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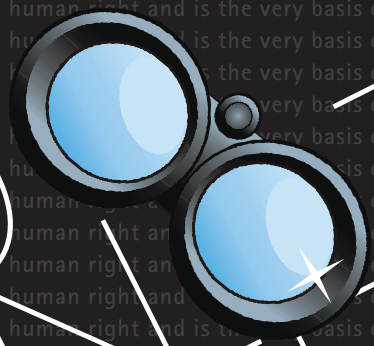

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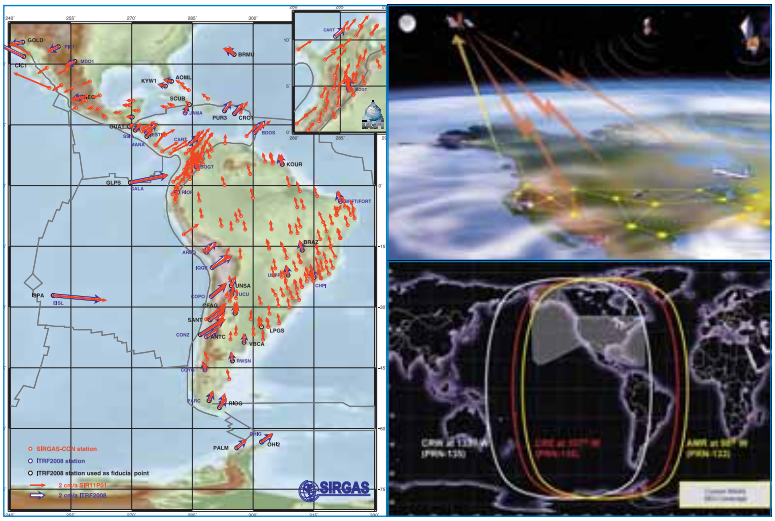

In this issue

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Articles

Columns

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The dilemma

When various governments raise objections

To the easy access to geospatial information for security reasons

Especially by online providers of such information,

We demand liberated and conducive policy ambience.

On the other hand, we also express concerns,

When privacy of individuals are intruded

By such and similar technology providers.

However, shrugging off the ‘security concerns of the states’

And raising the ‘privacy issues of the individuals’

Sometimes poses a challenge to be consistent in our stance,

And exposes the dilemmas and contradictions.

Bal Krishna, Editor
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Do Not Track!

One wonders now whether geospatial technologies have exposed privacy, and whether this exposure has given rise to an unrealistic expectation of privacy protection

George Cho
Institute for Applied Ecology and
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There is a saying that "it takes a thief to catch a thief". This is because to know the *modus operandi* of a presumptive thief is to know when, where and how that person operates. What better way than to put a 'tag' that will follow every movement of that person to gather evidence in order to implicate that person. Hiding a global positioning system (GPS) on a person's vehicle is one means of collecting information with a view to later prosecution of the driver of the vehicle where a criminal act is committed. Simple logic, one might think. But all that is not what it seems because every person has rights not only of a personal and private nature but also over one's property. In the U.S. it seems that law enforcement agencies cannot use GPS equipment planted on vehicles to gather information from suspects without a credible and probable cause of criminal activity and without a court warrant. In the recent case of *United States v. Jones* 132 S. Ct. 945 (2012) at the U.S. Supreme Court, all nine Supreme Court Justices agreed that Jones was *searched* when police attached a GPS device to the undercarriage of his car and tracked his movements for four weeks. The act of attaching the device was a violation of Jones's rights to his property and effects. The monitoring of Jones was a violation of his reasonable expectation of privacy. And, the Fourth Amendment provides significant other guarantees.

> Privacy is a fundamental human right and is the very basis of human dignity and values, freedom of association and freedom of speech.

In general, these rights and the checks and balances in the system of justice in the U.S. such as the rights to privacy, are ensconced in the Bill of Rights. The concept of 'zones' of privacy, rights against property intrusion such as trespass are guaranteed under the Fourth Amendment of the U.S. Constitution. This article is a brief commentary on the evolving legal issues pertaining to privacy and its loss through overt and covert surveillance with the use of geospatial technologies.

Do Not Track

Do Not Track (DNT) and the proposed U.S. Act of the same name, is a mechanism for protecting online privacy that specifically addresses the challenge of pervasive online behavioural tracking (see ElectronicFrontierFoundation.org) especially those employed by behavioural advertisers (see WorldPrivacyForum.org) that use sophisticated tracking technologies. *Do Not Track* is unique in that it combines both technology (a signal transmitted from a user) as well as a policy framework as to how companies that receive the signal should respond. Some countries, such as Australia, have legislation to prevent cold calling by telemarketers in a *Do Not Call* (DNC) database that users can register with *(www.donotcall.gov.au)*. The *Do Not Call* Register is a secure database where one can list an Australian phone number to opt out of receiving most telemarketing calls and marketing faxes. Arguably, DNT and DNC facilities are there to enhance privacy and to protect property against unauthorised intrusion. The case of *United States v Jones* (2012) suggests that in the physical world coupled with the geospatial technologies there may be some protection of sorts. But we need to understand the law and the technology to appreciate the nuances properly.

Global Positioning Systems

The use of GPS for tracking, navigation and location has blossomed to become a leading technology that, perversely, has created potential privacy leakages. The

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How Google managed to get all your private data and got away with it

By David Streitfeld and Kevin J. O'brien

Secrets spilled across the computer screen. After months of negotiation, Johannes Caspar, a German data protection official, forced Google to show him exactly what its Street View cars had been collecting from potentially millions of his fellow citizens. Snippets of e-mails, photographs, passwords, chat messages, postings on websites and social networks - all sorts of private Internet communication - were casually scooped up as the specially-equipped cars photographed the world's streets. "It was one of the biggest violations of data protection laws that we had ever seen," Caspar recently recalled about that long-sought viewing in late 2010. "We were very angry."

Google might be one of the coolest and smartest companies of this or any era, but it also upsets a lot of people - competitors who argue it wields its tremendous weight unfairly, officials like Caspar who says it ignores local laws, privacy advocates who think it takes too much from its users. Just this week, European anti-trust regulators gave the company an ultimatum to change its search business or face legal consequences. American regulators may not be far behind. The high-stakes anti-trust assault, which will play out this summer behind closed doors in Brussels, might be the beginning of a tough time for Google.

But never count Google out. It is superb at getting out of trouble. Just ask Caspar or any of his counterparts around the world who tried to hold Google accountable for what one of them, the Australian communication minister Stephen Conroy, called "probably the single greatest breach in the history of privacy". The secret Street View data collection led to inquiries in at least a dozen countries, including four in the US alone. But Google is yet to give an explanation of why the data was collected and who at the company knew about it. No regulator in the US has ever seen the information that Google's cars gathered from the citizens.

The tale of how Google escaped a full accounting for Street View illustrates not only how technology companies have outstripped the regulators, but also their complicated relationship with their adoring customers. Companies like Google, Amazon, Facebook and Apple supply new ways of communication, learning, entertainment and high-tech wizardry for the masses. They have custody of the raw material of hundreds of millions of lives - the intimate e-mails, the revealing photographs, searches for help or love or escape. People willingly, at times eagerly, surrender this information.

But there is a price: the loss of control, or even knowledge, of where that personal information is going and how it is being reshaped into an online identity that may resemble the real you or may not. Privacy laws and wiretapping statutes are of little guidance, because they have not kept pace with the lightning speed of technological progress. *http://www.nytimes.com*

provision of coordinates and technological developments have gone hand in glove with other tools, such as facial recognition, biometrics and street cameras to make it a safer environment for everyone. But the digital revolution and use of powerful sensor devices now seem to have exhausted all rights to privacy of the individual. Ironically, some of these are officially sanctioned, as in the case of closed circuit television (CCTV) in Britain. CCTV poses both ethical and legal questions and it may be the price one pays for living in a digital age where a digital trail of data is left behind everywhere one ventures. This may be *sousveillance par excellence* -- the "watchful vigilance from underneath" [derived from the French *sous*, meaning "below" as opposed to *sur*veillance meaning from "above"]. In sousveillance subjects are aware that their movements are being tagged and observed and their spatial movements over time have been recorded for security purposes.

Privacy

Privacy has often been discussed and its interpretation is varied. Privacy is both a concept and a right and is a broad area of law that offers protection to one's confidences and private information. Privacy is a fundamental human right and is the very basis of human dignity and values, freedom of association and freedom of speech. Such rights are protected by the Universal Declaration of Human Rights (UDHR) (1948) and the International Covenant on Civil and Political Rights (ICCPR) 1976. Nearly every country has a right to privacy in its Constitution with protections against intrusions in one's home, the confidentiality of communications and specific rights to access and control of one's personal information. Where such rights are not provided in a Constitution, courts have found a means of giving protection.

Canadian courts have recognised a general right to privacy and the protection of privacy interests under the rubric of nuisance law. The tort of invasion of privacy has been recognised in the *New Zealand Bill of Rights Act* 1990. In India protection is available under common law for an actionable wrong for the invasion of privacy. Privacy also has deep roots among the major religions of the world. A right to privacy is recognised in the Qur'an, to references in the Bible and in Jewish law. But, there is no universal definition for privacy, and its definition varies according to the context and usage. The concept of privacy may also differ between cultures and legal traditions. The Australian Constitution, for example, has no vested powers over privacy protection, while the common law protects privacy rights indirectly. The European Convention for the Protection of Human Rights and Fundamental Freedoms 1950 (ECHR) guarantees a right to respect of a person's private and family life, home and correspondence and that no public authority has the right to interfere with this right except in accordance with the law and as necessary in a democratic society in the interests of national security, public safety or economic well-being of the country.

However, the relevant legislations across jurisdictions render the concept unclear and its application variable. It seems that there

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are no clear enforcement mechanisms and there are many potential issues, including constitutional difficulties. In addition, there are divergent views regarding its interpretation and meaning. This is no more so than highlighted in the case of *United States v Jones* (2012) and related cases citing the Fourth Amendment.

US cases change emphasis from an expectation of privacy to an intrusion to property

In the U.S. the Fourth Amendment refers to: "*The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.*" (U.S. Constitution Amend. IV).

In the case of *Katz v United States* 389 U.S. 347 (1967) the Court held that police officers violated the Fourth Amendment when they conducted a warrantless search using a listening and recording device placed on the outside of a public phone booth to eavesdrop on the conversation of a suspect who had 'justifiably relied' upon an expectation of privacy of the phone booth. Similarly, in *Kyllo v United States* 533 U.S. 27 (2001) the Court decided that a suspect had a reasonable expectation of privacy in his home when the police, suspecting him of growing marijuana, used a thermal imaging device without a warrant to detect the heat emanating from it. In contrast in *United States v Ciraolo* 476 U.S. 207 (1986) the Court held that there was no reasonable expectation of privacy in his 10-foot-high fenced-in back yard after the police looked into it without a warrant from an airplane to see if he was growing marijuana.

However, in *United States v Knotts* 460 U.S. 276 (1983) police officers placed a beeper in a container that was in the defendant's car and maintained visual surveillance with the help of a monitor to receive the beeper signals. The Court held that the officers' actions did not constitute a search or seizure and that there was no legitimate expectation of privacy as the monitoring of the defendant was along public highways and other areas visible to the naked eye. In *United States v Karo* 468 U.S. 705 (1984) the placement of a beeper with the consent of the owner of a container of drugs that was sold to the defendant and tracked and later used as evidence to prosecute a drug offence produced an ambivalent decision in the courts. The Court found that there was no reasonable expectation of privacy protection in the use of the beeper but that monitoring the beeper in a private residence not open to visual surveillance violated the Fourth Amendment.

The ruling in the case of *United States v Jones* (2012) has changed the emphasis of the Fourth Amendment such that whereas in the case of *Katz v United States* (1976) and following cases the ruling hinged on an expectation of privacy to the present where the instant decision is property-based. That is, an intrusion of one's property and effects, a trespass no less.

> The technology has the capacity to expand and expedite the analysis of personal data and create connections not otherwise perceived – it is the 'new' problem for privacy in its wider modern conception.

While such developments in the law in the U.S. are instructive as each ruling is fact and case sensitive, there have been developments elsewhere to go hand in hand with the evolution of information technology. There might be inter-generational differences in what and how people reveal information about themselves. "Gen Y" it seems happily and voluntarily surrender their private information in exchange for friendship, followers and social networking. People of the Gen-Y age readily share their lives through new social media such as Twitter, Facebook and Foursquare, in contrast with the more conservative 'baby-boomers' of the sixties. Social networks challenge the very fabric of what is 'private' and what is secret and confidential. But sometimes, technology might also lure us into complacency where privacy is revealed both advertently and inadvertently which makes it difficult to identify, protect and to police. Ironically, and on reflection, a lot of our loss of privacy to the public domain is entirely consensual. The social media of Twitter, Facebook and Foursquare could become the very tools of the modern burglar.

Modern mobile phones and in-build GPS devices in motor vehicles provide geolocation information automatically. Sometimes, one forgets as happened in the case of the presenter of the television series *Mythbusters* Adam Savage. He took a photograph of his vehicle using a smart-phone and posted the image on a Twitter account with the phrase "Off to work". The image contained metadata which revealed the exact geographic location of the photograph, the make of the vehicle and the time he left for work (see *New York Times http://nyti.ms/917hRh)*.

There are thus competing interests in the use of geospatial technology that suggests a dire need for a balance to be struck between law enforcement on the one hand and the protection of privacy and property on the other. While GPSs may help law enforcement become more effective and efficient in detecting criminal activities with preventative measures there may be no need to engage in high speed chases which endanger the lives of the public, the police and the suspect. With GPS surveillance becomes affordable with the simultaneous monitoring in more places and over greater distances. The GPS may provide more 'eyes' than is ever possible and may not offend any legislative provision such as an expectation of privacy as observations are in the public arena. The use of technology is simply a matter of efficiency.

The advantages of using GPs technology outlined above need to be balanced against the unacceptable costs its use. One 'social'

cost that is unacceptably high is where the device discloses activities that are indisputably private in nature such as a trip to the plastic surgeon, the abortion clinic, AIDS treatment centre, strip club, union meeting, mosque, synagogue or church. While these locations may be public one might not be present to explain the reasons for being at these locations when the data are harvested and mined for geoanalytical purposes. One's patterns of professional and vocational pursuits could be misinterpreted with various undertones of guilt by association. The ability of law enforcement agencies to obtain such comprehensive and detailed information of one's movements suggests Big Brother secretly monitoring movements in time and space through a small device such as a mobile phone or the car. Pervasive monitoring that is prolonged and continuous can be both burdensome and intrusive.

The view therefore is that if there is available technology it should be used for good or to adopt the Google mantra of '*don't be evil*' – namely follow the law, acting honourably and treat each other with respect. If there is a need for a warrant, as dictated by local laws, then unless it were an emergency, it is not a big burden to take a few minutes to apply for judicial approval before using such revealing technology. Technology has the potential to interfere with privacy interests but legislation provides the baseline for protection.

Conclusion

Information technology reduces the ability of an individual to control information pertaining to that person, and it is this aspect of individual privacy that is placed at risk by high powered computers and informatics. Cloud computing and linked networked personal information reveals a rich vein of data to be mined for many purposes. This linked information seems to be a particular problem of protecting privacy in an age of automated data processing and analytics. The technology has the capacity to expand and expedite the analysis of personal data and create connections not otherwise perceived – it is the 'new' problem for privacy in its wider modern conception.

One wonders now whether geospatial technologies have exposed privacy, and whether this exposure has given rise to an unrealistic expectation of privacy protection. It may be that privacy has been poorly understood – involving emotional and mass fear and uncertainty so that calm reflection and contemplation has not taken place. In the Web 2.0 generation, where things happen by mass action, the solutions are embedded in technical and social standards and not solely in legal avenues. The law might be lagging behind all these dynamic changes. One might ask whether privacy in a public place is a contradiction in terms. GPS devices might be protect property and enhance privacy but it does so in the cyberspace commons.

Geodetic activities in Latin America and The Caribbean: always IN

Readers may recall that we have published an article" Geodesy: Out with the Old, In with the New" by Prof Chris Rizos in November 2011. We present here some observations of SIRGAS on that article and clarification by Prof Rizos

C Brunini
SIRGAS President

L Sánchez
SIRGAS Vice-President

Geodesy has taken several important steps forward since the early days in which it was defined by Helmert as the science devoted to measuring and mapping the Earth's surface. Today, the challenge of modern Geodesy is to incorporate within Helmert's definition the determination of many more parameters of the "Earth System". As in other fields, the continuous and relentless transition from the "old" Geodesy to the "new" Geodesy generates controversial discussions within the geodetic community. One point of view regarding this process was recently proposed by Prof. Chris Rizos in his article "Geodesy: Out with the Old, In with the New", published in Coordinates (vol. VII, No. 11, November 2011). We have read this article with interest and appreciate the opportunity offered to us by the Coordinates' Editor to debate the point of view presented there regarding the evolution of Geodesy in different parts of the world. We hope the arguments presented in the following paragraphs provide valuable information regarding the current situation of Geodesy in the Latin America and Caribbean regions.

