y0 + RY * (t - 1997)$$

$$Z(t) = Z0 + RZ * (t - 1997)$$

where,

t is the date, in years, of the processing day

X_o, Y_o, Z_o are the given ITRF2000 coordinates at epoch 1997.0

The obtained results

The computed coordinates of the IGS stations are used as fixed values in order to estimate the corresponding coordinates of the GPS station at the tide gauge.

This strategy has been applied for each day of the available 477-day GPS data set. Therefore, a time series of the Alexandria tide gauge GPS station has been attained.

The raw height time series range from 30.562 m to 30.613 m with an average of 30.575 m and a standard deviation equals 0.010 m. The previously mentioned analysis scheme proposed by Teferle

GPS, GLONASS, GALILEO[1], COMPASS

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[1] Developed under a License of the European Union and the European Space Agency

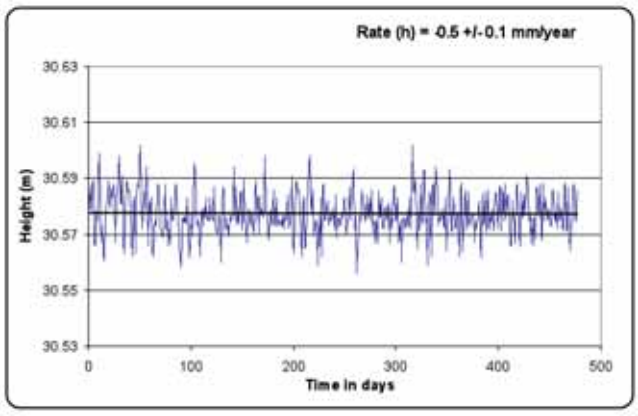

Figure 3: Revised GPS height time series and velocity estimates

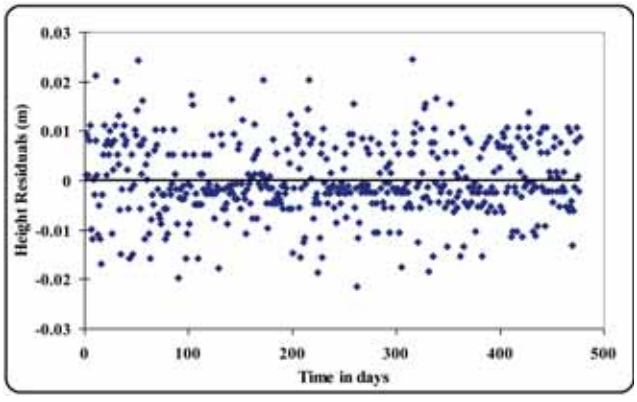

Figure 4: Residuals of revised height time series

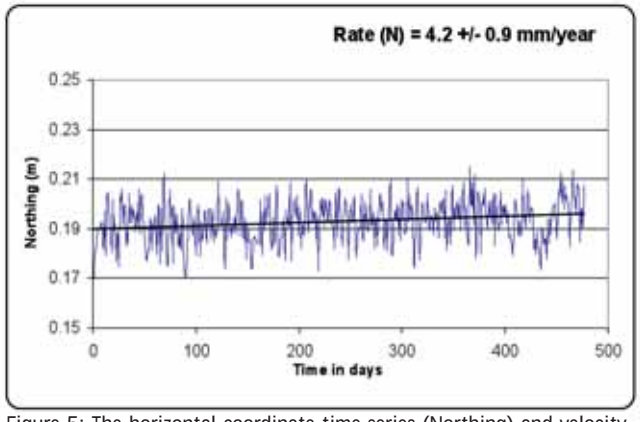

Figure 5: The horizontal coordinate time series (Northing) and velocity estimates

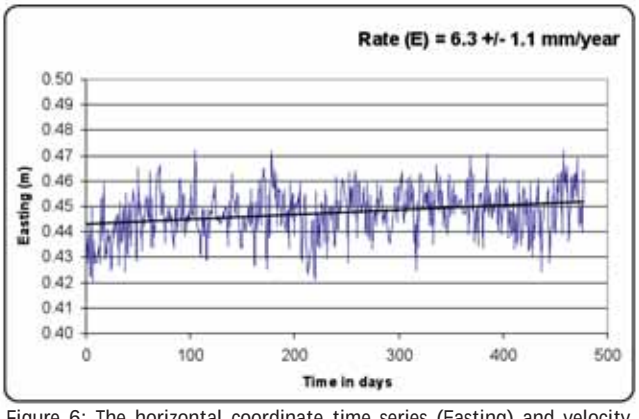

Figure 6: The horizontal coordinate time series (Easting) and velocity estimates

[2000] and Bingley et al [2001] has been obeyed. Fitting a linear regression to those values produces an estimate of the height velocity of -0.52 mm/year. The resulted residual values vary between -0.028 m and 0.030 m, with a mean equals zero Then, weighted height residuals have been computed and the residuals that are found to be greater than three times the WRMS are defined as outliers and removed from the height time series. The clean set of heights range from 30.556 m to 30.602 m with an average of 30.578 m and a standard deviation equals 0.008 m. Another linear regression model is fitted to the clean height time series. This model produces a revised linear velocity estimate of the TG GPS station height that is equals -0.47 ± 0.08 mm/year. The results are tabulated in Table 4 and depicted in Figure 3 and Figure 4.

5- Investigating the horizontal displacement

Even though the geodetic height of the GPS station in hand is the most important item in the context of this research, the horizontal coordinates of the station have been also analyzed.

The same analysis strategy has been applied to the horizontal coordinates of the GPS at the tide gauge station. The Cartesian coordinates time series and the horizontal coordinates time series (Northing and Easting) have been obtained (Figure 5 and Figure 6). The revised trends for the Northing and Easting components have been estimated as 4.2 ± 0.9 mm/year and 6.3 ± 1.1 mm/year respectively. Similar results have been reported by El-Fiky [2000], where the analysis of GPS observations collected at Helwan revealed that it moves northward, relative to the Eurasian plate, at a rate of 6 mm/year.

6- Conclusions and recommendations

Having estimating the height trend, the absolute sea level rise rate may be determined. Refereeing to [Faisel, H., 2005], the reliable estimate of the relative sea rise rate has been computed as 1.7 mm/year. Taking out the land deformation rate at the tide gauge station, which is -0.47 mm/year, the absolute sea level rise at Alexandria becomes 2.17 mm/year.

However, because of the relatively short time span of the utilized data sets, it is recommended to continue collecting continuous GPS measurements at the Alexandria tide gauge station and performing further analysis in order to be able to estimate a precise land movement measure and, then, be capable of determining the absolute sea level rise in Egypt. Tide Gauge stations should be established at other well distributed places at the Egyptian shores. Similar investigations should also be done at those proposed stations to assure the obtained results.

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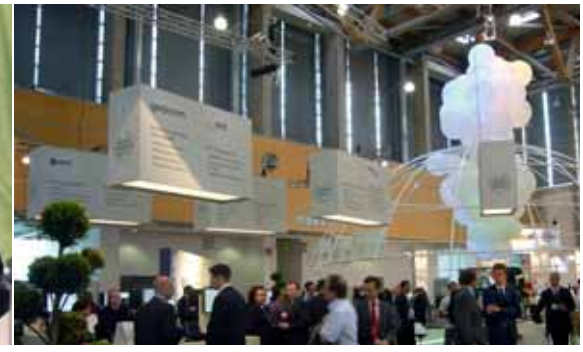
Emerging technologies: The driving force behind new approaches and applications

INTERGEO 2011, September 26 – 29, 2011, Germany



After the three-day INTERGEO event in Nuremberg, one thing was clear: "INTERGEO is a platform for dialogue between technology users from a variety of sectors – dialogue that gives rise to new approaches and applications. The resultant scope of possible new uses is considerable," stated Olaf Freier, Managing Director of HINTE GmbH and INTERGEO organiser. "There is quite simply no better specialist platform for suppliers and users to network than this leading international trade fair," said Professor Karl-Friedrich Thöne, President of INTERGEO patron DVW e.V. – the German Society for Geodesy, Geoinformation and Land Management.

A representative survey of exhibitors highlighted the optimistic mood at INTERGEO. Just under 70 percent of exhibitors felt the innovation rate in the industry was higher, while 21 percent expected an equally strong impetus from innovations.

Some 16,000 trade visitors from 80 different countries attended the 17th INTERGEO to find out about new developments. The event was more international than ever, with more than one in four visitors travelling from abroad. Attracting 1,500 participants, the conference included 140 lectures and provided an opportunity for intensive interdisciplinary discussions on around 40 topics.

Collaboration with the SatNav Forum proved highly successful. For the first time, the BMVBS (German Federal Ministry of Transport, Building and Urban Development) and BITKOM (Federal Association for Information, Technology, Telecommunications and New Media) held the annual navigation conference in parallel with INTERGEO. "Never has there been such intensive dialogue between politicians and representatives from geoinformation technologies as at this year's INTERGEO. This provides clear proof of geoinformation's current and future significance in everyday life," said DVW President Thöne. Discussions on further intensifying and continuing collaboration have already been agreed. On a tour of the three trade fair halls with a total exhibition area of 28,000 square metres, BMVBS State Secretary Rainer Bomba was impressed by the numerous solutions on offer from industry and service providers.

Exhibitors provided impressive confirmation of the event's success. Some 92 percent of participating companies, institutions and associations indicated that they had achieved their trade fair targets. Their top priorities were cultivating new and existing contacts and presenting innovations. More than 85 percent of exhibitors gave one of the top 3 ratings when evaluating the overall impression of INTERGEO. A high proportion of just under 89 percent indicated that they would be returning to the trade fair. And 16 percent of these companies spontaneously indicated that they would be increasing their level of participation. Exhibitors were united in their praise for the high quality of contacts they made.

Trade visitors – 98.7 percent according to the representative visitor survey – were happy to travel some way to the event. Thanks to intensive media networking worldwide and a high level of acceptance for INTERGEO's mobile concept, more than 53 percent travelled to Nuremberg from a distance of more than 300 kilometres. This is 13 percent higher than the figure for the previous year. The long journey proved worthwhile for first-time visitors, too. They accounted for 35 percent of total visitor numbers. Some 95 percent of visitors participating in the survey rated the range of products and services on offer positively. Their top priority was to find out about innovations, obtain a general overview of what was on offer, establish and cultivate contacts, and take a closer look at specific products.

"INTERGEO is one of Trimble's most important events," said Chris Gibson, Vice President of the conference sponsor. One key factor that made INTERGEO so important for companies was the high proportion – a total of 75 percent – of people making or involved in making decisions among the trade public. Just under a third of visitors reported that they had placed orders at INTERGEO or had indicated at the fair that they would be doing so. Nearly 70 percent of the high proportion of decision-makers attending the event wait for INTERGEO before placing their orders.

The focus in 2011 was on geodata infrastructure, sensors and 3D mapping. Olaf Freier expects these topics to be joined by smartphones at INTERGEO 2012 in Hanover.

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"Retrofitting the existing receivers can be a win-win situation"

Javad Ashjaee, President and Chief Executive Officer, Javad GNSS in a recent statement presents his views on LightSquared and GPS interference issue. Here are the excerpts

LightSquared is a gem! I am not only talking about its nationwide high-speed 4G capabilities and that it will be a boost to our lagging IT industry which has fallen behind 18 other nations. I am focusing on how it can beautifully complement high precision applications of GPS. It is a gem for GPS high precision users and for RTK.

In our GPS receivers we have 6 different communication systems to transmit/receiver RTK messages: 1) UHF, 2)Wi-Fi, 3)LAN, 4)GSM/GPRS, 5)Spread Spectrum, and 6) L-Band. None of them can conveniently provide a good, reliable and cost-effective RTK communication channel. I say LightSquared is a gem because of what it can do for GPS RTK applications.

Unfortunately, in the past several months so much misinformation has been published about this subject that many have been convinced that LightSquared and GPS cannot exist together. Every single GPS-related magazine is full of editorials and commentaries against LightSquared without giving substance and reason for what they write. There were even attacks on LightSquared executives for their political contributions and how they made their initial money! The root of the problem is us, the GPS manufacturers. We designed our receivers without paying reasonable attention to other systems that may come close to the GPS bands. The problem manifests itself in two ways: 1) Most GPS receivers do not have proper protective filters in the antenna section, and 2) The receivers don't have a means to indicate if there is any interference in the area of operation.

The first problem of inadequate filter causes our GPS receivers to "invite" LightSquared signals to arrive to our GPS receiver. This can block and/or damage the GPS signals and cause the receiver to not function properly. We solved the first problem by adding a set of Ceramic and SAW filters in the signal entry to our GNSS receivers. The filters were all existing off-the-shelf components. The filter system works fine and does not impose any noticeable negative effect on the quality of GNSS signals and solution results. In particular in has no noticeable effect on the multipath mitigation capabilities of receivers that need intact and undisturbed GNSS signals. The cost of the additional filters is negligible.

The second problem is inadequate test and warning features inside GPS receivers. Most receivers do not give any information regarding the existence of interferences. It is exactly for the lack of such test features that caused NTIA to go through a solid month of hard work to test receivers using external means. Such external means include very expensive test equipment and sophisticated test plans which can only be carried out by highly experienced people. Interferences are not only from LightSquared. Even harmonics of a radio station signal can cause interference. GNSS receiver should have a means to alarm the user of the existing interferences in its area. It is impossible to assemble NTIA-like test setups in every area that users need to use their GNSS receivers and perform such tests ahead of each daily job. We also have solved the second problem of "self test" by adding "interference analysis" feature to our GNSS receivers. This feature analyzes the effect of interferences in a much better way than NTIA test procedures specify and it does it in a much shorter time: It does it in 30 seconds, rather than 30 days, and it does it by a click of a button which any novice user can do easily in the field.

There has been a lot of discussion about what should be done with existing receivers in the field. I have the following points:

1. All existing receivers will be obsolete when new GPS satellites are launched. New GPS satellites will transmit "modernized signals" which, unlike P1 and P2 codes that we currently use, are not encrypted. Currently two of these modernized GPS satellites are on orbit and others will follow soon. It may take until 2020 before the constellation fully consists of all new satellites, but as soon as a few more are launched, users who have GPS receivers that receive the new signals will be able to benefit and have a competitive advantage in the marketplace.

2. All receivers that we currently ship are LightSquared compatible or are eligible for free retrofit. We have also offered to retrofit our existing receivers with cost of $300 to $800 depending on the model. Also, if customers chose to purchase these options, our receivers can track the new modernized GPS and GLONASS signals, as well as Galileo.

3. We have offered to retrofit receivers of other manufacturers to be LightSquared compatible.

4. We also offer a better plan for the qualified existing units in the field. Instead of retrofitting the existing units to be LightSquared compatible and later buy an expensive new receiver, we offer attractive financial incentives to upgrade receivers to not only be LightSquared compatible, but also track new modernized GPS signals as well.

In summary, retrofitting the existing receivers can be win-win situations for all sides. Owners of existing GPS units may need to pay a little, but they will get a lot more in return; and they will not be stumbling blocks on the way of progress and innovations.