From Chris' article we particularly quote the following paragraph: "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."

SIRGAS policy promotes the installation of (at least) one analysis centre per country, ensuring the development and sustainability of in-country capabilities to manipulate modern reference frames at the national level.

For nearly two decades we have been committed to activities concerning the Geocentric Reference System for the Americas, SIRGAS, which was initiated in 1993 as a South American project with support of the International Association of Geodesy (IAG) and the Pan American Institute of Geography and History (PAIGH), and was recommended by the United Nations' Cartographic Conference in 2001 to be extended to all American countries. In the new structure of IAG 2003, SIRGAS was integrated as Sub-Commission 1.3b "Regional Reference Frame for South and Central America". This quite long experience convinced us that the reasons of the somewhat low participation of the Latin-American organisations and their scientists in the global IAG Services that Chris pointed out in his article, should be attributed to cultural reasons (in the

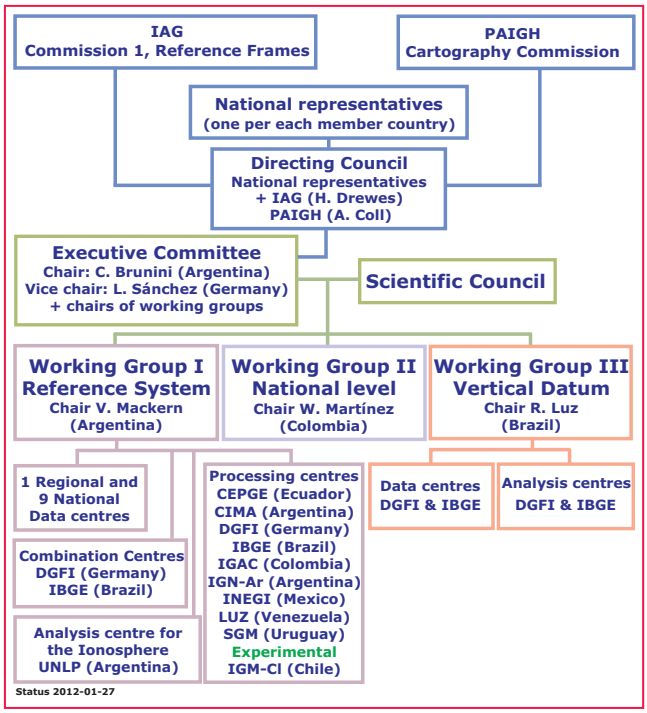

Figure 1: Organisational structure of SIRGAS.

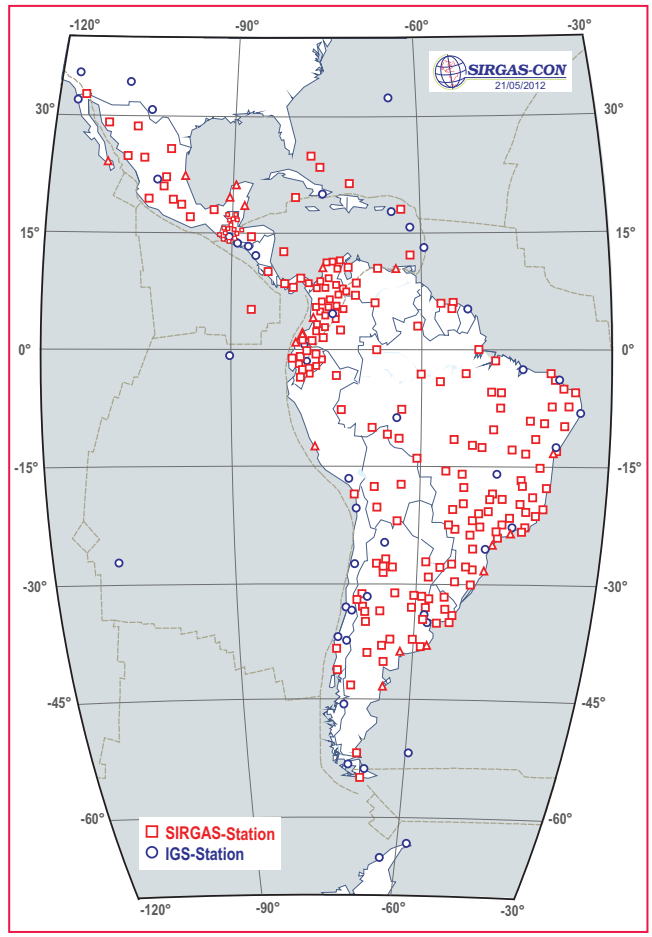

Figure 2: SIRGAS Continuously Operating Network (SIRGAS.CON), status May, 2012.

broad sense of the word "culture", the idiom being not a minor limitation), rather than to a real underdevelopment of Geodesy in these regions. Cultural transformations take longer to occur, but along the years we have experienced encouraging progress in most Latin American and Caribbean countries.

SIRGAS has made efforts to build stronger expertise, including organising several training courses to install analysis centres for its Continuously Observing Network of GNSS stations (SIRGAS-CON), the present realisation of SIRGAS, and the IAG-PAIGH-SIRGAS Schools on Reference Systems. The Schools have been convened during the last three years with local support from the Agustin Codazzi Geographic Institute (Colombia) in 2009, the National Geographic Institute of Peru in 2010, and the National University of Costa Rica in 2011. More than 350 participants from almost all Latin American and Caribbean countries have attended these Schools – a demonstration of the great interest in modern Geodesy. We are confident of attracting even greater participation of geodesists of these regions in the activities being coordinated by the IAG and other international organisations concerned with the production and application of geo-referenced data. Fig. 1 summarizes the participation of different countries in the organisational structure of SIRGAS.

At present, SIRGAS-CON consists of more than 240 continuously operating GNSS stations (Fig. 2). Until the first years of this century, most of these stations were installed as part of research projects initiated and funded by foreign institutions, while local scientists were mostly involved in the collection of the data. This situation has changed dramatically during the last decade. Most national mapping/geodetic agencies now understand the need for upgrading their geodetic infrastructure and have begun the deployment of modern GNSS networks, including in many cases with real time capabilities. At present, 14 Latin American countries rely upon SIRGAS to realise their national geodetic reference networks, stations of which are integrated in SIRGAS-CON, and are maintained and data processed following international standards and specifications, particularly those of the International GNSS Service (IGS) and the International Earth Rotation and Reference Systems Service (IERS). Thanks to the operational and administrative efforts of the Latin American institutions responsible for the national reference frames, SIRGAS is today able to make available high quality, long time series observation data of about 40 regional stations, which will be included in the second global IGS reprocessing. This will enable the improvement of the International Terrestrial Reference Frame (ITRF), by strongly linking the northern and southern western hemispheres (Fig. 3).

The installation and management of continuously operating GNSS stations has complemented an intense capacity building process that led to a strong involvement in the analysis of the data produced by SIRGAS-CON (Fig. 4). Today, SIRGAS-CON is divided into different sub-networks that are processed, on a weekly basis, by 8 analysis centres

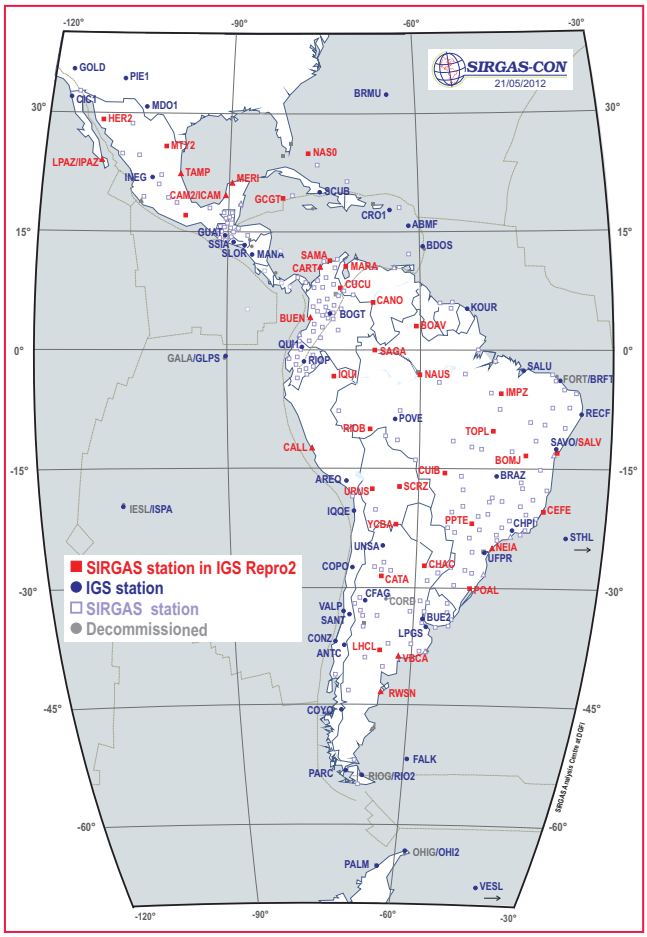

Figure 3: SIRGAS stations included in the reprocessing of the IGS global network.

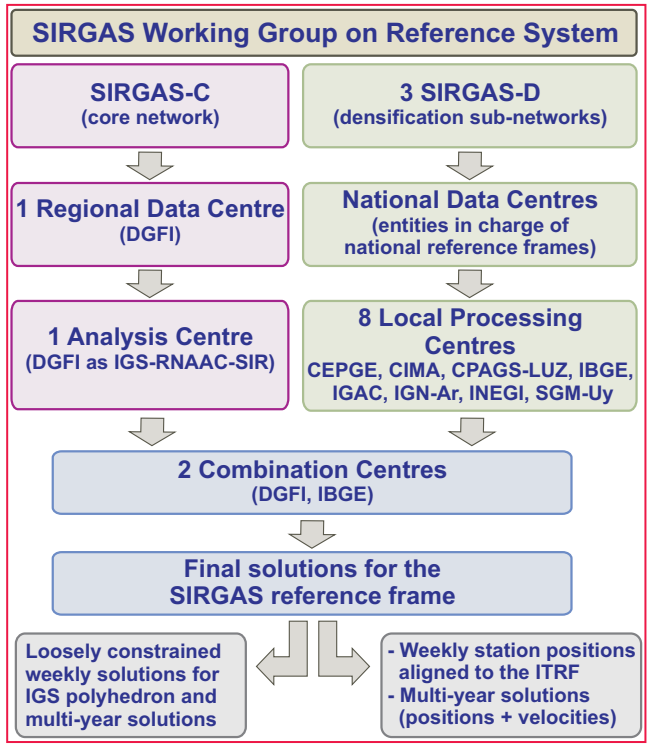

Figure 4: Dataflow within the weekly analysis of the SIRGAS Reference Frame.

operated by: the Military Geographic Institute of Ecuador, the National University of Cuyo (Argentina), the University of El Zulia (Venezuela), the Brazilian Institute of Geography and Statistics, the Agustin Codazzi Geographic Institute (Colombia), the National Geographic Institute of Argentina, the National Institute of Statistics and Geography (Mexico), and the Military Geographic Service of Uruguay. The processing strategy satisfies all IGS requirements and guarantees that each station is included in three individual solutions. The loosely constrained weekly solutions produced by the analysis centres are combined in a continentally consistent solution aligned to the ITRF by two combination centres, one operated by the Brazilian Institute of Geography and Statistics and the other by the Deutsches Geodätisches Forschungsinstitut (DGFI – Germany). Having two combination centres, functioning independently in different institutions, improves quality control and redundancy of the final products delivered to the community by SIRGAS.

SIRGAS policy promotes the installation of (at least) one analysis centre per country, ensuring the development and sustainability of in-country capabilities to manipulate modern reference frames at the national level. Within this policy, SIRGAS encourages and supports the installation of experimental analysis centres, which are candidates to become SIRGAS analysis centres. During a specified probation period, they align their processing strategies to those required by SIRGAS and demonstrate their capacity for timely and regular delivery of weekly solutions. Once they satisfy these requirements, they may be appointed as official analysis centres. During this test period (at least one year), they process a set of SIRGAS-CON stations, however their solutions are not included in the computation of the final SIRGAS-CON products. Presently, the Military Geographic Institute of Chile is an experimental analysis centre, and the Geographic Institute of Bolivia and the National University of Costa Rica are this year preparing to become experimental processing centres.

SIRGAS contributes to the IGS through the IGS Regional Network Associate Analysis Centre for SIRGAS (IGS-RNAAC-SIR), operated by the DGFI. Since 1996 this centre delivers loosely constrained weekly solutions, that are combined together with those generated by the other global and regional IGS analysis centres, to form the IGS Polyhedron. In addition, state-of-the-art multi-year solutions for the SIRGAS reference frame have been computed on an almost yearly basis (Fig. 5, Fig. 6).

Since 2006, SIRGAS operates a service for computing regional ionospheric maps based on SIRGAS-CON observations (Fig. 7). The ionospheric model used by SIRGAS has evolved from a “thin layer” simplification for computing the integrated electron density to a formulation that represents the four-dimensional distribution of the electron density of the E, F1, F2 and top-side ionospheric layers. The SIRGAS maps of vertical Total Electron Content are being used for kind of studies, such as validating the International Reference

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The International Association of Geodesy (IAG) Response

C. Rizos, IAG President

In my article "Geodesy: Out with the Old, In with the New", published in Coordinates (vol. VII, No. 11, November 2011), the following sentence caused some controversy: "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." I am pleased to see Claudio Brunini and Laura *Sánchez* respond with a very enlightening article on the development and current status of SIRGAS (Geocentric Reference System for the Americas).

In hindsight my words may have been ill-chosen, and perhaps a little harsh, and I apologise if they caused offense to my South American, Asian or African colleagues. Certainly progress in South America has been rapid, as the Brunini and Sánchez article explains very well. In fact SIRGAS is a successful example of regional geodetic cooperation in which, in addition to a number of objectives being met, the resulting institutions, expertise and linkage mechanisms have become permanent and self-sustaining. The SIRGAS experience in many ways mirrors the foundation of the International Association of Geodesy (IAG). Let us look back at the history of the IAG and tease out some lessons.

At the invitation of the Prussian General Johann Jacob Baeyer, representatives of the states of Prussia, Austria and Saxony met from 24th to 26th April 1862 in Berlin to discuss Baeyer's "Proposal for a Central European Arc Measurement" ("Entwurf zu einer Mitteleuropäischen Gradmessung"). By the end of 1862, 16 nation states had agreed to participate in the project: Austria, Belgium, Denmark, France, seven German states (Baden, Bavaria, Hannover, Mecklenburg, Prussia, Saxony, Saxe-Gotha), Italy, The Netherlands, Poland, Sweden, Norway and Switzerland. The IAG counts this international scientific initiative, and the organisation it spawned, as its origin and is therefore celebrating its 150th anniversary this year.

In October 1864, the first "General Conference of the Representatives to the Central European Arc Measurement" took place in Berlin. The organisational structure (Permanent Commission, Central Bureau, and triennial General Conferences) was agreed to and a research program was developed. The IAG considers this conference as its first General Assembly. Baeyer was appointed Director of the Central Bureau and Peter Andreas Hansen appointed President of the Permanent Commission. The project extended rapidly to other European states and consequently the name of the organisation was changed in 1867 to "Europäische Gradmessung", and in 1886 to "Internationale Erdmessung" ("Association Internationale de Géodésie") with additional member states Argentina, Chile, Japan, Mexico, and USA. (The current name "International Association of Geodesy" was adopted in 1932.)

The past 150 years cover a remarkable historical era. From the mid-19th Century – with its social turmoil, national rivalry and endless continental wars – to the present day, characterised by technological wizardry and unprecedented levels of globalisation. That so many countries, in such a short time, pledged to work together, is an amazing achievement in itself. I have compiled some lessons that I believe can be drawn from this enterprise:

Strong personalities – administrators, government official, military leaders, scientists, all contribute through expertise, drive and leadership.

Rationale for cooperation – a range of benefits were expected, including scientific results, engineering and practical outcomes, and the sharing of know-how and expertise.

Well defined structures – clear objectives, emphasis on operational and analysis guidelines, strong central bureau, significant government "buy-in", and being well-funded, served the organisation well in its early years.

Active government agency involvement – critical early support by governments is mirrored by today's crucial contributions by national mapping/geodetic organisations and space agencies.

Range of activities – promotion of "blue sky" research projects, by groups and individuals from different countries, as well as the development of standards and practical procedures, ensures the needs of multiple stakeholders are addressed.

Communications –publication of reports, convening regular conferences and encouraged networking amongst scientists and national agencies.

Strong scientific focus – the geodetic enterprise was (and still is) taking advantage of advances in data measurement technology and analysis theory, driving the generation of geodetic outputs of ever improving quality.

Service oriented – what drove the establishment of the IAG still holds today, that its outputs can be applied in the service of science and society.

Adaptability – as circumstances change, the organisation and its objectives, structures and rules must adapt.