There have been rumors that LightSquared signals affect military receivers. If this is true our military has a disaster in its hands. If military units cannot tolerate the LightSquared signals which 1) are far from the GPS band and, 2) are not coming from sophisticated jammers, how can they operate in a hostile theatre of operation? Were there not any anti-jam requirements in RFP of military GPS receivers? Has there been any anti-jam test performed on military receivers? Is LightSquared the first test? The irony is that the filters that we have designed can tolerate LightSquared signals and track encrypted P-codes, but our military receivers cannot tolerate LightSquared while military receivers have access to un-encrypted P-codes which are up to 1,000 times stronger than the encrypted versions that we track.

House Small Business Committee asks the FCC to halt waiver on LightSquared

House Small Business Committee Chairman Sam Graves (R-MO) along with eight members of the Committee sent a letter to Federal Communications Commission (FCC) Chairman Julius Genachowski requesting that the FCC not proceed with LightSquared's waiver until federal testing ascertains that there will be no interference with all types GPS devices. The Committee also requested the FCC to report their action plan regarding the proposal to the Committee. LightSquared is proposing to build a ground-based broadband network that could interfere with current GPS technology and impact millions of small businesses. "While LightSquared's aim to increase broadband to rural areas is a noble goal, we must find a solution without jeopardizing established GPS systems and further burdening small businesses," said Graves. "Under the current LightSquared proposal, small businesses would be left to foot the bill that will easily cost billions to replace or retrofit their current GPS devices. "Small companies should not be required to spend one dime on account of this plan—and that is why we are calling on the FCC to put a hold on the waiver until all federal tests make clear there will be no interruptions to current GPS systems."

LightSquared and PCTEL to resolve precision GPS applications

PCTEL has developed an antenna that will allow existing high precision users to retrofit their GPS devices to make them compatible with LightSquared's network. This antenna provides high precision GPS users with another in a series of solutions to make their equipment LightSquared-compatible. PCTEL's antenna solutions address applications including public safety, agriculture, construction and aviation. The new antenna will be independently tested with a range of receivers at the world-renowned Alcatel-Lucent Bell Labs in Murray Hill, NJ.These solutions will undergo extensive National Telecommunications and Information Administration (NTIA) and Federal Communications Commission (FCC) testing in the coming weeks. *www.lightsquared.com*

"A general GNSS industry view that retro-fitting new filters on all fielded receivers was impractical"

John Pottle Marketing Director, Spirent, Positioning and Navigation Group on LightSquared and GPS interference issue

LightSquared has forced to see GPS device makers what they could not foresee earlier. Has it caught GPS device makers unguarded?

The GNSS community has been operating on the assumption that the band that LightSquared would use, just below the GPS L1 band, would not be occupied by a high power terrestrial signal. In other words, the assumption has been that GPS would not have "noisy neighbours". The current debate between LightSquared and the GNSS community is whether LightSquared signals in the adjacent band to GNSS L1 are powerful enough to cause operational issues for GPS receivers. The results of the initial testing have been published and are available online. Further testing based on a revised LightSquared signal, with less power directly adjacent to GPS L1, is now underway and results are due to be published later in 2011.

What is the Spirent's position on LightSquared GPS interference issue?

For many years Spirent has provided test equipment that enables quantification and analysis of GPS system performance. We also supply systems that enable GPS performance to be evaluated in the presence of one or more interference signals. As such, Spirent's position on LightSquared has been that it's helpful to assess quantitatively effects of the proposed LightSquared signals on GNSS receiver performance. This is what has been done in the testing conducted under the auspices of the FCC-mandated Technical Working Group.

How can Spirent help in addressing this issue?

Spirent has helped in three ways: provision of test equipment to generate the signals involved (GNSS and LightSquared simulated signals); providing expertise on test methodology; and providing automation scripts to run the hundreds of tests that have been defined by the Technical Working Group.

Do you think that filter in GPS can solve the problem?

There has been a lot of debate over the "right" level of filtering on GPS receivers in future. However, a major consideration is that there are literally millions of GPS receivers already in the field and being used by consumers, businesses and governments for a huge range of applications. At a recent debate on this topic at the Institute of Navigation conference in Portland, Oregon, USA there was a general GNSS industry view that retro-fitting new filters on all fielded receivers was impractical.

Can there be a scenario where GPS and LightSquared network can comfortably coexist?

This is a difficult question to answer until further test data is available. The current testing will report from later this year and this question will be assessed by LightSquared, the GNSS community and the FCC.

Javad to discuss GPS receiver filter solutions at PNT meet

The National Aeronautics and Space Administration have announced a meeting of the National Space-Based Positioning, Navigation, and Timing Advisory Board during November 9-10. These meetings are generally open to the public, in accordance with the Government in the Sunshine Act. The meet is expected to have a panel on LightSquared with LS2 Executive VP Martin Harriman and Javad Ashjaee, CEO of JAVAD GNSS to discuss their proposed GPS receiver filter solutions as well as the latest test results. *www.pnt.gov/advisory*

Japanese spy satellite in orbit after successful launch

A spy satellite for the Japanese government rode an H-2A rocket into orbit replenishing a fleet of secret spacecraft designed to keep track of missile development in North Korea. The secret satellite, built by Mitsubishi Electric Corp., is circling Earth in a sun-synchronous orbit with an altitude of more than 300 miles. The spacecraft was a more than $500 million payload outfitted with an optical camera and telescope to supply imagery to the Japanese government for intelligence, defense and civilian remote sensing applications. The spacecraft will become an operational member of Japan's optical spy satellite fleet. *http://spaceflightnow.com/h2a/f19/*

SSTL plans to build radar satellites

Surrey Satellite Technologies (SSTL) will soon begin to develop a low-cost Synthetic Aperture Radar (SAR) satellite system. The medium resolution (6-30 m ground sample distance) NovaSar-S satellite system would be developed in coordination with SSTL's parent company Astrium. The satellite platform will be an adaptation of the company's very-high-resolution imaging NigeriaSat-2 mission, which was launched earlier this year. The prime advantage of SAR over its traditional counterpart is that it can take images regardless of cloud cover and also during both day and night.

GeoEye receives contracts for imagery production totaling more than $25 mn

GeoEye has received two new awards worth more than $25 million. These awards will increase the backlog for the Company's production services line of business. The first is a Delivery Order for "Enhanced GEOINT Delivery" for the National Geospatial-Intelligence Agency (NGA). This Delivery Order is authorized under the EnhancedView award that GeoEye received from the NGA in August 2010. The second award is a subcontract with The Boeing Co. for Controlled Image Base production. The Boeing Co. contract provides products to the NGA. Under this subcontract, which was expected earlier in the year, the Company will provide highly precise imagery products from multiple satellite imagery sources, including imagery from GeoEye's high-resolution satellites. *www.geoeye.com*

Lockheed Martin Begins GeoEye-2 Satellite Integration

Lockheed Martin will soon begin integration of GeoEye's next-generation, high-resolution Earth-imaging satellite, known as GeoEye-2, with the planned delivery of its integrated propulsion system to Lockheed Martin's Sunnyvale, Calif. facilities later this month. *www.lockheedmartin.com*

Iran to launch Zafar satellite in 2012

Iran will launch an advanced satellite, Zafar, in 2012. It aims to take high resolution wall maps and aerial photos of locations around the globe as seen from space, according to Hossein Bolandi, Head of Satellite Technical Support Department at Tehran's University of Science and Technology. *www.presstv.ir*

DMCii signs contract to supply UK-DMC2 imagery to Russia's ScanEx

Remote sensing solutions provider DMC International Imaging Ltd (DMCii) has agreed a 3-year agreement with Russia's ScanEx Research and Development Center to provide rapid 22m data reception from the UK-DMC2 satellite to ScanEx ground stations in Russia and CIS countries. *www.scanex.ru*