We can see from the Brunini and Sánchez article that SIRGAS exhibits many of the characteristics of a long-lived institution such as the IAG. The will to cooperate with other countries, to share experiences, expertise and data, are necessary conditions, however not sufficient conditions. What is required is a change in mindset – from local or national perspective to one that is regional and global – implying a deep cultural change. Competing countries become cooperative nations.

Baeyer died in 1885, and under his successor, Friedrich Robert Helmert, the Central Bureau moved from Berlin to Potsdam, together with the Geodetic Institute, which is the predecessor of today's GeoForschungsZentrum (GFZ) at Potsdam. Against all odds the IAG survived two World Wars, evolving in the process, and becoming part of the International Union of Geodesy and Geophysics (IUGG) after its establishment in 1919. For more details the reader is referred to an excellent article by Torge (2005).

It must be acknowledged that the (perhaps utopian) goals of close European cooperation and unfettered sharing of geodetic data were not substantially achieved until well after WWII. However, in the past few decades the IAG has "come full circle", and is again strongly promoting increased global collaboration in order to advance the practice and science of geodesy. The SIRGAS enterprise therefore shares the original ideals of the IAG, and at the same time is a positive example of the relevance of Modern Geodesy – the application of advanced geodetic technologies to address the needs of science and society. It is hoped that the SIRGAS geodesists will share their experiences with colleagues in other parts of the world, where tight regional-level cooperation still more an aspiration than a reality. That will require SIRGAS geodesists to play a larger role in global geodesy by, for example, leading and contributing to IAG components (Commissions, Sub-Commissions, Working Groups, Services, etc).

To celebrate its origins, the IAG will hold its regular quadrennial Scientific Assembly in 2013, between the dates of its foundation and the first General Conference of the Mitteleuropäische Gradmessung, in Potsdam and Berlin.

Torge, W.: The International Association of Geodesy 1862 to 1922: From a regional project to an international organization, **Journal of Geodesy** (78): 558-568, 2005.

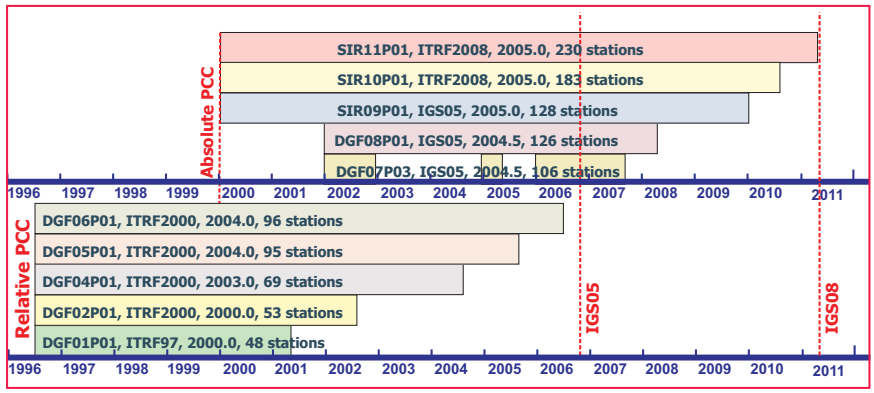

Figure 5: Inventory of the multi-year solutions of the SIRGAS Reference Frame. (PCC: phase centre correction)

Figure 6: Horizontal velocities computed within the latest SIRGAS multi-year solution (SIR11P01).

Ionosphere (IRI) over the South American region, improving the performance of single-frequency GPS receivers, and testing the feasibility of computing the ionospheric corrections for a regional satellite based augmentation system (SBAS).

SIRGAS is also contributing to the modernisation of the classical vertical reference systems. The main objective is to refer all existing physical heights to one and the same equipotential surface, which has to be defined and realised in

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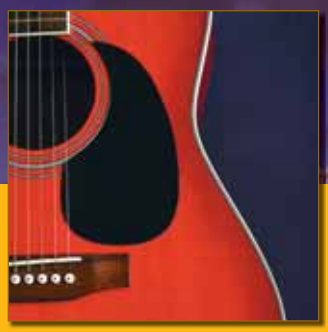

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a global frame with high precision. This demands a close collaboration with all colleagues working worldwide on this topic. During the four coming years, SIRGAS is participating in GGOS-Theme 1 (Unified Global Height System) through activities carried out within the joint working group "Vertical Datum Standardisation", a common effort of the Global Geodetic Observing System, the IAG Commission 2 (Gravity Field) and the International Gravity Field Service (IGFS).

Besides the SIRGAS participation in the IAG Commission 1 (as Sub-Commission 1.3b), the IGS-RNAAC-SIR and GGOS-Theme 1, SIRGAS contributes to the IAG Commission 1 working group on "Integration of Dense Velocity Fields into the ITRF", the IGS working group TIGA, the IAG Commission 1 working group on "Deformation Models for Reference Frames", the IAG Commission 1-IERS-ICTT joint working group "Strategies for Epoch Reference Frames", and the IAG Commission 4 study group "Ionosphere Modelling and Analysis". Up-to-date and detailed information about SIRGAS, its achievements and challenges, can be obtained from the organisation's web page (www.sirgas.org) and, among others, the following papers recently published in S. Kenyon, M.C. Pacino, U. Marti (Eds.), "Geodesy for Planet Earth", IAG Symposia, Vol. 136, Springer 2012:

Brunini, C., F. Azpilicueta, M. Gende, A. Aragón-Ángel, M. Hernández-Pajares, J.M. Juan, J. Sanz: Toward a SIRGAS Service for Mapping the Ionosphere's Electron Density Distribution, 753-760.

Brunini, C., L. Sánchez, H. Drewes, S. Costa, V. Mackern, W. Martínez, W. Seemüller, A. da Silva: Improved Analysis Strategy and Accessibility of the SIRGAS Reference Frame, 3-10.

Costa, S.M.A, A.L. Silva, J.A. Vaz: Processing Evaluation of SIRGAS-CON Network by IBGE Analysis Center, 859-867.

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Drewes, H., O. Heidbach: The 2009 Horizontal Velocity Field for South America and the Caribbean, 657-664.

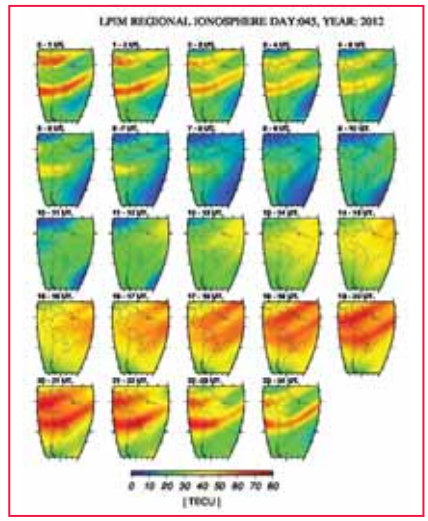

Figure 7: SIRGAS vTEC map for the February 14th, 2012.

Sánchez, L., W. Seemüller, M. Seitz: Combination of the Weekly Solutions Delivered by the SIRGAS Processing Centres for the SIRGAS-CON Reference Frame, 845-852.

Seemüller, W., M. Seitz, L. Sánchez, H. Drewes: The new Multi-year Position and Velocity Solution SIR09P01 of the IGS Regional Network Associate Analysis Centre (IGS RNAAC SIR), 877-884.

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Federal Aviation Administration Wide Area Augmentation System (WAAS) Program Manager

The role of WAAS

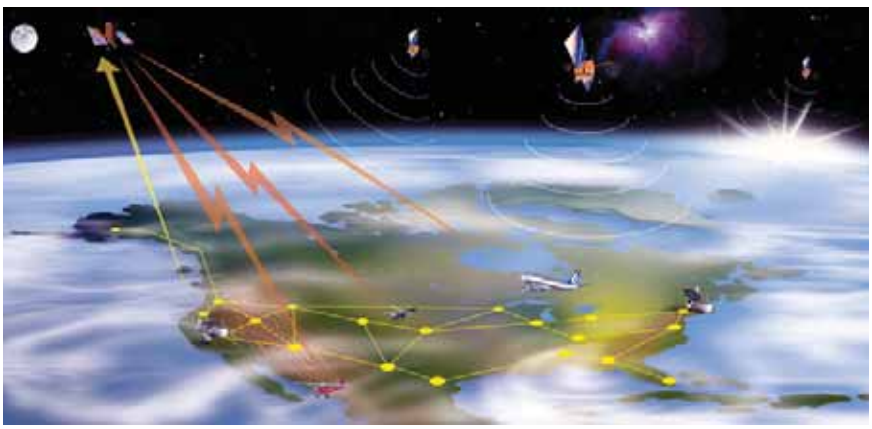
The Wide Area Augmentation System (WAAS) was developed by the Federal Aviation Administration as an augmentation to the Global Positioning System (GPS). WAAS is needed because GPS alone does not meet the FAA's navigation requirements for accuracy, integrity, and availability. In just one example, WAAS increases accuracy from 10-12 meters with GPS alone, to 1-2 meters horizontal.

WAAS was developed to support navigation during all phases of flight – enroute through Category I precision approach. WAAS is also an important part of the FAA's Next Generation Air Transportation System (NextGen) plans. As part of NextGen's mission to meet the needs of U.S. National Airspace System (NAS) users, WAAS supports the FAA's goal to transition from the use of ground-based navigation systems to those based on satellites.

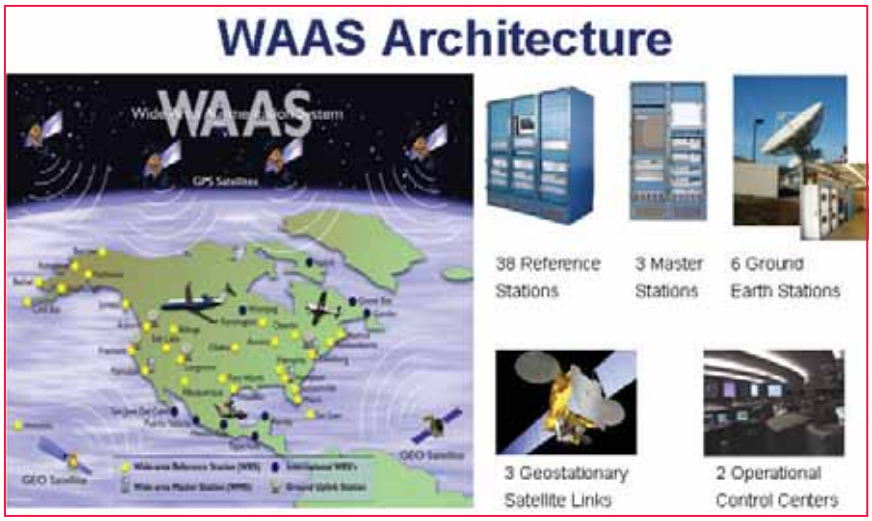
WAAS today

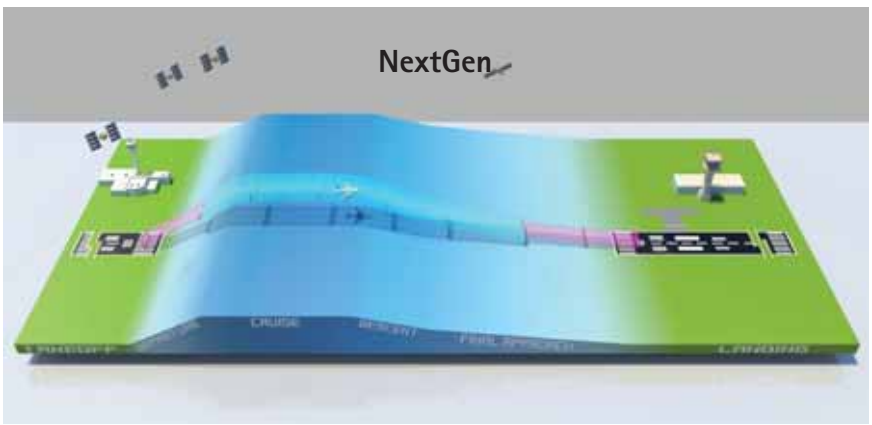
WAAS, which became operational in 2003, currently consists of 38 monitoring stations installed across the United States, Canada, and Mexico; three master stations; six ground earth stations serving three geostationary satellites; and two operations control stations. WAAS provides very precise navigation service, with both horizontal and vertical guidance over the Continental United States (CONUS) and a large portion of Alaska, Canada, and Mexico. Other countries and regions of the world also have fielded or are fielding similar systems. WAAS and each of these other systems are known as a Satellite Based Augmentation System, or SBAS. As envisioned at its inception, WAAS today provides service from enroute through approach.

For enroute flight, WAAS has eliminated the need for airways to be tied to ground-based navigation aids. WAAS-equipped aircraft enjoy the flexibility and benefit of point-to-point operations. Specifically, WAAS satisfies equipment requirements for the new, more direct enroute flight options of 'T' and 'Q' routes. A T-Route is an Area Navigation (RNAV) route used in low-altitude airspace operating below 18,000 feet. A Q-Route is an Area Navigation (RNAV) route used in high-altitude airspace (18,000 feet – 45,000 feet). In addition to the convenience of more direct routes and the associated time savings, fuel use and pollution are being reduced through the use of WAAS in the enroute environment.



Because of WAAS, the FAA is starting to discontinue the service provided by older, ground-based navigation aids, such as VHF Omni-directional Ranges (VOR). Most of these systems are more than 20 years old. Replacing them would cost an estimated $1 billion. As of the spring of 2012, the FAA had 954 federally-owned and operated VORs (including VORTACs and VOR/DMEs). The FAA recently announced its plans to transition to a minimum operational network (MON) of roughly half of the





current number of VORs by 2020. With WAAS in place, these older systems can be discontinued, thereby saving replacement costs while providing an improved level of navigation service.

The most significant benefit of WAAS can be realized in approach operations. Before WAAS, the Instrument Landing System (ILS) Category I approach was the standard for precision approach operations. With WAAS, future Category I instrument requirements will generally be satisfied through the use of WAAS Localizer Performance with Vertical guidance (LPV) approaches. LPV approaches use the refined accuracy of WAAS lateral and vertical guidance to provide an approach very similar to a Category I ILS approach. Just like an ILS, an LPV approach can provide minimums as low as 200 feet at qualifying airports.

Unlike ILS approaches, WAAS LPV approach procedures do not require the installation or maintenance, both costly, of navigation systems at the airport.

WAAS also enables another new type of approach procedure called Localizer Performance (LP). LP approaches are non-precision approaches, providing only lateral guidance, which is provided by WAAS. LPs are being published in locations where terrain or obstructions do not allow publication of vertically guided LPV procedures. LP procedures can often provide lower minima than the lateral navigation (LNAV) procedures which rely on ground-based navigation systems or on GPS alone. LPs will be published at locations where the terrain or obstructions do not allow publication of LPV procedures.

In February of 2012, the FAA reached a major milestone when the number of published WAAS approach procedures available nationwide exceeded 3,000. By the summer of 2008, there were already more than twice as many WAAS approaches as Instrument Landing Systems (ILS) approaches. The FAA's goal is to publish a LPV or LP approach procedure for every instrument runway in the U.S. Today, WAAS is providing the equivalent of precision approach capability at more than 1,400 airports throughout the United States, including about 2,800 runway ends.

Who is using WAAS?

To date, over 70,000 WAAS-capable receivers have been sold. This number is increasing at a rate of approximately 1,000 units per month. Current WAAS users can be found across many segments of the aviation community. The general aviation (GA) community was the first to support WAAS and continues to be strong proponent today, aggressively equipping with WAAS receivers that include LPV certification. Regional aircraft are also equipping with WAAS LPV capability in increasing numbers. There are over 2,100 regional aircraft equipped so far. Horizon Airlines, which equipped their Q-400s with WAAS,

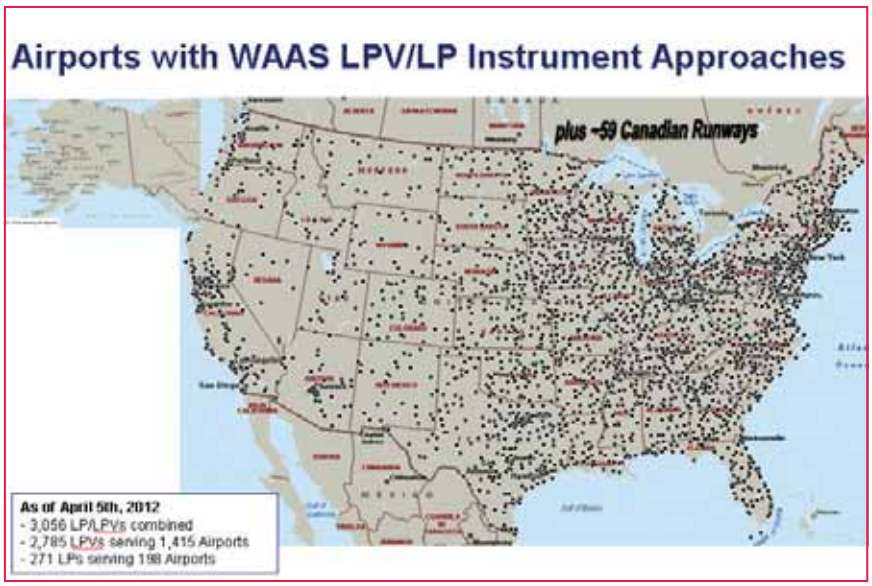
have increased poor weather operations. For Cape Air, another regional carrier, WAAS is helping to improve efficiency and enhance safety of their operations by providing more approaches with vertical guidance at numerous runways, including those with unique terrain challenges. The cargo carrier, Northern Air Cargo (NAC), was the first in the U.S. to equip a Boeing 737-200 aircraft with WAAS. For NAC, WAAS has enabled more direct flights paths than those provided by the current ground-based navigational systems, reducing fuel consumption, and providing environmental benefits. WAAS has also increased the rate of successful landings at remote Alaskan airports for NAC through the use of the lower WAAS approach minimums.

Helicopters are also starting to equip with WAAS. WAAS offers unique benefits to vertical flight operations. CareFlite, a provider of emergency medical service (EMS) helicopter operations in the Dallas-Ft.Worth metroplex, is participating in activities to help quantify the benefits that WAAS can provide to EMS helicopter operations. These efforts have supported the development of a low-altitude route structure throughout the Dallas-Ft.Worth metroplex and the advancement of LPV point-in-space (PinS) instrument approach procedures. In Des Moines, Iowa, Air Methods, another EMS helicopter operator, has equipped with WAAS and has been approved to use a low altitude

> To date, over 70,000 WAAS-capable receivers have been sold. This number is increasing at a rate of approximately 1,000 units per month.

Instrument Flight Rules (IFR) enroute structure which will enable a higher rate of landings at medical facility helipads. Without WAAS, these aircraft would often be re-routed to a nearby airport which could add as much as an hour or more delay before a patient reaches the intended facility. These critical benefits provided by WAAS are a strong incentive for equipage.

Although originally developed for aviation, WAAS is now also popular for many other uses. When WAAS was first available, GPS manufacturers would sometimes add WAAS capability as a bonus. Today, it is rare to find a GPS chip manufacturer that does not include WAAS. WAAS is used by fisherman, boaters, farmers, and others that require precise positioning accuracy for the things that they do. More accurate than GPS alone, WAAS provides extremely accurate and reliable guidance when a mariner needs to get to a specific location – whether this is a fishing hole, a diving site, or an underwater object. Many marine manufacturers emphasize the availability of WAAS in specific products to appeal to their consumer base. WAAS also is popular for several uses within precision farming. WAAS allows farmers to plant their crops with high levels of accuracy and can help farmers more precisely administer the application of fertilizer and other materials to their fields. The popularity of WAAS in precision farming is evidenced by the presence of WAAS tutorials, WAAS status updates, and general WAAS information on websites dedicated to precision farming. In the field of mapping, post-processing was required for GPS data to be usable; with the greater accuracy of WAAS, there is often no need to post-process data. Even for more recreational uses, such as geocaching, WAAS is often considered a necessity. As an aviation agency, the FAA does not actively track non-aviation uses of WAAS, but it seems safe to say that anywhere there is a need for precise positioning; WAAS may be in use.



What's next for WAAS?

To ensure WAAS continues to be a viable resource for the future, the FAA implements continued system development, sustainment, and technology refresh activities. WAAS is currently in Phase III of development, which includes activities to make WAAS compatible with the new GPS L5 frequency. This phase also includes the transition of WAAS operations and maintenance responsibilities from the WAAS prime contractor to the FAA's WAAS Operations group. Phase III is scheduled for completion in 2013. Phase IV, the final phase of WAAS, begins in 2014. In Phase IV, the inclusion of GPS L5 - introduction of dual-frequency (L1 and L5) operations - into WAAS will be complete. The FAA plans to initiate WAAS Dual Frequency service in concert with the full L5 capable GPS constellation. (Two GPS satellites with L5 capabilities have already been launched and a full GPS constellation of L5 capable satellites is estimated to be available by approximately 2019.) The FAA will also continue to

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The biggest challenge in developing SBAS capability in South America involves the ionosphere. Due to volatile ionospheric conditions in that region of the world, the use of an ionospheric grid as used in the U.S. is not practical.

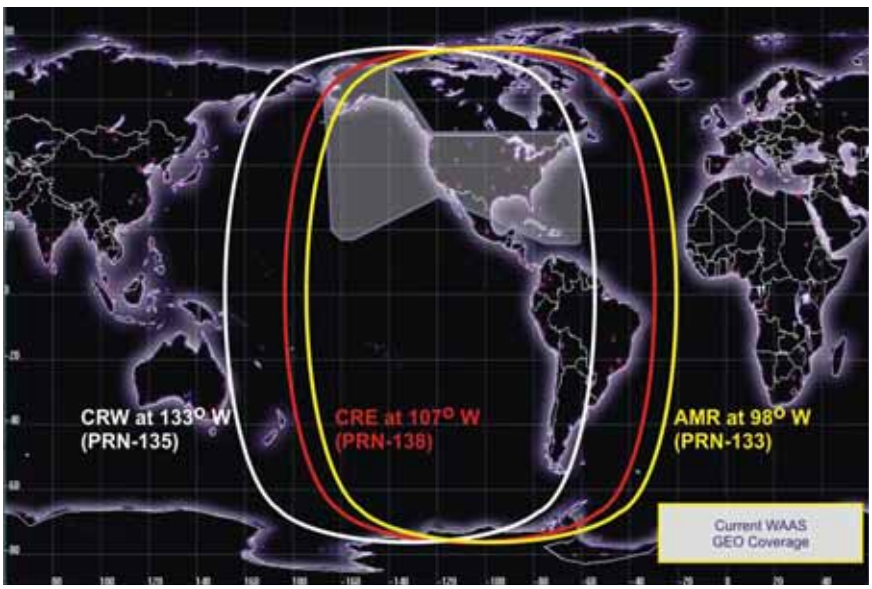
support the current Single Frequency service. Phase IV will also include WAAS lifecycle maintenance activities and will continue until at least 2028.

As part of sustainment and development activities, the FAA is committed to maintaining a robust constellation of geostationary satellites (GEOs). Today, WAAS uses three GEO satellites to broadcast the WAAS signal-in-space: the Intelsat Galaxy XV (also known as CRW); Anik F1R (a.k.a. CRE); and the Inmarsat I4F3 (a.k.a. AMR). The FAA is in the midst of acquiring leases on three additional GEOs. When these WAAS GEOs become operational, the use of existing (and older) GEOs will be discontinued. It is expected that all three new WAAS GEOs will be operational by 2018. The location of these new WAAS GEOs will optimize coverage and will also provide the ability to broadcast WAAS over dual frequencies.

Beyond continued system development, sustainment, and technology refresh activities for WAAS; future WAAS initiatives include support of global interoperable SBAS services including the development of SBAS in South America, dual-frequency multi-constellation (DFMC) SBAS, and Advanced Receiver Autonomous Integrity Monitoring (ARAIM).

To extend SBAS into South America, various technical approaches are being evaluated. The biggest challenge in developing SBAS capability in South America involves the ionosphere. Due to volatile ionospheric conditions in that region of the world, the use of an ionospheric grid as used in the U.S. is not practical. However, the use of dual-frequency GNSS does offer the technology to mitigate ionospheric conditions in South America. Because of this, the implementation of a South American SBAS will likely be dependent upon the timelines for the completion of dual-frequency GNSS capabilities.

In coordination with the SBAS Interoperability Working Group (IWG), the FAA is helping to draft operational concepts to support standards development for DFMC SBAS. The SBAS IWG is an international group comprised of SBAS service providers who meet on a regular basis to ensure seamless operations as systems expand, are enhanced, or as new SBAS systems are implemented. The IWG provides work products to the International Civil Aviation Organization, RTCA, and the European Organization for Civil Aviation Equipment (EUROCAE) to help guide the evolution of Standards and Recommended Practices (SARPs) and development of dual-frequency GNSS Minimum Operational Performance Standards (MOPS). Using the MOPS, the avionics industry can begin to manufacture dual-frequency GNSS avionics.



ARAIM is another approach being investigated for using multiple frequencies to help resolve ionospheric delays. ARAIM uses ranging sources from two GNSS constellations to identify errors in both horizontal and vertical directions. ARAIM can identify errors smaller than those identified by traditional RAIM. In the future, ARAIM may be able to enable appropriately equipped aircraft to conduct precision approach operations based on minimally-validated constellation performance assumptions. Over the next two to three years, the FAA intends to clearly define how the ARAIM concept will work. With sufficient concept definition and maturity, standards development for ARAIM avionics can begin. Associated challenges include identifying threats, assessing algorithms, and determining the best way to inform aircraft of the validated constellation performance assumptions.

As future initiatives progress, technical challenges, institutional challenges, or both are likely to present themselves. Continued collaboration with industry, academia, and international partners will provide benefit as the GNSS community moves forward together to meet future challenges. It will be exciting to see how WAAS and other GNSS systems continue to evolve over the next ten to fifteen years.

For those interested in staying informed of WAAS activities, the FAA publishes a quarterly newsletter, SATNAV News, which can be accessed at *http://gps.faa.gov*

JAVAD's good filter

Coalition's bad filter

Bad GPS filters invite harmful extra noise which exists everywhere. The spectrum will get even more congested as the need for modern communication increases. It is selfish, impossible, unfair and unwise if we expect to block modern communication because GPS manufacturers design bad filters.

Our talented and dedicated team of scientists designed this filter to protect GPS by not looking into other spectrums; and at the same time improve the GPS performance.

This is the filter that Coalition team uses. Instead of focusing on science, they employed talented and dedicated team of lawyers and lobbyists. Their leaders in their letter to PNT declared that a good protective filter could not be built even in a decade. We did it in one month!

Unfortunately sometimes politics wins over science.

Most GNSS receivers soon will face the "retrofit" problem because of their bad filters and because they don't track all modernized GPS signals of new GPS satellites and others.

- **GPS L1, L2, L5**
- **GLONASS L1, L2, L3**
- **QZSS L1, L2, L5**
- **Galileo L1, E5A, E5B, altBoc**
- **Compass B1, B2**

The black Sheep saved GPS by building a smart filter, not a senseless coalition!

Where Were You in 1982?

It was in late 1982 when at the National Geodetic Survey (NGS) we performed a test to prove that GPS could be used for precision surveying. Captain Sam Baker, R. Admiral Dr. James Collins (previous heads of NGS) participated. I also vividly remember the excitement of Dr. Clyde Goad, Dr. Ben Remondi, Dr. Gerry Mader, Larry Hothem, Chuck Froncheck, Roy Anderson and many other NGS folks that helped to promote the use of GPS in precision surveying. I am still proud to call them all good friends.

Shortly after, I delivered GPS survey units to the County of Lincoln, Nebraska, to another good friend, Larry Worrel. The first observing session started at 2:00 AM because the four GPS satellites were only visible at that time. Even for me, a semi-native of Iowa, it was cold! Larry did a fantastic job of promoting GPS to the surveyors in Nebraska, and was a pioneer in this field. He later helped neighboring states, too.

At the same time there were some surveyors who were making fun of GPS. One said "I would never trust my survey job to anything that had an antenna!" Another declared, "I'll be happy with my total station for the rest of my career!" It probably took them a long time to outgrow their survey chains and learn total stations.

While we were promoting GPS, they said they would never trust their survey jobs to anything that had an antenna. Déjà vu!

Fast-forwarding thirty years later to 2012, I see the same surveyors complain about the position I took on LightSquared. They are quite happy with the problematic GNSS instruments they are using. They don't care about new GNSS systems and signals. They don't understand that a GPS receiver that cannot withstand LightSquared will eventually suffer from other interferences as well. They don't understand why, in some areas, their GPS receivers do not work as well as in other areas. They have no clue what the low-cost, nationwide RTK network based on LightSquared stations could have done for them and for their children. **When I first met with LightSquared executives, the first thing I asked was, can we build a low-cost, reliable nationwide RTK system?** We started to work on that plan with then-executives team. The opportunity presented by LightSquared may be gone forever, or at least for the near future.

They don't understand that a GPS receiver that cannot withstand LightSquared will eventually suffer from other interferences as well.

But many surveyors did what they were told and just followed the lead of lawyers and lobbyists, and that senator from Iowa! LightSquared showed us the problem that we had in our GNSS receiver designs. Transport Ministry reported that during two days 337 aircrafts report-

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- GLONASS L1, L2, L3
- QZSS L1, L2, L5
- Galileo L1, E5A, E5B, altBoc
- Compass B1, B2

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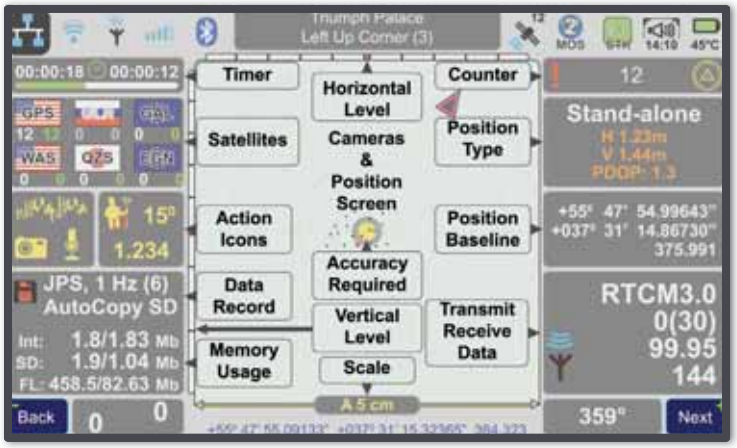
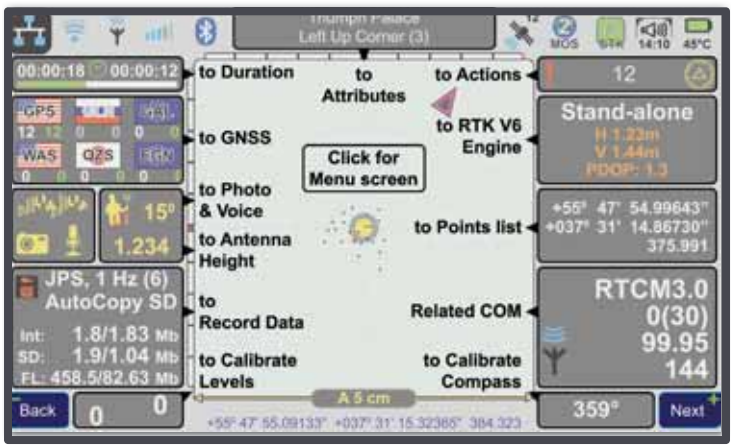
VICTOR-VS



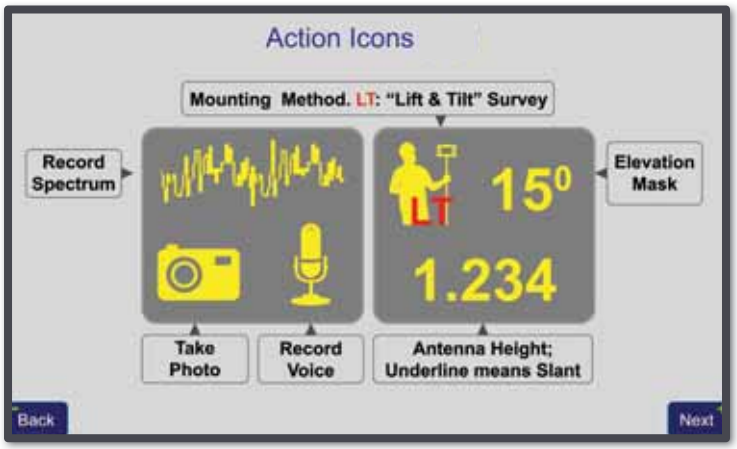
Have you seen our controller software lately?

These are some samples of over 100 screens.

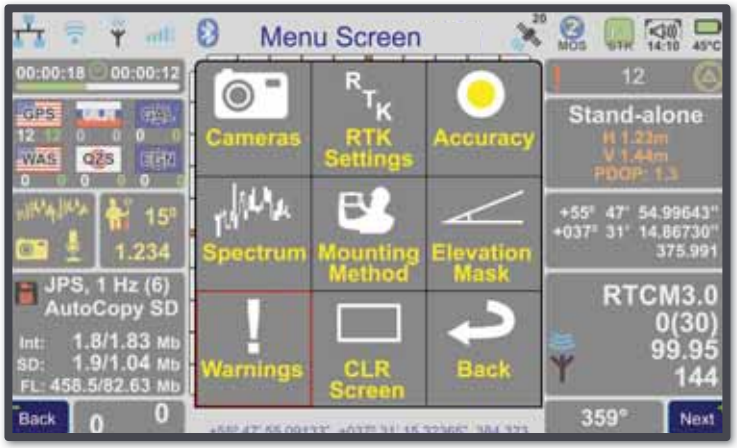
• Select the action that you want to perform. It optimizes the Action Screen and the Command screen to easily perform your tasks.