First Turkish satellite begins image transmission

RASAT, Turkey's first remote sensing satellite, begun to transmit its first photos to a Scientific and Technological Research Council of Turkey (TÜBİTAK) land station located in Ankara, Anatolia news agency reported. The satellite is the first national product in the field of space technology in Turkey and was produced by TÜBİTAK with the sponsorship of the State Planning Organization (DPT). itak.gov.tr. *www.todayszaman.com*

DigitalGlobe wins U.S. Government Value-Added Services Contract Valued at up to $38 Million

DigitalGlobe has been awarded a one-year contract at a funded level of $37.9 million by the U.S. Government via the National Geospatial-Intelligence Agency (NGA) under the NGA's new Enhanced GEOINT Delivery (EGD) program. This award advances the production capabilities of the company's "Rapid Delivery of Online Geospatial Intelligence" (RDOG), a capability first pioneered jointly by DigitalGlobe and NGA in 2009, and which NGA has since used to develop imagery and map-based intelligence solutions for U.S. national defense, homeland security and safety of navigation in multiple geographic locations around the world. *www.digitalglobe.com*

Bhuvan's data to be available for common users

Bhuvan, India's answer to Google Earth, will now provide satellite data to the general public, reported Deccan Chronicle. Registered users will be able to, browse and download satellite data through the city-based National Remote Sensing Centre's Open Earth Observation Data Archive. Bhuvan, which has many more features than the Google Earth, is run by ISRO which has thrown open some of the earth observation data obtained through its satellites. *bhuvan.nrsc.gov.in*

CMPDI uses geospatial tech for site selection

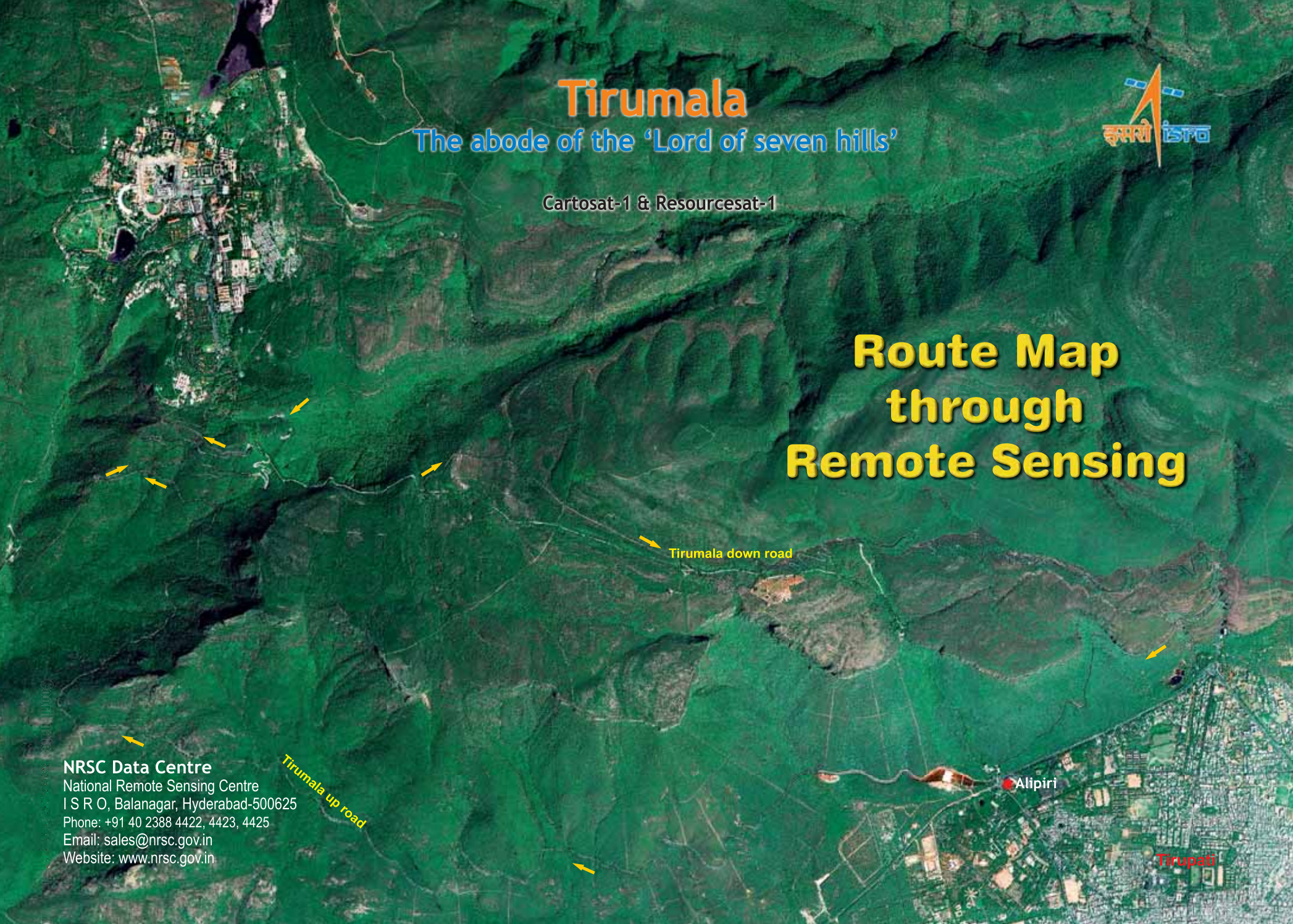
Central Mine Planning & Design Institute (CMPDI) of India used satellite data and GIS for potential site selection for Thermal Power Station (TPS). Most of the TPS sites selected have been allotted to IPP for setting up the thermal power plants. High resolution satellite data in conjunction with collateral data integrated on GIS platform proved very useful in locating the sites for power stations. *www.cmpdi.co.in*

Tirumala

The abode of the 'Lord of seven hills'

Cartosat-1 & Resourcesat-1

Route Map through Remote Sensing



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National Remote Sensing Centre
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Phone: +91 40 2388 4422, 4423, 4425
Email: sales@nrsc.gov.in
Website: www.nrsc.gov.in

Mapping Quality of Northern Ireland to improve

Land & Property Services (LPS) has announced its plan to deliver a programme of improved mapping for Northern Ireland. The Positional Improvement Project, which examines the accuracy of features of LPS Ordnance Survey Northern Ireland (OSNI) maps, will deliver significant improvements to the quality of current mapping, enabling its customers to provide more efficient and accurate service delivery. *http://blomasa.com*

NAMRIA to make 3D GIS of Philipines

The Office of Civil Defense (OCD) and the National Mapping and Resource Information Authority (NAMRIA), Philippines shall soon make GIS of 3-D satellite image of the country and a spatial data infrastructure that disaster simulations can be made for a more reliable preparedness programme. *www.manilastandardtoday.com*

GIS-based tool to measure solar incidence levels

Researchers at Gothenburg University, Sweden, developed a GIS-based tool that can determine solar incidence levels. The scientists at the university have worked together with consultancy WSP to develop a GIS that can calculate the suitability of a roof to house solar panels. The system is called SEES — Solar Energy from Existing Structures — and will be freely available to companies and municipalities. *www.theengineer.co.uk*

India gets Web Map Service and maps at 1:10,000 scale

Vilasrao Deshmukh, Minister of Science & Technology and Earth Sciences, Government of India, released two innovative products of Survey of India (SOI), the first map of the country at 1:10,000 scale and Web Map Service (WMS). The map of Jadcherla Mandal, Mahabubnagar District in Andhra Pradesh, has been prepared at 1:10,000 scale. It has been prepared in association with NRSC and APSRAC and cleared by the Ministry of Defence. Another product released was the launch of Web Map Service (WMS) which will make accessible map data of 1:50,000 scale to users. This service in combination with Bhuvan WMS of Department of Space fulfils the long felt need of the user community in India. *www.surveyofindia.gov.in*