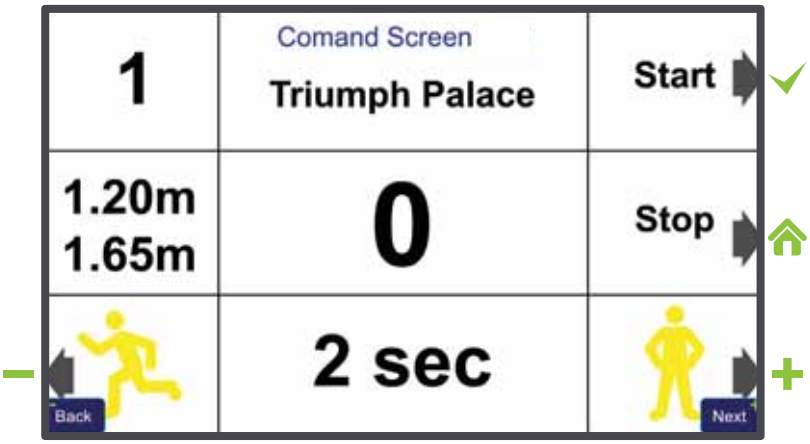
• After you define Settings and select your desired operation, click the Action button to take you to the Action screen where you can see the summary of the GNSS and communication settings and the current status of satellites and communication activities.



• In Lift & Tilt mode ("**LT**") you only need to lift the unit to near vertical on top of the survey point to start survey and then to tilt it to end the survey.

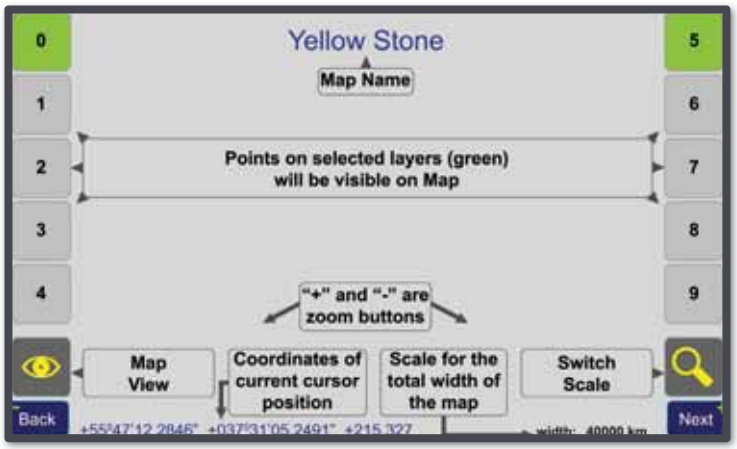


• *Click the center of the Action Screen to take you to other actions with a single click.*



• *Click Action button again to see some important items in large fonts and to start/stop and command actions (depending on the current action settings).*

• *You can create or import maps easily via the Map icon of the Home screen.*



• *Points, and their attributes, are stored in the selected layers of the Current Map.*

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ed failure of their GPS signals due to interferences. With or without LightSquared we have to solve our problem. This is what I did while improving performance, too. Others formed Coalitions and hired lawyers and lobbyists. And the surveyors hid their heads in the sand and said "I am happy with my GNSS receivers and don't care about new modernized GPS, GLONASS, Galileo, and Compass signals, either."

LightSquared showed us the problem that we had in our GNSS receiver designs. With or without LightSquared we have to solve our problem.

None of these surveyors complain about why they have been sold receivers which have no protection. None of them ask why this trend continues. They still buy receivers with the same problems. They still don't care that they don't benefit from the new modern signals.

None of these surveyors complain about why they have been sold receivers which have no protection. None of them ask why this trend continues.

I have written several papers and given presentations to technical committees —including NASA, JPL, and academia—addressing technical issues regarding LightSquared and the solution for it. So far I have received not one negative comment from scientists and engineers regarding my technical solution. But I have received personal attacks from some surveyors.
The support from many real surveyors still encourages me to strive to build the best instruments that surveyors and high precision users need. This is my deep passion and not a business searching for financial rewards.
Now I see those surveyors in chat rooms. They pose as GPS experts, but their vocabulary, logic, and their personal attacks on me regarding this highly technical issue, reveals that they still belong to the chain-survey generation. Fortunately, such surveyors account for less than 1% of educated surveyors who comprise the backbone of the survey profession in the United States of America. Benefit to surveyors aside, do they realize that in America, because of the monopoly of the two major carriers, it's been estimated that we pay 80% more for our cell service than the rest of the world? This is what LightSquared was trying to change. Lobbyists and lawyers were successful and science and engineering failed.

Lobbyists and lawyers were successful to push back science and engineering, at least temporarily.

So, what's it going to be? Will surveyors continue to stick their head in the sand, or will they look to the future and prepare themselves for even better GNSS capability and cheaper broadband?

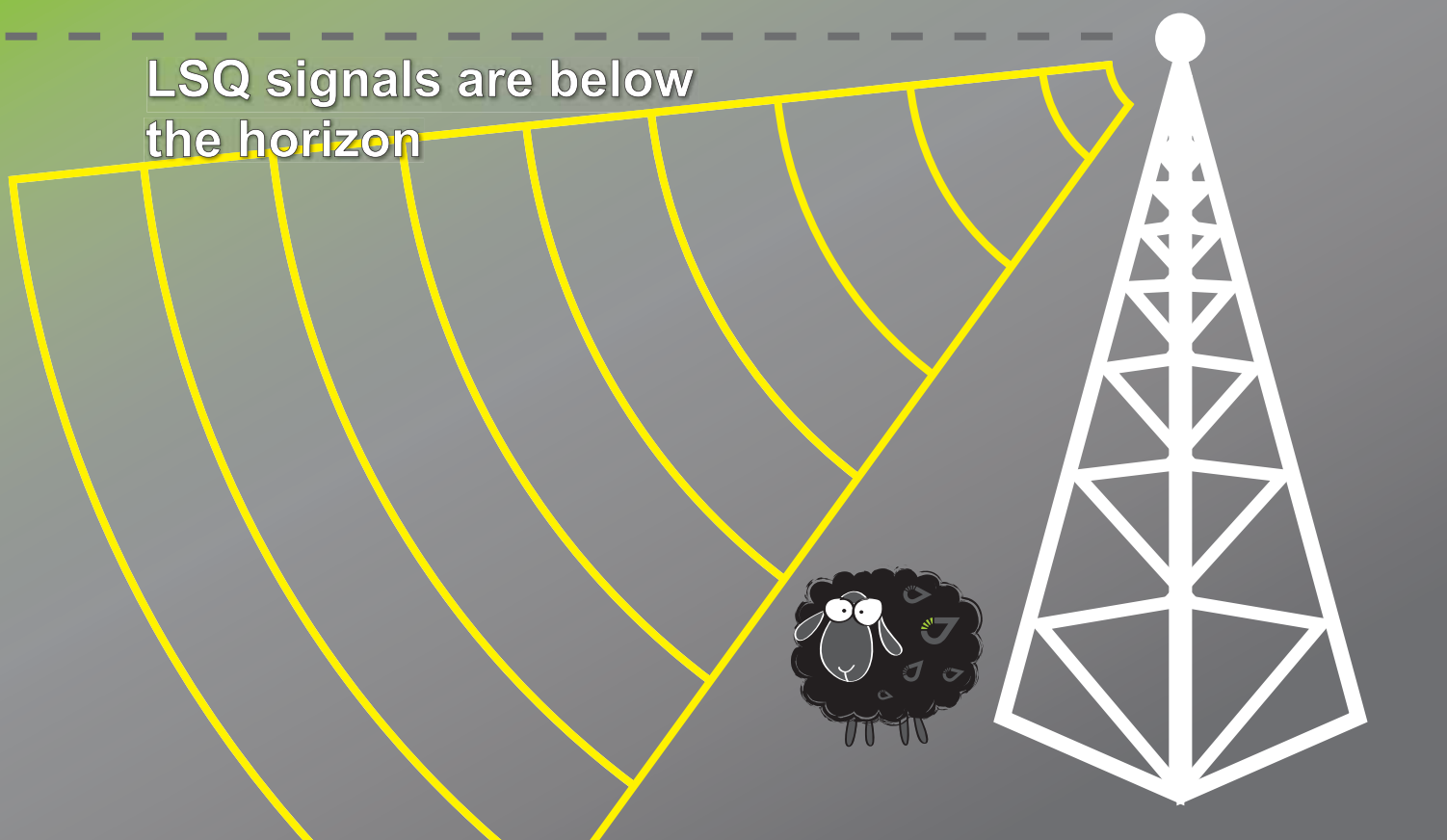
Airplanes fly way up here

We love LightSquared because we want to establish RTK reference stations in LightSquared's transmitting towers and use their infrastructure to provide low cost nationwide RTK networks for the benefit of all surveyors and high precision users. The existing RTK networks have limited coverage, limited performance and are very expensive.

Special interest groups use scare tactics to block LightSquared. Example: "LightSquared signals interferes with GPS receivers in airplanes and planes will crash".

This is not true. Even if GPS receivers in airplanes do not have required protective filters, they still are not affected. The reason is that all LightSquared transmitting antennas are tilted six degrees below the horizon and less than 1% of their power is transmitted above the horizon (where airplanes fly). The Coalition ignores this fact in their test reports.

Please see www.javad.com for other examples of how lawyers and lobbyists of special interest groups attempt to beat science.



Accuracy maintenance method for mobile mapping system data at GPS invisible area

In this paper accuracy investigation of MMS vehicle position correction process using GCP and development of accuracy maintenance method for MMS data at GPS Invisible Area are discussed. We present here the first part of the paper. The concluding part will be published in July 2012 issue

Akihisa Imanishi
PASCO CORP. MMS High Accuracy Information Center, Japan

Kikuo Tachibana
Research and Development Center of PASCO CORP, Japan

Koichi Tsukahara
Technical advisor, PASCO CORP, Japan

Roads are improved and maintained depending on its roles such as transport routes, minelayers of lifelines, refugee roads at disaster and also needs of users. To improve the roads safety and convenience, road authorities need the data to be used to comprehend 3D shape of the road space and its deformation quickly and accurately.

Recently, approaches in the fileld of the maintenance of topographic map data have been improved significantly in Japan. The typical advance is three-dimensional measurement of road space using Mobile Mapping System (MMS). Measurement accuracy of the MMS data is highly dependent on GPS satellite constellation, the number of satellites and the signal acquisition situation. While enough GPS satellite signals are captured, the absolute accuracy of the position i.e. latitude, longitude and altitude is accomplished less than 10cm.

However there are so many GPS invisible area in the geospatial space such as urban and mountainous area in Japan where high accurate MMS data can not be achieved. It is expected that maintenance of topographic map can be improved efficiently and secondly use of map data in various purpose is prospected if the MMS measurement data in such area can be improved. In this paper, from these perspectives, accuracy investigation of Land Mark Update (LMU) which corrects MMS vehicle position utilizing ground control point was carried out and depending on this result development of accuracy maintenance method in GPS invisible area was considered. Established accuracy maintenance method can be expected that it contributes to common use of MMS and the rapid and steady supply of national infrastructure data.

General description of MMS

MMS developed by Mitsubishi Electric Corporation Obtains its position and orientation accurately by 3 GPS antennas which allocated as triangle constellation, IMU and odometer. Each collected laser point is given geographical coordinates and superimposed onto imagery captured simultaneously. By using the MMS data, very accurate road 3D spatial information can be obtained. In Fig.1, the system configuration of MMS (Type-X) and in Fig2., collected MMS measurement data(laser point cloud and imagery) are displayed.The specification of position and orientation measurement equipment of MMS are listed in Table.1.

The key facility and technology to achieve precise positioning of MMS are Japanese GPS permanent ground control network (GEONET) and commercial real time kinematic GPS services which utilize 1sec interval real time data derived from GEONET. GEONET consists of approx.1,200 GPS continuous observation stations which are well distributed all over the country. The average distance between the stations is about 25km. VRS (Virtual

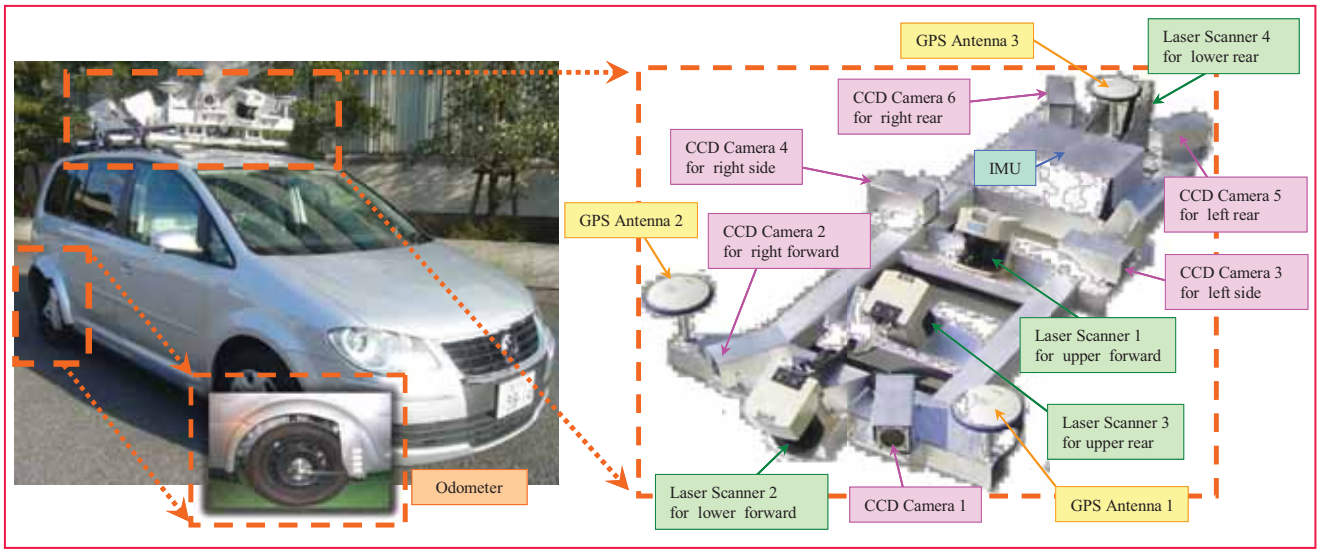


Figure 1: System configuration of MMS (TYPE-X)

Figure 2: MMS measurement data

Reference Station) and FKP(Flaechen Korrectur Parameter) services are available. For MMS, FKP method is adopted.

To determine the orientation GPS gyro which consists of three GPS antennas set as triangle configuration is adopted and it enables to get precise orientation even if GPS observed period is very short. However, during GPS observation outage caused by factors such as ambient environment, it will become inertial positioning by IMU and odometer. The inertial positioning is relative positioning which computes next position by adding the amount of movements by odometer with the direction by IMU to previous position just before GSP observation is broken off. Since it is carried out by the embedded sensors the positioning is completed certainly without any influence of the surrounding environment but the error which occurred is accumulated without disappearing and accuracy of absolute position is degraded with progress of time.

Table 1: Specification of MMS

Measurement equipment		Specification
GPS	Single frequency receiver: 2 Dual frequency receiver: 1	10 Hz FKP (area correction parameter) is adopted.
IMU	Roll/Pitch detection accuracy	0.015deg (Absolute orientation angle by 3 axis GPS/IMU intgration process, actual value) Assumption: Straight way with constant velocity under good GPS condition
	Heading detection accuracy	0.03 deg (Absolute orientation angle by 3 axis GPS/IMU intgration process, actual value) Assumption: Straight way with constant velocity under good GPS condition
	Data observation rate 1	00 Hz
Odometer	Resolution	0.64 mm

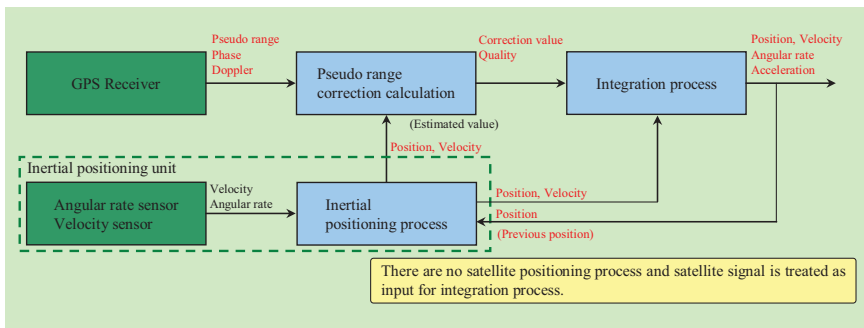


Figure 3: Tightly coupled GPS/IMU/odometer integrated navigation system

The satellite positioning and the inertial positioning are tightly coupled and constitute Kalman filter of 24th order such as position, orientation, IMU and odometer error. The block diagram is shown in Fig. 3. In the tightly coupling system pseudo range information can be reflected even there are only few visible GPS satellites available and it is effective to the positioning in the urban areas where GPS satellite is visible and/or invisible. Odometer is functioning as a part of velocity sensors of an inertial positioning part.

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Establish of mapping procedure using MMS and its problems

Establish of mapping procedure using MMS

An effort of topographic mapping by using MMS was started in 2008 as an internal project in Pasco Corp. and since then, accuracy investigation of MMS measurement data and establishment of MMS operation manual have been carried out and compleated with successful results. In 2010 MMS was employed in the first-ever public mapping project to update road administration map of Toyonaka City in Osaka prefecture. The result of this project was checked by the Japan Association of Surveyors and certified as public mapping result by GSI (Geospacial Information Authority of Japan) after its evaluation.

Through this project we confirmed that MMS can reduce field surveying task drastically and lead to approx.10% reduction of total cost and approx.30% reduction of total project period respectively.The reduction of field surveying task is also very effective in ensuring safety. At present, MMS is adopted by many local municipalities and is firmly fixed as a value-added and efficient method of topographic mapping.

Problem at satellite invisible area

In case of MMS, GPS, IMU and odometer data are integrated to process precise vehicle position and thus most important factor is to observe sufficient number of GPS satellites during MMS mission. However there are GPS-invisible areas where GPS signals are obstructed by buildings, overpass and trees along a road. The vehicle positioning at invisible areas is highly dependent on IMU and odometer data. Therefore longer invisible period results in lower accuracy of vehicle position.Fig.4 shows the result of GPS outage simulation at the curved road where GPS information is rejected manually during 75 sec. The lenght is about 1,040m and average vehicle velocity is 50km/h. The planimetric positioning error shown here is position element of observation residual of integration process (Kalman filter) shown in Fig.3 and it represent estimated posteriori

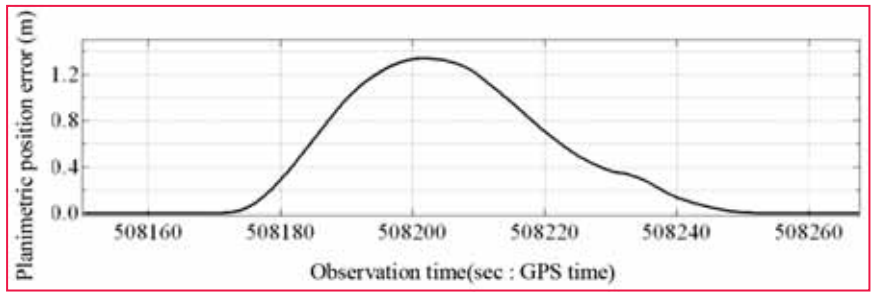

Figure 4: Position error during GPS invisible period

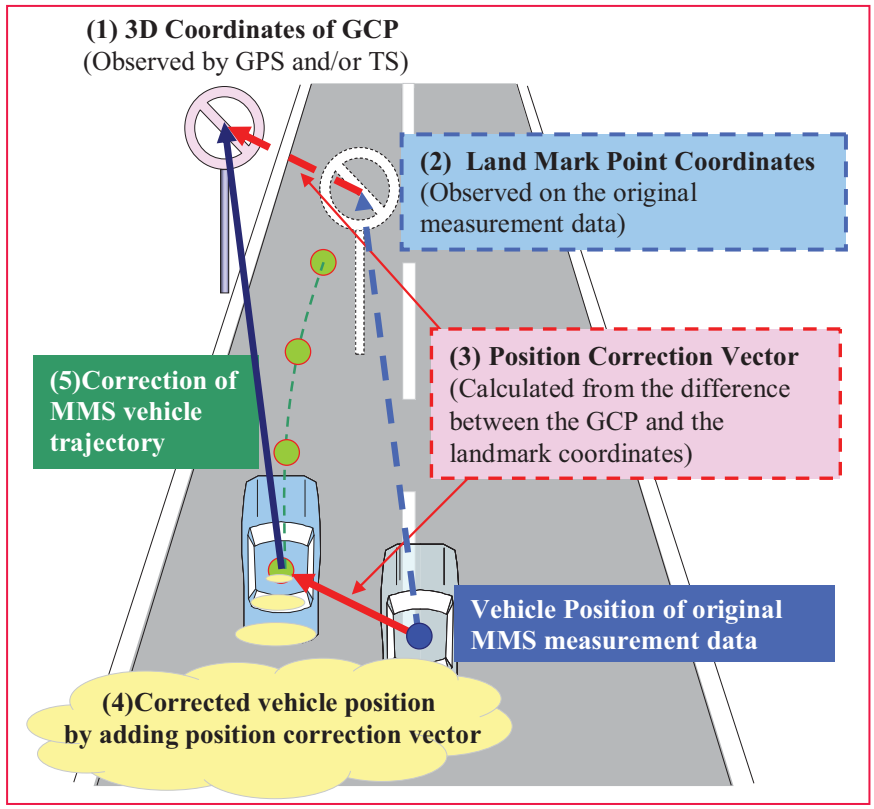

Figure 5: Overview of correction

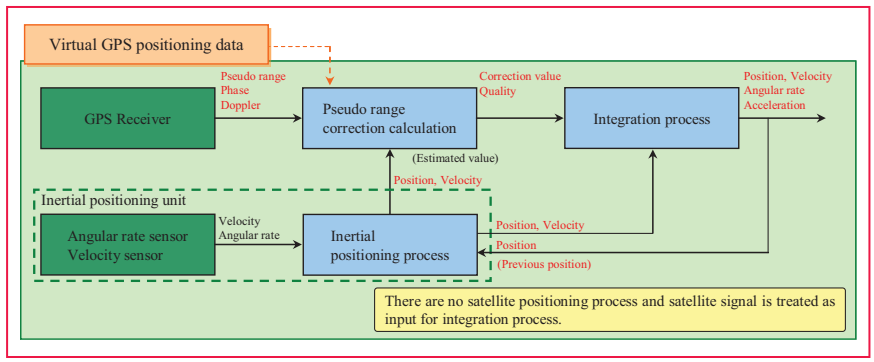

Figure 6: Correction process of MMS vehicle trajectory by LMU

error (EPE). This EPE value is used as barometer of vehicle positioning accuracy. Since bidirectional forward and backword analysis is carried out maximum residual of 1.2m is appeared at the midle of GPS outage period. Since the positioning error is increased depending on the elapsed time and distance complement of GPS positioning result at the GPS invisible period is most effective to get

precise accuracy of MMS observation data. To examine this data improvement method accuracy investigation of Land Mark Update (LMU) , correction process of MMS vehicle position using control point, was carried out.

General discription of land mark update

The LMU method developed by MITSUBISHI ELECTRIC CORP. consists of processes to correct MMS vehicle position by using coordinates of ground control point (land mark) to be used for adjustment observed by GPS and/or total station as ground control point(Kajiwara, et al, 2008). Fig.5 is its overview.

Processing method of LMU

Ground coordinates observation of ground control point (GCP) Fig5. (1)

3D coordinates of GCPs for the LMU are observed by using network RTK-GPS method and/or total station. Ground objects which can be identified clearly e.g. street inlet, corner of the road marking, traffic sign are selected as GCP.

Land mark point coordinates observation Fig.5 (2)

Observe the position of land mark point selected at step1 in the original (uncorrected) measurement data using LMU tool.

Calculate position correction vector Fig.5 (3)

Calculate position correction vector depending on the discrepancy between the coordinates obtained in STEP1 and STEP2.

Correction of vehicle position Fig.5 (4)

Calculate corrected vehicle position by adding position correction vector calculated in STEP3 to vehicle position of original MMS measurement data. This vehicle position is treated as virtual GPS observation data.

Correction of MMS vehicle trajectory Fig.5 (5)

Correct MMS vehicle trajectory by re-adjusting of GPS/IMU/Odometer data and calculated virtual GPS positioning data. The diagram is shown in Fig.6

Updating MMS measurement data

Finally laser point cloud data are updated using corrected MMS vehicle trajectory data by LMU.

to be continued in next issue

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Dispense with the dated two receiver method of the Base-Rover configuration to achieve meter grade accuracy. This SX Blue receiver uses the Indian GAGAN SBAS signal and a single receiver directly to give proven meter grade accuracy. This differential signal in essence removes Ionospheric tropospheric multi-path, ephemeris and clock related errors

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Crowdsourcing and land administration

The closing of the 'security of tenure gap' experienced by the poor and vulnerable in the developing world is of critical importance to future global economic progress

Robin McLaren
Director, Know Edge Ltd

Only 1.5bn of the estimated 6bn land parcels worldwide have land rights formally registered in land administration systems. Many of the 1.1bn slum dwellers and further billions living under social tenure systems wake up every morning to the threat of eviction. These people are the poor and most vulnerable and are excluded any form of security of tenure; they are trapped in poverty. Increasing global population and the rush to urbanisation is only going to turn this gap into a chasm.

This groundbreaking research project from Know Edge Ltd, an independent ICT and Land Policy consultancy, with support from RICS explores one possible solution to the tenure gap: establishing partnerships between land professionals and citizens that encourage and support citizens to capture directly and maintain information about their land rights. The research presents a vision of how this might be implemented and investigates how the risks associated with this collaborative approach could be managed.

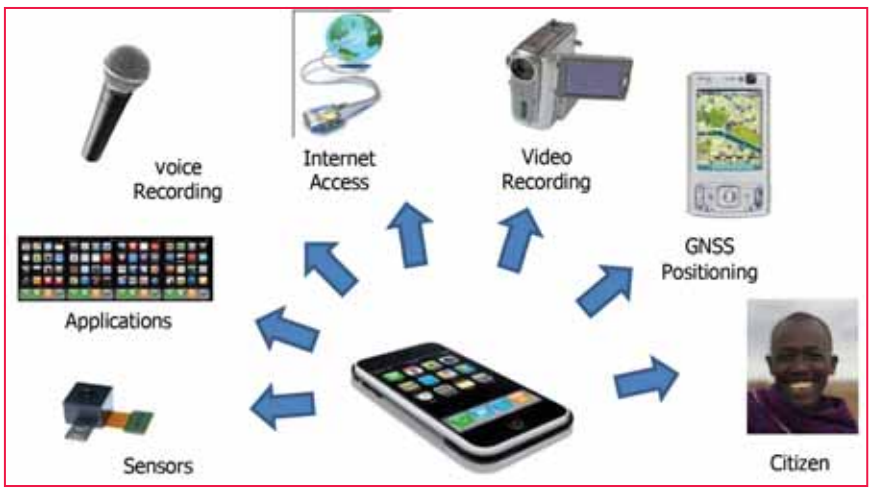


Figure 1: Smart mobile phone cyborg functionality

Land administration systems

Land administration systems (LAS) provide the formal governance structures within a nation that define and protect rights in land, including non-formal or customary institutions. Their benefits range from guarantee of ownership and security of tenure, through support for environmental monitoring, to improved urban planning, infrastructure development and property tax collection. Successful land markets depend on them.

The security of tenure gap cannot be quickly filled using the current model for registering properties through land professionals. There are simply not enough land professionals worldwide, even with access to new technologies. To quickly reduce this inequality, we need new, innovative and scalable approaches to the problem. This is one of our fundamental global challenges.

This research paper explores 'crowdsourcing' as a means of extending registers of property rights. Crowdsourcing uses the internet and online tools to obtain information from citizen volunteers. It is currently used to support scientific evidence-gathering and to record events in disaster management, as witnessed in the recent Haiti and Libya crises, for example.

A key challenge of this innovative approach is how to ensure authenticity of the crowdsourced land rights information. The research paper explores applicability of the approaches adopted by wikis, e-commerce and other mobile information services and recommends the use, initially, of trusted intermediaries within communities, who have been trained and have worked with local land professionals.

Limitations of existing LAS

Despite the clear link between effective LAS and efficient land markets, a number of factors limit the scope for implementation:

- Costs are significant and national solutions can take from five to more than 20 years to implement.
- Overly complex procedures lead to high service-delivery costs and end-user charges, which exclude the poor and the vulnerable.
- Lack of a supporting land policy framework ensures that the LAS do not deliver against the main drivers of land tenure: land markets and socially desirable land use.
- Insufficient support for social and customary tenure systems excludes large sections of the population.
- Lack of transparency encourages corruption in the land sector and discourages participation.
- Communication channels to customers are either office or internet-based and lead to geographic discrimination or exclusion through the 'digital divide'.
- A mortgage requires a bank account and a credit rating, both out of reach of the poor and those remote from financial services.
- Cadastral surveys using professional surveyors are normally mandatory and subject to high fees.

It is estimated that there are around 6bn land parcels or ownership units worldwide, but only 1.5bn are formally registered and have security of tenure. Within many of the 4.5bn unregistered parcels, 1.1bn people live in the squalor of slums. With urbanisation predicted to increase from the current 50% to 60% in 2030 and a further 1bn likely to be added to the world's population over the same period, the security of tenure gap will become a chasm. This will be impossible to address in the foreseeable future within the available land administration capacity.

The lack of effective, affordable and scalable LAS solutions conspires to limit access to land administration services by large sections of society, especially the most vulnerable, leaving them trapped in poverty. There is a pressing need to radically rethink LAS: simplify procedures, reduce the cost of transactions and open new channels for participation. Crowdsourcing through mobile phones, for example, offers the opportunity for land professionals to form a partnership with citizens to create a far-reaching new collaborative model and generate a set of LAS services that will reach the world's poor.

The increasingly pervasive mobile phone

Although citizens can provide their crowdsourced data through a number of traditional channels, including paper, mobile phones are proving to be the device of choice. Mobile phones have made a bigger difference to the lives of more people, more quickly, than any previous communications technology. They have spread faster and proved easier and cheaper to adopt. In the 10 years before 2009, mobile phone penetration rose from 12% of the global population to nearly 76%. It is estimated that around 5bn people have mobile phones already and 6bn will have them in 2013.

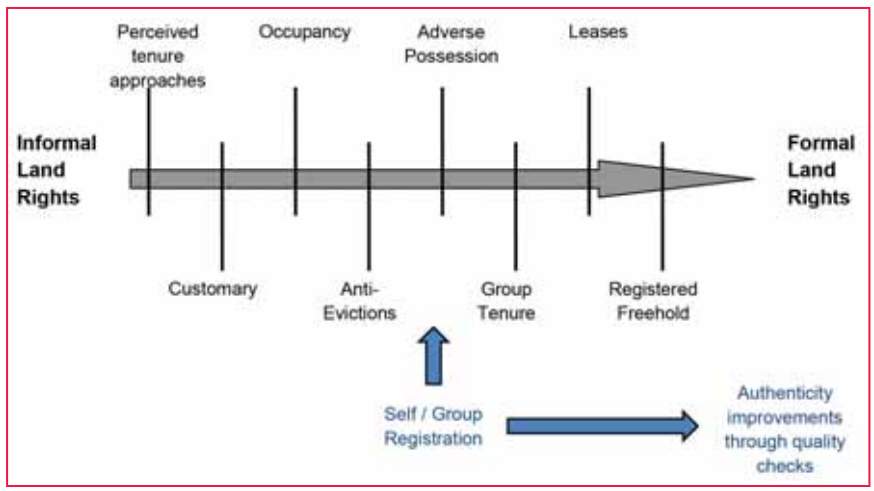
Recently, the fastest growth has been in developing countries, which had 73% of the world's mobile phones in 2010, according to estimates from the International Telecommunications Union *(www.itu.int/ITU-D/ict/statistics/).* In 1998, there were fewer than 4m mobiles on the African continent. Today, there are more than 500m. In Uganda alone, 10m people, or about 30 percent of the population, own a mobile phone, and that number is growing rapidly every year. For Ugandans, these ubiquitous devices are more than just a handy way of communicating; they are a way of life (Fox, 2011). Not all phones in the developing world are in individual use; some are a communal asset of the household or village. Due to their high ownership levels and widespread geographic coverage, especially in developing countries, mobile phones are an excellent channel for obtaining crowdsourced land administration information. But are they affordable and do they have the necessary functionality?

The rise of smart phones and tablets

Telecommunications has developed exponentially. Phones have changed and there is a big shift from holding a phone to your ear to holding it in your hand. Smartphones are able to browse the web, send and receive emails, and run applications, as well as storing contacts and calendars, sending text messages and (occasionally) making phone calls. Although smart phones may cost around US$600 (£379) today, the volume of sales and frugal innovation will drive the cost down to an estimated US$75 in 2015. A US$100 smartphone has already arrived on the streets of Nairobi. Before the end of the decade, every phone sold will be what we'd now call a smartphone and cost US$25.

Vision of a crowdsourced LAS

This increase in mobile phone functionality, its migration to lower-cost devices through frugal innovation



Continuum of tenure types (Source: UN-HABITAT)

and the phenomenal market penetration of mobile technology in developing countries have opened up the prospect of it being used to deliver more effective and accessible land administration services. The possibilities are explored below.