Delhi to implement geospatial law from November 15

The Delhi State Government in India is considering implementing the Delhi Geographical Spatial Data Infrastructure Act 2011 from November 15, 2011. Under the Act, all state departments and civic agencies have to mandatorily access, use and share information on all projects and update Delhi's spatial database. Geospatial Delhi Ltd. along with the Chief Secretary of Delhi as its Chairman will be in charge of maintaining and updating the database. *timesofindia.indiatimes.com*

Esri incorporates OS OpenData into World Topographic Map

The Ordnance Survey's (OS) small- and midscale OS OpenData products have been included in Esri's World Topographic Map, the crowdsourced map at the foundation of Esri's Community Maps program. The map service can be accessed from the basemap gallery in ArcGIS Online. *esri.com/communitymaps.*

Mapping the formation of an underwater volcano

On Oct. 9 an underwater volcano started to emerge in waters off El Hierro Island in the Canaries, Spain. Researchers of the Spanish Institute of Oceanography (IEO, Ministry of Science and Innovation) only needed 15 days to map its formation in high resolution. As seismic movements were detected it gave way to the birth of the underwater volcano. Then, by the 24th of the same month, scientists on board the IEO's ship Ramón Margalef had already completed the bathymetry (mapping of the sea bed) with unprecedented precision. The boat had a cutting-edge sensor system which means that details of less than 10 metres could be observed on the sea bed. The bathymetry was obtained in two days by tracing parallel scans. *www.fecyt.es/fecyt/home.do*

Researchers track Indian nuclear sites using Google Earth

The Institute for Science and International Security (ISIS) in Washington, US, used imagery from Google Earth (GE) to conclude that India may be constructing a gas centrifuge plant for uranium enrichment for military purposes. The ISIS is a nonprofit organisation, focused on stopping the spread of nuclear weapons. The research published by ISIS senior analyst Paul Brannan had four clear images, said to be of India's Rare Materials Plant, which were credited to GE. This study reinforced fears that GE can be misused to compromise national security.

In 2005, India's former president, A.P.J. Abdul Kalam , criticised Google Earth and other online satellite mapping services for exposing sensitive installations in developing countries to terrorists. *www.pcworld.com*

Bentley's WaterGEMS for Westernport Water

Westernport Water, a utility in the state of Victoria, Australia, is using Bentley's WaterGEMS water distribution modeling software, integrated with Open Spatial's GIS and Control Microsystems' supervisory control and data acquisition system (SCADA), to cost-effectively operate and manage more than $43 million in water assets. *www.bentley.com/WaterGEMS.*

J&K gets INR 1700 crore package for RAPDRP project

Government of India approved INR 1700 crore package under Restructured-Accelerated Power Development and Reforms Program (R-APDRP) to

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Rachapudi Kamakshi Memorial Gold Medal for 'Young Geospatial Scientist™ 2011'

To encourage young scientists, Rachapudi Kamakshi Memorial Gold Medal for 'Young Geospatial Scientist™' has been instituted by Rachapudi Kamakshi Memorial Trust. The award consists of a Gold Medal, Certificate of Merit and a Citation Plaque. The award will be presented to the selected young researcher during the annual India Geospatial Forum, 8-9 February 2012 at New Delhi.

Criteria for selection

Basic criteria for the award will be the research work carried out in the field of geosaptial science and technologies with innovativeness and appropriate use of scientific methodology, backed with quality write-up, social relevance and commercial acceptability of the idea and the adequate usage of geospatial technology.

Selection process

An eminent panel of jury will evaluate the nominations and interact with the nominees, if required, before selecting the awardee.

Past awardee

Ms. Thiyam Tamphasana Devi, Indian Institute of Technology Guwahati, receiving the 2010 award from Shri Narendra Modi, Chief Minister of Gujarat

Nominations

Nominations are invited from scientists, engaged in research work in any of the areas related to Geospatial Information Science and Technology, who is not more than 35 years of age, as reckoned on 31 December 2011.

Nominations for the award should clearly state the scientific contribution supported by relevant documents. Self nominations are permitted.

The nominations are required to be submitted to Dr. Hrishikesh P Samant, Associate Professor, Department of Geology, St. Xavier's College, Mumbai - 400 001 and also by email at hrishikesh.samant@xaviers.edu or rkmt2011@gmail.com

The last date for receipt of the nominations is December 15, 2011

For more information visit: http://www.rachapudikamakshi.org/

Jammu and Kashmir State for reviving the ailing power sector. The first phase of the scheme, which is under execution in different targeted areas and is scheduled for completion in 18 months, involves setting up Data Centre, Disaster (Data) Recovery Center, Centralized Customer Care Call Center, GIS based customer indexing and asset mapping and GIS survey in the identified towns and achieving e-management in power distribution and other initiatives. *www.greaterkashmir.com*

TCS to provide GIS-based MIS to Karnataka treasury

Tata Consultancy Services (TCS) signed a contract with the Karnataka State Government in India to automate its treasury and finance department functions. When fully operational, Khajane-II will provide GIS-based MIS and dashboards for the decision makers, wherein implementation of government schemes and projects, in terms of funds utilised, could be monitored online on a real-time basis.*business-standard.com*

Reliance Infra launches environment monitoring system

Reliance Infrastructure Ltd. has launched an environmental monitoring system, Enterprise Road Management System (ERMS), at the 140 km stretch of Pune Satara corridor in India. As part of the system, GPS equipped mobile vans at the project corridor will provide information about every stage of the construction in the corridor. It will take protective measures to control toxic pollutants by marking exact location on the GIS maps. *www.rinfra.com*

Blue Marble Geographics is now an approved GSA vendor

Blue Marble Geographics has been awarded a contract with the General Services Administration (GSA). It is excited to now be able to offer their products to Federal Organizations through the streamlined process this organization manages for federal purchasers.

New satellite brings GLONASS' accuracy to 5 metres

Russia's GLONASS has been upgraded to a precision of up to 5 metres after the successful launch of the 24th GLONASS satellite on 3rd October 2011. The launch marked a turning point bringing the number of GLONASS satellites to a complete set, as planned by the designers. Previous versions of GLONASS had an accuracy within 50 metres. *en.rian.ru/*

Indian army could use Russian satellite navigation system

Moscow - India's military is considering using Russia's Glonass satellite system for navigation and targeting. Russian Defence Minister Anatoly Serdyukov offered Delhi access to the system during a recent meeting with his Indian counterpart. Russian army spokesmen have said that the Glonass system would allow guided missiles to strike targets anywhere on Earth with an error margin of less than one metre.

GPS Navigation and Tracking Market in India 2011

Netscribes (India) Pvt. Ltd., has recently released its 'GPS Navigation and Tracking Market in India 2011 report. An analysis of the drivers explains growth factors, for each segment, such as the growth in logistics vertical, growth in radio cabs, increasing penetration of high end phones, demand from the BPO sector, entry of mapping portals, increasing sales of luxury cars and government initiatives. The key challenges identified include the lack of awareness and consumer perception, fragmented logistics sector and operational issues. *www.netscribes.com*

MikroKopter captures precision photos and videos using u-blox GPS

HiSystems GmbH has introduced MikroKopter, a small, unmanned helicopter with autonomous navigation capabilities based on u-blox GPS technology. The device is optimized for capturing and transmitting photos and videos taken from precise GPS locations and altitudes. *www.u-blox.com*

India NSG to have wearable GPS

India's elite counter-terrorism force, the National Security Guard (NSG) has proposed that the 'Black Cat' commandos will have GPS attached to their body wearable computer along with other accessories like cameras, self-care medication etc. The commander giving directions to a commando on the task would be able to see him in action. *www.dnaindia.com*

MoD halts GPS jamming after safety complaints

A huge naval exercise has been banned from using GPS jamming technology after safety complaints. A major naval exercise off the coast of Scotland has been ordered to stop using GPS jamming technology after complaints it is endangering the lives of fishermen and is disrupting mobile phones. The Nato exercise, dubbed 'Joint Warrior', involves the military forces from 14 countries and is taking place off the west coast of Scotland. As part of the operation, GPS services were jammed in a radius of 20 miles around the various warships. Apparently, the Royal Navy had issued warnings last month and in early October that GPS in parts of Scotland would be disrupted during the naval exercise.

But according to the BBC, Western Isles fishermen said the first they knew was when their equipment went offline. And it seems that the military's GPS jamming also impacted mobile phones, Internet connectivity as well as satellite TV. Following the fisherman's complaints, the jamming of GPS has been suspended, and the Royal Navy said the military would seek to address safety concerns. Yet it seems that the military could be right in feeling a tad aggrieved about the complaints, as the Joint Warrior is held twice a year, and its jamming of GPS back in April drew no complaints.

Oxford researcher tests pilotless robot car

Robotic car technology being developed at Oxford University that interprets its surroundings and makes decisions about where to go could eliminate the agony and cost of traffic jams.

Whilst human drivers might use GPS to find their way such systems cannot provide anything like the coverage, precision, and reliability autonomous cars need to safely navigate. GPS also fails to tell a robotic car anything about what surrounds it; its proximity to obstacles, other cars, pedestrians, or their intentions.

The new technology, which Oxford researchers have now installed on a 'Wildcat' vehicle built by BAE Systems, is set to remove the dependence on GPS, improve navigation precision, lower emissions, interpret local traffic conditions, track risks, and above all offer a hands-free experience to the driver. All this by interpreting a flood of data from sensors such as cameras, radars, and lasers mounted on the car itself. *www.ox.ac.uk*

Rajasthan: RECL to track its trucks carrying explosives using GPS

The vehicles carrying explosives at Rajasthan Explosives and Chemicals Limited (RECL), henceforth will have GPS, which will tracked in active mode. Realtime data will be processed in the control room at company's premise to analyse any deviation from the predeterminded route. *http://timesofindia.indiatimes.com*

Competitive Container Shipping Market to Boost Tracking Revenues to $690M by 2016

Container security and tracking revenues will grow at a compound annual growth rate (CAGR) of 27 percent from $212 million in 2011 to $690 million in 2016, according to a report by ABI Research.

At the same time, end-to-end visibility, monitoring, and tracking are becoming more important in an increasingly competitive and security-challenged container transportation industry where cheaper and safer container transport is urgently needed. While this will represent another strong driver for the uptake of GPS-based tracking in the future. *www.abiresearch.com*

Phone app to ensure safety of women in India

Whypoll, a nonprofit organisation, will launch a phone app "Fight Back" soon. The app will function as an SOS alert device -- sending out a text message with a GPS location to up to five people, including police, and as a post on Facebook and Twitter. *www.csmonitor.com*

Public transport ITS market in Europe expected to reach 1.3 billion by 2015

New market report, 'ITS in Public Transport', from Berg Insight analyses the latest developments on the intelligent transport systems market for public transportation in Europe.

According to the report, European market for ITS solutions for public transport is in a growth phase which will last for several years to come. Individual markets may however experience temporary fluctuations, depending on the political climate and local developments. The total market value for public transport ITS solutions for buses and trams is forecasted to grow at a compound annual growth rate of 15 percent from € 0.65 billion at the end of 2010 to € 1.3 billion by 2015.

3D mapping from C3 Tech bought over by Apple

Swedish startup C3 Technologies, the company that showcased their 3D maps on iPad has been bought over by Apple. It calculates the terrain and buildings directly from aerial images. The approach takes into account the positions and angles of the cameras that took aerial images in order to give each pixel its geographical position with high accuracy. *www.fastcompany.com*

iPhone 4S adds supports for GLONASS

Apple iPhone 4S adds GLONASS satellite location system, which can contribute to faster, more accurate results. In an update to the handset's published specifications, Apple added GLONASS capability to Assisted GPS and cellular location finding. *www.appleinsider.com*

Navguard launches GPS app for BlackBerry

NavGuard has has entered the Middle East market with the launch of combined navigation and tracking application, NavTrack, for BlackBerry smartphones, which is now available on BlackBerry App World. It has been optimised specifically for the BlackBerry platform and allows users in the Middle East region to access accurate GPS maps to ensure they never lose their way, the company said. *www.thehindu.com*

Antenova offers complete GPS receiver module for under $3

Antenova Ltd announced a special sub-$3 price offering of its GPS RADIONOVA SS3 Receiver Module – a complete GPS receiver including SiRFstarIII GPS IC and all front end RF components in a very small low profile single package module. It is ideal for device manufacturers looking for a very low cost solution. *www.antenova.com*

Genes and GPS used to map spread of typhoid

A combination of geographic and genetic data is showing how typhoid fever spreads, and could be used for mapping other disease patterns, a study has reported. Researchers used DNA sequencing GPS and Google Earth technologies to track typhoid transmission in Kathmandu, the rapidly growing capital city of Nepal, where thousands fall ill with typhoid fever each year.

They found disease clusters around

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public water spouts — pipes that tap into natural water sources — which suggests that the main transmission route is environmental, rather than between people. “This is the first time that bacterial genotyping techniques have been associated with patient location to map the spread of infectious disease,” said Amit Arjyal, co-author and a clinician at the Oxford University Clinical Research Unit–Nepal (OUCRU-NP). *www.dawn.com*

Kerala state transport to go for GPS

As part of the total computerisation project, the Kerala State Road Transport Corporation (KSRTC) has embarked on an ambitious plan to implement IT enabled systems including GPS based Fleet Tracking System on its vehicles and Passenger Information System at depot premises across Kerala. *www.keralartc.com*

C-Nav announces 5cm precise positioning

C-Nav has launched its improved five-centimeter C-NavC2 GNSS subscription service. C-NavC2 supports GPS + GLONASS corrections and delivers the most accurate real-time Precise Point Positioning solutions around the world. *www.cnavgnss.com*

Mobile LBS poised for massive growth in Japan

Mobile LBS market in Japan is poised for a substantial growth. A report from market research and consulting firm Seed Planning estimates a 340 percent increase between 2010 and 2015.

The LBS market accounted for 43 billion yen (USD 560 million) in 2010 and is expected to expand to 147 billion yen (USD 1.9 billion) by 2015. Increase in LBS demand is roughly in line with anticipated smartphone adoption over the next few years. However, a closer look shows that the market isn’t growing simply due to an increase in smartphone users. *www. penn-olson.com*

Galileo update

Europe launches first GALILEO satellites for smart navigation system

Europe has taken a major step in its history by launching the first two operational Galileo satellites with a Soyuz launcher to reach their orbit at 23.000 kilometres. From 2014, the new constellation will enable improved services ranging from more precise in-car navigation, effective road transport management, search and rescue services, more secure banking transactions as well as reliable electricity provision, which all rely heavily on satellite navigation technologies to work efficiently. The overall economic impact is estimated to be around 90 billion euro over the next 20 years.