1. *Accessing customer information services.* Already, a whole new generation of innovative information services, in fields such as agriculture and health, are being provided to users of mobile phones in developing countries.
2. *Recording land rights.* The mobile phone will allow citizens to record the boundaries of their land rights. This can be achieved in several ways:

- marked-up paper maps photographed digitally by phone
- a textual description of the boundaries recorded on the phone
- a verbal description recorded on the phone
- geotagged digital photographs of the land parcel recorded on the phone
- a video and commentary recorded on the phone
- the positions of the boundary points identified and recorded on imagery-using products – for example Google Maps and Bing
- the co-ordinates of the boundary points recorded directly using the GNSS capability of the phone.

In all cases, the authenticity of the captured information would be enhanced by passive recording of the network timestamp at the time of capture. This information is not something that most (99.999%) of users can tamper with. The results of this crowdsourced or self-service information could then be submitted electronically to either the land registration and cadastral authority or an open data initiative for registration. Although there will be limitations in terms of the quality and authenticity of the ownership rights information provided, it could form the starting point in the continuum of rights being proposed by UN-HABITAT. This recognises that rights to land and resources can have many different forms and levels.

When the captured land rights are submitted to the property register (or shadow register), a variety of quality checks can be applied to the submitted information, including random checks in the field, comparisons with other applications submitted from the same area, checks on ownership of the mobile phone, checks on the location of its owner through the log showing that the phone is frequently used within that location, network time-stamping of captured information, and contacts with clients and their neighbours by mobile phone to ask for clarification.

3. *Obtaining title.* Fees for submission of applications for registration of title could be paid through mobile banking and encrypted forms of land title could be incorporated into clients' mobile phones with biometrics to provide proof of ownership.
4. *Accessing land information.* The next development stage is to make LAS outward-facing and accessible by customers, either by extranet or internet on mobile phones.
5. *Paying mortgage instalments.* Secure payment of land administration fees could be done through mobile banking, and a simplified process would create the potential for wider property ownership.

Implications of the new citizen collaboration model

The introduction of this new LAS model might be perceived as radical by most land professionals working in the land administration sector and as a serious threat by some. The attitude of land professionals to this new model will determine how land administration is shaped in the future. Here are two possible scenarios:

A 'shadow' property register

In countries where land professionals reject citizen collaboration, but there is little citizen trust in poorly performing or corrupt land administration services provided by the government, an alternative property register could be created through crowdsourcing; similar to the OpenStreetMap crowdsourced model. Ultimately, it might either replace the government land administration service, reinforcing the informal land market, or be adopted by government once it has reached a critical mass and quality that land professionals accept.

A supplement to the formal property register

In other countries, the new model might be embraced as a new opportunity to accelerate the number of properties being registered across the country and to support a much more inclusive solution to land administration. This would involve a change in the role of land professionals, working *with* citizens rather than *for* citizens.

Managing the risks

As with all radical changes to long-standing systems, there are some risks.

Can crowdsourced information be authenticated?

One of the most contentious issues surrounding crowdsourced information is the authenticity or validity of the information provided. So what techniques can be used to quality-assure the authenticity of the information to a level that would be acceptable for inclusion in a property register?

Community knowledge workers as intermediaries

This approach would avoid open, direct crowdsourcing, initially, and accept information only from trusted intermediaries within communities who had worked with local land professionals. Over time, quality assurance sampling would significantly decrease and the intermediaries could help establish a network of 'experts' across communities.

Community-based quality assurance

Quality assurance could be provided by community members who would take direct responsibility for authenticity. The crowdsourced land right claims could

be posted for communities to review and comment on. Some form of local or regional land tribunal could be established to arbitrate on conflicting claims. The local public display of the results combined with the witness function of the local land committee and the citizens will provide societal evidence of land rights.

Wiki and e-commerce solutions

A centralised user reputation system similar to buyers rating sellers on eBay could be used to assess the credibility of contributors and the reliability of their contributions.

Crowdsourcing quality assurance

Some elements of the quality assurance process do not require local knowledge of the land rights claim and could be crowdsourced to a network of informed consumers and worldwide professionals, or could even be automated.

Passive crowdsourcing quality assurance

Mobile phones can passively collect evidence that supports validation of user-entered information - e.g. the continual logging of mobile data by the network, which confirms where phones are frequently used, inferring the location of the owner, and the automatic network timestamp.

The extent to which control is held by the contributor, by the institution, or by 'the crowd' of contributors assessing each other's contributions may be different across different implementations of crowdsourcing.

Will land professionals form a new partnership with citizens?

This new partnership model implies that land professionals will have a different relationship with citizens – or 'pro-amateurs'. The increased collaboration with citizens opens up the opportunity for new services to train citizens and community intermediaries and quality-assure their crowdsourced information, so it should not be perceived as a threat to individual livelihoods and the

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profession. But will land professionals accept this new role and will sufficient citizen entrepreneurs provide land rights capture services and become trusted intermediaries? Technology will continue to challenge the relationship between 'pro-amateurs' and land professionals, but these drivers of change also present significant opportunities for all concerned.

Will crowdsourcing just reinforce the informal land market?

There is a danger that the emergence and acceptance of crowdsourced land rights information by citizens will just reinforce the informal land markets in countries where there is ineffective land governance, poorly performing land administration systems and weak formal land markets. The final outcome of the informal or formal market will depend on the land administration agencies' reaction to crowdsourcing and whether they reject or embrace it.

Conclusions

Crowdsourcing within the emerging spatially enabled society is opening up opportunities to fundamentally rethink how professionals and citizens collaborate to solve today's global challenges. This paper has identified land administration as an area where this crowdsource-supported partnership could make a significant difference to levels of security of tenure around the world.

Mobile phone and personal positioning technologies, satellite imagery, the open data movement, web mapping and wikis are all converging to provide the 'perfect storm' of change for land professionals. The challenge for land professionals is not just to replicate elements of their current services using crowdsourcing, but to radically rethink how land administration services are managed and delivered in partnership with citizens. Land administration by the people for the people can become a distinctly 21st century phenomenon.

Galileo update

The best application idea for EGNOS

Since its certification for use in managing air traffic and other security-critical applications in 2011, EGNOS – Europe's augmentation system for GPS – now enables new applications for precise and reliable satellite navigation. To promote EGNOS, the European GNSS Agency (GSA) is offering a special prize for the most promising idea using the system. The prize is part of this year's European Satellite Navigation Competition (ESNC). The winner will receive the support they need to realise their project at a European incubation centre. *www.galileo-masters.eu*

Next Galileo satellites to launch after the summer

The European Commission has announced the launch date of the next pair of ESA-procured Galileo satellites. These will be launched together on a Soyuz from French Guiana on 28 September, joining the two satellites already in orbit.

Antonio Tajani, Vice President of the European Commission, responsible for industry and entrepreneurship, announced the launch on 2 May in Brussels, together with Jean Yves Le Gall, Chairman and CEO of Arianespace, in the presence of industrial leaders involved in the programme, and in agreement with ESA's Director of the Galileo Program and Navigation-related Activities Didier Faivre. The new launch will take place within a year of the first two Galileo In-Orbit Validation satellites, which reached orbit on 21 October 2011.

Four navigation satellites are the minimum needed for satellite navigation - to measure latitude, longitude and altitude while checking ranging accuracy - so these four Galileo satellites can be used to assess the performance of Galileo's world-spanning ground system that serves to maintain the precision of the Galileo system. *www.spacedaily.com*

GNSS Agency moves to Prague

The lower chamber of the Czech Parliament announced, on 3 May, that it has given the green light to the transfer to Prague of the administrative headquarters of the agency in charge of managing Galileo. The agency will move to Prague during the summer. The European Global Navigation Satellite System (GNSS) Agency is the first EU regulatory body to move its headquarters to the Czech Republic, after having been provisionally located in Brussels. *http://www.europolitics.info*

Astrium built Galileo satellites fit and fully operational

The first two Galileo In-Orbit Validation (IOV) satellites built by Astrium, Europe's leading space company, are working perfectly and now begin full in-orbit operations.

The satellites successfully passed a series of in-orbit tests following their launch on the first Soyuz flight from the Guiana Space Centre, French Guiana on 21 October 2011.

The satellites now fully qualified in orbit are the first two of four IOV satellites developed by Astrium for the Galileo system. *http://www.spacedaily.com*

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Scientists design indoor navigation system for blind

Human-computer interaction researcher Eelke Folmer of the University of Nevada, Reno, watches as Dora Uchel, a university student, demonstrates the indoor navigation system for the visually impaired developed by Kostas Bekris and Folmer of the Computer Science Engineering Department. She was one of several visually impaired students and community members who helped test the low-cost accessible system that operates with a standard smartphone. Both the researchers explained how a combination of human-computer interaction and motion-planning research was used to build a low-cost accessible navigation system, called Navatar, which can run on a standard smartphone. *http://phys.org*

Apple iPhone to use GPS and GLONASS

The latest Apple iPhone will be the first among cellphone manufacturers outside Russia to use both the global navigation satellite systems – American GPS and Russian GLONASS. Russia is working on promoting the use of the GLONASS, an in order to do so it is planning to levy heavy import duties in the country on the Phones not using GLONASS. *www.successcds.net*

Google Maps update offers indoor walking directions

The popular mapping service rolled out an update offering several additions including indoor walking directions, allowing users in the U.S. and Japan to use Google Maps to navigate inside malls and airports. The update comes in Google Maps 6.7 for Android. *http://www.foxnews.com*

Smartphone location-based services on the rise, says study

More smartphone users are using location-based services, according to a recent study by Pew Research. Almost 74 percent of smartphone users enable location-based services to get real-time information, with 18 percent using the technology to "check in" to share their location with friends. The number is a rise from 55 percent of American adults in 2011. The study suggests part of the reason for the jump in users is because of the increasing number of smartphone owners. *PewInternet.org*

USD 15 bn lawsuit on Facebook for tracking users

A lawsuit, filed in Federal Court in San Jose, California, demands USD 15 billion from Facebook for violating federal wiretap laws. The lawsuit combines 21 separate cases across the US in 2011 and early 2012. It's an amended consolidated class-action complaint that claims the company is invading the privacy of its users by tracking them across the Internet. *www.zdnet.com*

Google Maps to provide warships' location info soon

Google will soon make public information about virtually every ship at sea, giving the current location and identity even of American warships highlighting a trend of great interest to the intelligence community and the military. "I think the macro level issue here is: Welcome to the new age of transparency," said Keith Masback, president of the US Geospatial Intelligence Foundation. "Access to data from space-based and airborne commercial remote sensing from has become relatively ubiquitous; GPS is ubiquitous and the Chinese and Europeans are also launching their own PNT [positioning, navigation and timing] systems. This announcement by Google regarding ship tracking and collection of bathymetric data, along with the current discussion of the potential of proliferation of unmanned aerial systems in the skies over the US is the natural extension of the transparency we've seen coming for years."

Like its nascent project to map the ocean floor, Google's new technology to track ships on the surface takes advantage of prior investments by others. In this case, it is the Maritime Automatic Identification System, known as AIS, a system of transponders installed in all legitimate seagoing vessels that periodically transmit their position to avoid collisions even when the crews can't physically see each other due to darkness or heavy weather. *www.defense.aol.com*

Univ student develops disaster tracking software

Using home broadband routers, a new software developed at the UK-based University of Abertay Dundee can 'ping' thousands of addresses to check whether buildings are still standing. The system shows live data on 'safe' areas using Google Maps. Within seconds, any disaster can be detected, mapped and its progress tracked – and support efforts targeted to the areas in greatest need at any moment. The basic principle of the software prototype could also be applied to mobile phone networks, if an app was developed to support this. And as geolocation runs on satellites, the disaster tracking could remain accurate even as phone networks go down. *www.abertay.ac.uk*

Users can search house numbers using MapmyIndia

MapmyIndia in collaboration with Telenav, launched India's first mobile app that offers house number search and navigation on iPhones. MapmyIndia Navigator by Telenav provides voice-guided turn-by-turn GPS navigation, moving maps and access to millions of places for easy search and discovery. All maps and places information within the app are cloud-based and always up to date. *www.marketwatch.com*

1.28 mn kilometres road network in India mapped by Nokia

Nokia's navigation software division, Nokia, Location & Commerce (known as NAVTEQ before being acquired by Nokia for USD 8.1 billion) is working on a big plan to map the whole of India. "We already have covered 1.28 million km of road network with all the turns, roundabouts and flyovers. We have also mapped over 4000 cities, including rural areas, 6.25 million points of interest, which include offices, malls, schools, hospitals, bus stands, historical monuments, and so on" said Rajat Tandon, country director, sales, Nokia L&C. Market experts believe that the money spent on LBS in India is expected to be close to USD 165 million by 2014. *www.ciol.com*

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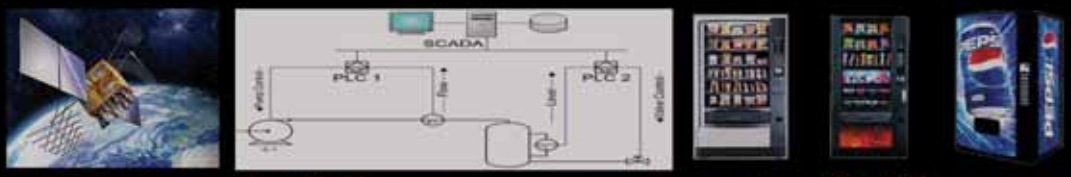

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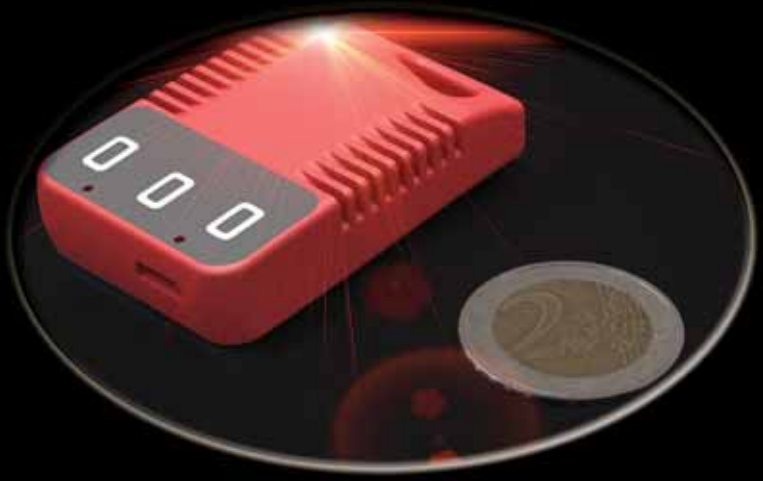

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NAMA to switch to performance based navigation

Nigeria is to switch to the satellite based navigation system also known as the Performance Based Navigation (PBN) soon. This is coming as airline operators and pilots have been urged to key into the satellite based navigation system. *www.vanguardngr.com*

Wireless broadband startup LightSquared files for bankruptcy

LightSquared Inc., which hoped to create an independent wireless broadband network in the U.S., filed for bankruptcy protection. Regulators blocked its plan this winter because of concerns that its transmissions would interfere with GPS navigation.

LightSquared hasn't given up. Chief Finacial Officer Marc Montagner said in a statement that the bankruptcy filing is intended to gain the company "breathing room" while it continues to work through its regulatory issues. *www.washingtonpost.com*

China launches new navigation satellite into orbit

Two satellites for China's Beidou navigation system launched aboard a Long March 3B rocket very recently, further expanding the space-based positioning network as China eyes global service by 2020.

The launch marked the first time China orbited two Beidou satellites on the same rocket. Chinese industry developed a dual-payload adapter to launch the satellites one on top of the other inside the Long March nose fairing. *www.space.com*

S Korea to protest North over GPS jamming

South Korea would urge North Korea to immediately stop jamming the satellite-based GPS that have raised new safety concerns for civilian flights and ships amid the Communist neighbor's military threats. North Korea has been disrupting GPS signals since April 28, though no accidents have been reported, the Korea Communications Commission said in a statement in Seoul. Both the Koreas are members of the U.N. agency in charge of information and communication technologies.

South Korea will also plan to hold close consultations with the international community over the North's electronic attacks and plans to raise the issue with the ITU and the International Civil Aviation Organization. *http://www.rttnews.com*

Pigeons' navigation skills linked to special 'GPS neurons'

Scientists have long known that the birds navigate using the earth's magnetic field. Now, a new study has found subtle mechanics in the brain of pigeons that allow them to find their way. A team at Baylor College of Medicine in the US identified a group of 53 cells in a pigeon's brain that record detailed information on the Earth's magnetic field, a kind of internal GPS. However, the study, published in journal Science, leaves open the question of how these "GPS neurons" actually help the birds sense the magnetic field."People had reported in the past, establishing that birds do not seem to respond to the polarity of the magnetic field, yet here we have neurons that are in fact doing that," study author Prof David Dickman said.

It's now believed that more than one mechanism may be at work in bird navigation -- in their eyes, beaks or ears -- and Prof Dickman said he is looking forward to getting to the bottom of it. *http://www.hindustantimes.com*

NASA Tests GPS Monitoring System for Big U.S. Earthquakes

The space-based technology that lets GPS-equipped motorists constantly update their precise location will undergo a major test of its ability to rapidly pinpoint the location and magnitude of strong earthquakes across the western United States. Results from the new Real-time Earthquake Analysis for Disaster (READI) Mitigation Network soon could be used to assist prompt disaster response and more accurate tsunami warnings.