Vice President Antonio Tajani, responsible for industry and entrepreneurship said: *“This is a proud moment for all Europeans; today’s launch is proof of Europe’s prowess in the field of space activities. I now call on European industry and SMEs, to seize without delay the important economic opportunities offered by this system – get innovating now! European citizens can get ready, Galileo is about to be a part of our daily lives”. http://ec.europa.eu*

True3D™ Head Up Display & Navigation System wins European Satellite Navigation Competition 2011

This year’s best ideas and applications for the innovative use of satellite navigation were awarded recently. At the eighth annual European Satellite Navigation Competition (ESNC), Bavarian State Minister for Economic Affairs Martin Zeil honored the overall winner with a €20,000 cash prize. In addition, the winners for each of the 23 ESNC partner regions were selected from a record-setting 401 total submissions from 49 countries.

The 2011 overall winner is the worlds’ first head-up display (HUD) to feature a remarkably small hardware package and a fully volumetric and conformal display engine, which superimposes objects on landscape imagery at distances from two meters to infinity with an exceptionally wide field of view. A digital 3D map, which is supplemented with augmented reality functions such as digital road signs or logos of local businesses, is projected directly onto the windshield without distracting the driver. The system already works well with GPS and can be operated with any accurate satellite guidance system.

Second place in the overall running was shared by Baden-Württemberg’s regional winner, Jens Rieder and his team from the Universität Heidenheim, for SkyAmps - a highly efficient, fully automatic wind power plant based on two kites; and the regional winner for Switzerland, Philipp Elbert and his team from the ETH Zürich and the Swiss company HESS AG, for AHEAD - a system designed to minimise the CO2 emissions of hybrid electric buses through a predictive energy management strategy based on precise positioning.

Third prize in the competition was also shared by two regional winners: Hesse’s Dr. Jörg Pfister of pwp-systems GbmH with PTbox, a robust positioning unit for public transport designed to offer enhanced attractiveness and reduced CO2 emissions; and Vladimír Vejvoda of Prague for Mobile Epileptic Fit Detector (MEFID), a mobile remote unit that can help save lives by rapidly detecting signs of an imminent epileptic attack in child patients.*www.galileo-masters.eu*

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Juniper Systems to manufacture Topcon Tesla

Juniper Systems has partnered with Topcon Positioning Systems (TPS) and will manufacture the Topcon Tesla™, the newest data collector in Topcon's full lineup of rugged handheld computers and solutions for the survey industry. The Tesla features the advantages of both a rugged handheld and a tablet PC, without the disadvantages of either. *www.junipersys.com*

Trimble Outdoors launches Backpacker Map Maker App for iPad

Trimble and Backpacker magazine have released Backpacker Map Maker, a mapping and trip planning app for the Apple iPad. Now, from the touch-screen of an iPad, hikers and backpackers can find wild places, plot GPS points and plan their next adventure over seamless topographical maps. *www.trimble.com*

Centrifuge Systems Delivers RelateMap

Centrifuge Systems, Inc., announced the first embeddable VNA relationship mapping web service. Centrifuge RelateMap, a new web API relationship mapping service dynamically connects data about people, behavior and actions for dramatic visual results. It can be embedded directly into partner applications and provides over 50 API functions to tightly integrate robust, interactive visual network analytics into any application. *Centrifuge Systems, Inc.*

Intel buys Mobile Mapping Company for $350 Million

Intel's chips are finally going to start showing up in phones next year and Ultrabooks are due soon, but it looks like the world's top chip maker's making a push in mobile software, too. Intel just bought Israel-based mapping software company Telmap for $300 to $350 million to create a "true alternative" to Google Maps and Nokia's Ovi. It's a huge and telling step for Intel, which has increasingly been expanding its purview outside of pure chip-making. Intel's AppUp blog notes that Telmap will help supply AppUp developers with a standard set of location-based APIs and software to make location services easier to add to their apps. *http://appdeveloper.intel.com/en-us*

Amberg Geotechnics: innovative surveying solution

Amberg Geotechnics, a new software application provides a host of benefits for underground construction practitioners. This surveying tool permits quick and cost-effective identification of high-risk areas in underground construction projects. Tunnel surveyors and geotechnical engineers must seek to minimise underground construction risks and hazards, but are also under immense pressure to keep to tight budgets and schedules. *www.amberg.ch*

Topcon announces establishment of the new sale company

Topcon Corporation announces the establishment of a new sales company, Topcon Sokkia Positioning Japan (TPJ), by integrating the sale functions of Topcon Sales Corporation and Sokkia Co., Ltd. TPJ started business operations Oct. 1, 2011. The marketing of Topcon and Sokkia brands by TPJ will continue through the same, established national sales network. Topcon will maintain two call centers – one for Topcon products and one for Sokkia products to continue fast and smooth response to the customers. *http://global.topcon.com*

Hemisphere GPS and CLAAS announce OEM partnership

Hemisphere GPS and CLAAS Agrosystems announced a new OEM development agreement whereby Hemisphere GPS will develop next generation precision farming solutions for integration into CLAAS machinery. The two companies are combining their expertise to develop new intelligent machine control solutions including

Leica News

GR25 GNSS reference server

With integrated internal and external device management, multi-user management, high end security, modular and scalable design, the GR25 GNSS Reference Server will grow with users' needs and keep their GNSS applications and networks fully up to date. It is designed for numerous permanent and semi-permanent GNSS network installations and monitoring applications.

ScanStation C10 & C5 Laser Scanners

Leica Geosystems has announced advanced, onboard and handheld scanner control firmware (v2.6) that provides increased High-Definition Surveying™ productivity and versatility benefits for as-built and topographic surveys. With new V2.6 firmware, users can now take advantage of valuable onboard and handheld workflow options and professional field QA tools that had previously only been available when controlling these scanners using Leica Cyclone-SCAN software on a laptop.

CGR10 & 15 radio modems

The CGR10 and CGR15 radio modems for its Leica Viva CS 10 & CS 15 Controllers are an ideal extension to the Leica Viva NetRover and Leica Viva GS12 rover. They can also be used with the Leica Viva GS10, GS15, and the new GS25 receiver. They are receive-only UHF radios that can be mounted directly onto the Leica Viva CS10 & CS15 field controllers.

Partnership with Locata

Leica Geosystems Mining announced its partnership with Locata Corporation Pty Ltd recently. Known as the Leica Jigsaw Positioning System (Jps), Leica Geosystems Mining will provide this new technology as a part of their Jigsaw product suite. Leica Jps provides an unprecedented level of reliability for high precision positioning by deploying ground-based LocataLite transmitters which augment conventional GPS systems. *www.leica-geosystems.com*

Spirent News

MPLS-TP and Mobile Backhaul testing through Isocore Interoperability effort

Spirent Communications continues to play a key role in public mobile backhaul testing efforts including its recent participation in a demonstration showcasing the use of MPLS-TP in the transport network. Isocore leveraged the MPLS-TP capabilities of Spirent TestCenter to validate interoperability across a multi-vendor network environment that included solutions from Alcatel-Lucent, Cisco, Juniper Networks and NEC. *www.spirent.com*

QZSS support to Spirent Multi-GNSS Simulation Platform

Spirent Communications has added Japanese Quasi Zenith Satellite System (QZSS) simulation capabilities to its GSS6700 Multi GNSS Constellation Simulator, enhancing the ability to meet the current and future testing needs of GNSS devices. *www.spirent.com*

Spirent Extends Capability of GNSS Record and Playback Test System

Spirent Communications has launched new functionality on its GSS6400 GNSS Record and playback test system. Users can now benefit from record and playback of two channels of serial digital data alongside the digitized GPS L1, GLONASS L1 and even QZSS signals. This is particularly useful when designing and testing integrated GNSS devices. *www.spirent.com*

Spirent Positioning & Navigation Test Solution supports Compass

Spirent Communications has announced support for the Compass Navigation Satellite System (CNSS) on its GSS8000 navigation technology test system, which is already widely used to test GPS, GLONASS, Galileo, SBAS and QZSS technology. It enables easy set-up and control of simulated Compass constellations.

precise guidance, advanced automated steering, application controls, and remote data management. The multi-year partnership includes co-development funding to Hemisphere GPS for customized engineering of Hemisphere GPS technology to CLAAS specifications. *www.hemispheregps.com*

Get Improved 3D Visualization with Carlson Civil 2012

Carlson Civil 2012 gives users enhanced 3D visualization, with added support for realistic 3D symbols including trees, people, vehicles and utilities, plus the ability to produce customized, more professional reports among its many additional improvements. Carlson Civil, the comprehensive, yet easy-to-master civil engineering software solution, provides support in its 2012 release for AutoCAD® 2012 and comes with IntelliCAD® 7.0 built-in. This is as well as working on AutoCAD versions 2000 and up.

New Version of ArcGIS for iOS Now Available

Esri has released an updated version of ArcGIS for iOS that includes several enhancements, as well as support for pop-up windows, access to ArcGIS Online basemaps, and new collaboration features. The new update lets users view pop-up windows in their maps, giving them the ability to see additional information by simply tapping on the map. This intuitive feature makes accessing text, photos, pie charts, and website links even easier. *http://itunes.apple.com/us/app/arcgis/id379687930?mt=8*

FARO Launches the New CAM2 Measure 10 Software

FARO Technologies, Inc. released CAM2 Measure 10, its new measuring software for the FaroArm, ScanArm and FARO Laser Tracker. It marks FARO's return to the successful family of CAM2 Measure software products. This new release is built on the solid foundation of the previous CAM2 Q while also introducing key new features like Live Color Scan for point cloud inspection, Shortcuts and the Easy Move Wizard. These innovative functionalities are designed to improve measurement processes, whether tactile or scanning, and make CAM2 Measure 10 the first choice in portable measurement software.

Spectracom, easy scenario builder software enhances powerful simulation

GSG StudioView™ offers an easy way to create, edit and back-up complex scenarios for a Spectracom GSG series multi-channel GPS/GNSS simulator. GSG StudioView allows users to build and manage visual trajectories and supports the import and conversion of trajectory files from other software applications and devices such as Google Earth. Users can create visual trajectories with Google Maps. *http://www.spectracomcorp.com/*

TW3042 and TW3072 GPS Brickwall Pre-Filtered Antennas

Tallysman Wireless Inc., released TW3042 and TW3072 GPS Brickwall Pre-Filtered antennas. Both are

professional grade, high gain, pre-filtered permanent mount, GPS L1 antenna, specially designed for precision positioning and timing applications in environments characterized by high L-Band RF fields.

They feature a precisely tuned ceramic patch element, a tight band-pass SAW pre-filter, a first LNA gain stage, an in line SAW filter, followed by a two stage amplifier.

HCE Earthworks Optimization and Productivity Tools by Trimble

Trimble released version 2.50 of its heavy and highway construction office software for data management, data preparation and materials quantities takeoff—Business Center – HCE. It features new road takeoff, data preparation and earthworks planning functionality including a new Corridor Mass Haul module. In addition, estimators

can realize increased efficiencies with Business Center – HCE automation tools when importing Adobe® PDF vector files or CAD cross-section files.

Tenerife Fire Brigade turns to GMV for guiding its mobile resources

GMV has won the contract for supplying the System of Geolocation, Assisted Navigation, Management and Operational Emergency Coordination for the Consortium for the Prevention and Extinguishment of Fires and Rescue Operations of the Island of Tenerife. It is going to implement a solution based on HEGEO®, an inhouse GMV development for the planning, control and analysis of emergency and security services or public services. Under this project 48 firefighting vehicles will be fitted with tracking, navigation and cellular technology communications equipment for receiving notifications of accidents and travelling under guidance to the accident site, communicating at all times by voice and messaging service with the emergency center. *www.gmv.com*

ArcGIS Comes to the Android Platform

Google Android users can now access data and mapping capabilities on their smartphones with the ArcGIS for Android application. ArcGIS for Android lets users find and share maps as well as deploy GIS data and functionality on Android devices. The free app is now available and can be downloaded directly from the Android Market. *www.esri.com/android*

PC House introduces Marbella GPS

Sri Lankan IT products importer and retailer PC House recently added Marbella GPS to their local product portfolio. According to a company statement, the Marbella GPS, marketed at vehicle owners, is a "straightforward, easy-to-use GPS navigation system combined with extensive street atlases of over 60 countries in a super slim, sleek design with touch screen controls." *www.sundaytimes.lk*

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www.lidarmap.org/ELMF/

December 2011

12th esri User Conference 2011
7 – 8 December 2011
Noida, India
www.esriindia.com

GNSS Signals 2011
8 - 9 December
Toulouse , France
http://www.cborg.info

United Nations International Meeting on GNSS
12 - 16 December 2011
Vienna, Austria

NSDI 11
21 – 23 December
Bangalore, India
www.nsdiindia.gov.in

January 2012

International LiDAR Mapping Forum
23 – 25 January
Denver, CO, USA
www.lidarmap.org

March 2012

RIEGL LiDAR 2012 International Airborne and Mobile User Conference
28 Feb – 1 March
Orlando, USA
www.riegl.com

Munich Satellite Navigation Summit 2012
13 – 15 March
Munich, Germany
www.munich-satellite-navigation-summit.org

ASPRS Annual Conference
19 – 23 March 2012
Sacramento, California, USA
www.asprs.org

April 2012

ENS 2012
23 – 25 April
Gdansk, Poland
www.enc2012.org

Geo Siberia
25 – 27 April
Novosibirsk, Russia
http://www.biztradeshows.com

May 2012

FIG Working Week 2012
6-10 May
Rome, Italy
www.fig.net

Global Geospatial Joint Conference 2012
14 - 17 May 2012
Québec City, Canada
www.gsdi.org/gsdiconf/gsdi13

2nd International conference and exhibition on mapping and spatial information (ICMSI2012)
15 – 17 May 2012
Tehran, Iran
http://conf.ncc.org.ir

6th GNSS Vulnerabilities and Solutions Conference
21 - 24 May 2012
Baska, Croatia
http://www.rin.org.uk

MundoGEO#Connect 2012
29 – 31 May
São Paulo, Brazil
http://mundogeoconnect.com/2012/en/

The 3rd China Satellite Navigation Conference
May 2012
Guangzhou, China
www.beidou.org

June 2012

Hexagon 2012
4 - 7 June
Las Vegas, USA

July 2012

ESRI International User Conference 2012
23 – 27 July
San Diego, USA
www.esri.com

August 2012

The XXII Congress of the ISPRS
25 August - 1 September 2012
Melbourne, Australia
www.isprs.org

September 2012

ION GNSS 2012
September 17-21, 2012 (Tutorials & CGSIC: September 17-18)
Nashville Convention Center, Nashville, Tennessee, USA
www.ion.org

October 2012

INTERGEO 2012
9 - 11 October 2012
Hanover, Germany

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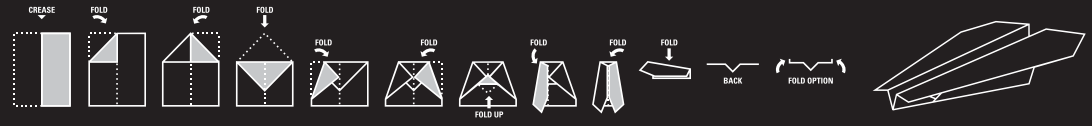

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