The new research network builds on decades of technology development supported by the National Science Foundation, the Department of Defense, NASA, and the U.S. Geological Survey (USGS). The network uses real-time GPS measurements from nearly 500 stations throughout California, Oregon and Washington. When a large earthquake is detected, GPS data are used to automatically calculate its vital characteristics including location, magnitude and details about the fault rupture. *http://www.nasa.gov*

GPS repaired in Space

Expedition 31 crewmembers Don Pettit and André Kuipers were given the task on their timeline to fix a failed GPS on the International Space Station (ISS). The repair was given certain priority as two operational GPS are required for next week's scheduled arrival of the SpaceX Dragon spacecraft

Attempts to restore the GPS from the ground were not successful. On May 14th 2012 Don and André's timelines were rearranged to give them time to remove and replace hardware for the system. At 15:30 CEST after the repair, the Station crew received word from the ground that the damaged GPS is now 'working just fine'. *www.esa.com*

Transneft to use GLONASS

The biggest oil transport company in Russia "Transneft" and the Navigational Information Systems company have begun to create a system of transport monitoring with the help of GLONASS.

The Russian GLONASS and the American GPS are now being used in Russia in different transport systems. All public government transport in Russia is to be fitted with GLONASS starting from this year. A special device will be installed on all transport, which will allow to pinpoint its location as well

as to control its work and to measure the amount of fuel in the tank. All the information will go to the control center to be analysed by the controller, who will then create a report. *English.ruvr.ru*

Compass to cover Asia-Pacific

China's home-grown Beidou Navigation Satellite System, or Compass Navigation System, will be able to provide high-quality services to most users in the Asia-Pacific region this year, an unidentified official from the system's management office said recently. "With the trial run of the Beidou navigation service, we believe that China can provide high-quality satellite navigation services for most users in the Asia-Pacific region in 2012," said Xie Haizhong, general manager of the Beidou navigation science and technology department of Beijing Unistrong, a company that focuses on the global navigation satellite industry. *chinadaily.com*

Indian state to map orchards using GPS

Chief Minister of Bihar state, India, directed the state's agriculture department to carry out mapping of orchards using GPS, to grant various incentives and assistances to the farmers. "The state government is committed to rejuvenation of the orchards to help the farmers generate a regular source of income. A number of incentives had been launched including grant of INR 1000 per acre for tilling of orchards, distribution of quality saplings and other supplements to keep the trees healthy with long life." *www.business-standard.com*

Indian court questions over surcharge for GPS-based services

Frowning over the surcharge levied upon passengers for installation of GPS/GPRS in autorickshaws, the Delhi High Court (in India) asked the Delhi State Government to explain the rationale behind the decision. HC's poser came after it went through the government's reply that claimed autorickshaw owners can't blame it for increasing their financial burden by making installation of GPS/GPRS compulsory as they have already hiked the fare to allow the autorickshaw owners to collect extra amount from passengers. In its reply, the government also argued it had allowed owners to install GPS from whichever dealer they wish as long as it conforms to some minimum standards. *www.timesofindia.com*

Glonass may be compulsory to fly in Russian airspace

Russian Deputy Prime Minister Vladislav Surkov said recently that all aircraft–even foreign-registered ones–flying in Russian airspace should use the Glonass satellite-based navigation system. The Russian government previously listed applications where Glonass receivers and respective timing devices would be made mandatory and set time frames for state and commercial companies to implement this, but foreign-registered aircraft were not included. There is a requirement for aircraft operated by Russian-registered airlines to use Glonass receivers, but its original 2011 implementation date has been deferred several times due to a shortage of Glonass equipment. The implementation date for Russian airliners is currently set for next year. *www.ainonline.com*

UID registration process to be smoother using GPS

As the second phase of the Unique Identification (UID) registration drive will kick off this month in Delhi, India, all UID machines' whereabouts will be monitored by GPS, according to Santosh Bhogale, Under Secretary (IT) and nodal officer for the UID. UID machines scan iris and take fingerprints of people registering for their 12-digit identification number. The need for GPS-based UID machines was felt for enhancing security of the machines. It was seen that the authorities did not have any means of knowing where the machines were being stored. It was left to IT companies that take up the job to safeguard the machines. The GPS-enabled tracking will help now all the authorities concerned to track each machine and it will cut down chances of any tampering with the machines or theft, explained Bhogale. *www.indianexpress.com*

China launches new remote-sensing satellite

China successfully launched the remote-sensing satellite Yaogan XIIII recently from Taiyuan Satellite Launch Center in the northern province of Shanxi. The satellite was carried into space aboard a Long March 4B carrier rocket which blasted off at 3:06 p.m. Beijing time, according to the center. The satellite will be used to conduct scientific experiments, carry out surveys on land resources, monitor crop yields and help with natural disaster-reduction and prevention.

The Long March 4B carrier rocket was produced by China Aerospace Science and Technology Corporation. Along with Yaogan XIIII, a tiny satellite named Tiantuo I was also sent into orbit during the flight. *http://news.xinhuanet.com*

Pakistan, Turkey to share expertise in RS tech

The Pakistan-Turkey Joint Ministerial Commission (JMC) agreed to cooperate and share their expertise in various fields, which include remote sensing technology and vessel tracking system. The JMC meeting was co-chaired by the Prime Ministers of both countries. *www.dawn.com*

Iran to launch Fajr satellite

Iranian Aerospace Industry Organization Director Mehdi Farahi announced on May 14th 2012 that Tehran plans to send the Fajr (Dawn) the lightweight telecommunications satellite equipped with remote sensing, satellite telemetry and geographic information system technology as well as remote and ground station data processing into space very soon. The Fajr satellite is a reconnaissance satellite powered by solar energy. Iran plans to send the satellite into space aboard the upgraded Safir, satellite carrier rocket. *almanar.com*

Moscow upholds ban against ScanEx

A Moscow court upheld a ban last week which prohibited the Russian research and development company ScanEx from

distributing satellite images of Earth at a resolution higher than two meters. Scanex works under license from the Russian federal space agency, Roscosmos, to collect, process and disseminate Earth remote sensing data. A 2008 ban prohibited ScanEx from distributing high-resolution images, considered by the defense ministry to contain sensitive military information. Last year Roscosmos announced that it was preparing a bill to lift all restrictions on the dissemination of civil satellite data. *rian.eu*

GeoEye, Rolta team up to enhance market presence

GeoEye has signed a memorandum of understanding (MoU) with Rolta. With this new partnership, Rolta gains access to GeoEye's high-resolution satellite imagery, services and expertise to develop innovative geospatial products and services. Rolta plans to offer these GeoEye-enabled solutions to its customers across high-growth global markets, beginning with India. *www.geoeye.com*

Row over commercial satellite imagery cut intensifies

Despite a recent assurance by the Pentagon, the row over satellite imagery cut got intensified. The nation's military and intelligence officials are at loggerheads over the future of the USA's spy satellites. The Obama administration has proposed a cut in contracts for commercial satellite imagery to about USD 250 million from USD 540 million as part its budget proposal for fiscal 2013. According to a report published in *The New York Times*, both Republican and Democratic leaders on the Congressional intelligence committees are resisting the budget cuts and siding with the private companies and the military, which argues that it could not get as much imagery as it needs for combat operations without turning to the less expensive commercial technology.

"The debate is really between the military, which needs a lot of imagery but doesn't need the highly classified imagery, and the intelligence community, which wants to keep the capability to produce its own imagery," said Bill Wilt, a senior official with GeoEye, one of the private satellite companies.

"The technology of the current satellite architecture is pretty much at its limit, and the commercial satellites are producing just about the same thing at a much lower cost," noted retired Gen. James E. Cartwright of the Marines, former vice chairman of the Joint Chiefs of Staff. "The government's satellites are better, but the question is, what do you need? Most studies show that about 90 percent of what the military needs can be solved with commercial."

The military also favours commercial satellites because imagery from the intelligence community cannot be easily shared with allies. "The beauty of commercial imagery is that it is unclassified," observed Walter Scott, chief technical officer of DigitalGlobe, a satellite company based in Longmont, Colorado. *www.nytimes.com*

DigitalGlobe rejects GeoEye's USD 792 mn bid

DigitalGlobe Inc. rejected a USD 792 million takeover bid from its rival GeoEye Inc., by stating that GeoEye undervalued the company. It also said that the bid was not in the best interest of the company's shareholders. Earlier, GeoEye had offered the USD 17 per share hostile bid for DigitalGlobe after holding talks with its target over several months. The bid was a 26 percent premium over DigitalGlobe's closing price of USD 13.52. According to media report, GeoEye has a smaller market capitalisation than DigitalGlobe, making it a somewhat unlikely acquirer, but it has higher revenue and is profitable. *www.businessweek,com*

GSDI Association elects Dave Lovell as President

Members of the Global Spatial Data Infrastructure (GSDI) Association chose EuroGeographics' Secretary General and Executive Director, Dave Lovell OBE FRGS CGeog as its President-elect. *www.eurogeographics.org*

Intergraph's LPS Supports VisionMap A3 Imagery

VisionMap Ltd has announced that its A3 digital aerial camera imagery is now supported by Intergraph's LPS photogrammetry software. This new compatibility provides LPS users the ability to perform stereo compilation with A3 imagery for mapping applications. LPS joins a group of photogrammetric suites that support A3 imagery, including DAT/EM, Socet Set, Photomod, ESPA, Atlas, Orbit GIS, and MultiVision. *www.visionmap.com*

Bluesky to fund night sky mapping project

Aerial survey specialist Bluesky is funding research into the development and use of a new system to map Britain's cities and towns at night. It is expected that the new system, mounted on survey aircraft, will accurately record the location of street lights, illuminated road signs and other night-time sources of light providing an accurate resource for asset inventories, light pollution assessment and energy optimisation measurements. *www.bluesky-world.com*

Pitney Bowes opens R&D centre in Pune, India

Pitney Bowes Inc. opened another R&D centre in Pune, India, which will be the second centre for the company in the country, and will focus on research and development for its global portfolio, including Volly - a digital mailbox solution. *news.pb.com*

Malaysia to get GIS-based forest management system

KTS Plantation Sdn Bhd is set to become the first forest management unit (FMU) to implement wildlife monitoring and enforcement programme using Management Information System (MIST). The MIST is a GIS database, which enables all data to be linked spatially. Raymond Alfred, head of conservation and research of Borneo Conservation Trust, explained that with the implementation of MIST, it is possible to

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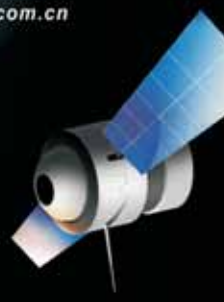

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  WCDMA/EDGE/GPRS/GSM)

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1cm+1ppm/external antenna
Static Accuracy:
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not only compare standardised indicators for anti-encroaching effectiveness between teams, conservation sites and time periods, but also to view results on maps that show where events occur and how often they occur in certain areas. *www.theborneopost.com*

Maps show status of human infections around the world

MusartE Continuendo Foundation (The Netherlands), Infectious Disease Research Foundation (The Netherlands) and the Wellcome Trust jointly produced and released the Atlas of Human Infectious Diseases. It is a collection of up-to-date maps presenting the status of major human infections around the world.

Researchers expand capabilities of SUPRAMAP

Associate Professor Daniel Janies, an expert in computational genomics at the Wexner Medical Center at The Ohio State University (OSU), USA and his colleagues had developed SUPRAMAP, a web-based application that synthesizes large, in 2007 to track the spread and evolution of pandemic (H1N1) and avian influenza (H5N1). Now, they developed a new client software application, GEOGENES (*www.geogenes.org*), to expand the capabilities of SUPRAMAP. Currently this service is hosted on large shared systems at OSC, the center's flagship HP Intel Xeon Oakley Cluster, their IBM Opteron Glenn Cluster and on a smaller dedicated cluster at Ohio State's Wexner Medical Center. *www.osc.edu*

Kuwait GIS to be made public

The General Director of the Public Authority for Civil Information (PACI) Musaed Al-Asousi launched the GIS project. This system allows PACI to perform its role in the best possible manner by using modern technology to combine maps, building data, and the available institutions in the Civil Information System. PACI will support institutions like the Ministry of Public Works, Ministry of Electricity and Water, Public Authority for Industry, Environment Public Authority and other institutions. *kuwaittimes.net*

Geospatial info sharing issue yet to be resolved by US Congress

The US Congress recognised the challenge of coordinating and sharing geospatial data from the local, county, and state level with the national level, and vice versa, but "challenges to coordinating how geospatial data are acquired and used - collecting duplicative data sets, for example -- at the local, state and federal levels, in collaboration with the private sector, are not yet resolved," concluded a new Congressional Research Service (CRS) report.

The report, *Issues and Challenges for Federal Geospatial Information*, written by Peter Folger, a CRS specialist in energy and natural resources policy, stated that, "The cost to the federal government of gathering and coordinating geospatial information has been an ongoing concern. As much as 80 percent of government information has a geospatial component, according to various sources," and "the federal government's role has changed from being a primary provider of authoritative geospatial information to coordinating and managing geospatial data and facilitating partnerships." *www.hstoday.us*

China to launch campaign against incorrect maps

The National Administration of Surveying, Mapping and Geoinformation (NASMG), China, will launch a campaign against publication of maps with information that could undermine sovereignty and state security.
The campaign, co-launched by 13 departments, including the NASMG, the Publicity Department of the Communist Party of China Central Committee and the Foreign Ministry, will be formally launched in June and last until October. The campaign will also strengthen supervision over the market for terrestrial globes to prevent unauthorised production. In addition, a network to safeguard geodata will be established through the joint efforts of several departments in order to prevent illegal mapping activity. *Chinadaily.com.cn*

C-Wet India to map potential wind energy site

Centre for Wind Energy Technology (C-Wet), India, launched wind assessment project to measure the potential of wind energy at a height of 100 meters in 75 locations and at 120 meters height in 4 locations. This phase will look for land availability through GIS along with a 'land-use land-cover' map, indicating the type of land cover which provides easy access to the wind power producers. It will also mark suitable land areas that are available for wind farming, using geographical instruments and applications like 'Google maps'. *www.economictimes.com*

US$2.05 billion ICT reforms for Australian state

The government of New South Wales, Australia, is ramping up its ICT reforms agenda—with plans to drag key agencies out of the "dark ages" into 21st century technology and service delivery programs by rolling out GIS based mobile apps, electronic maps, real-time access to open data, and a private government cloud tapping into virtualised and shared services. ICT Strategy 2012 focuses on creating open government, improving access to government data in an open-access environment, fast-tracking investment in cloud and virtualisation technology, and modernising information management programs. *futuregov.com*

Malaysian govt grants USD 300 mn fund for Sarawak LIS

The state government of Sarawak, Malaysia, allocated USD 300 million for the development of its land information system (LIS), in response to the growing demand for geospatial information, driven by population growth, rural-urban migration, improvement and expansion of physical infrastructures, and other related factors.

The LIS, which was developed by the Land and Survey Department, integrates all spatial information and is supported by cadastral and topographic data. *www.futuregov.asia*

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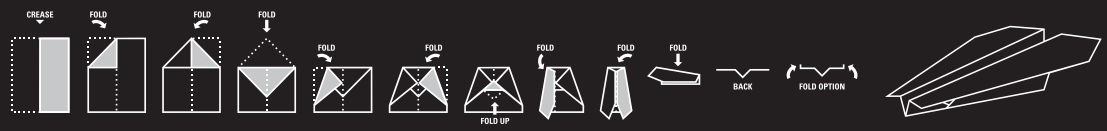

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OROLIA : New Dual Frequency Multi-GNSS Constellation Simulator

Spectracom has announced its new L1+L2 dual frequency 32-channel multi-GNSS simulator, the GSG-62. It offers multiple frequency band operation, multiple GNSS constellation simulation, and expansion capability for more frequency bands and channels. Spectracom's newest addition of industry leading simulators extends the brand's reputation for portability, flexibility and ease-of-use, with expanded capabilities for those who are testing more than GPS L1. *www.orolia.com*

Iteris awarded $2.45 million by Abu Dhabi DoT

Iteris, Inc has been awarded the prime contract by the Abu Dhabi Department of Transport (DoT) for the design, implementation, operation and maintenance of the first integrated travel information and navigation services (i-TINS) system in the Middle East. The contract is valued at $2.45 million. *www.marketwatch.com*

Hemisphere GPS and Stara S. A. Expand OEM Partnership

Hemisphere GPS and Stara S.A. Indústria de Implementos Agrícolas announced their expanded OEM partnership as part of Stara's new SpeedDrive X system. Stara is an agricultural equipment manufacturer, launched SpeedDrive X recently, which will be factory installed as standard equipment on various models of Stara tractors, sprayers, and spreaders. The new SpeedDrive X combines a customized Hemisphere GPS eDriveX automated steering system and A320 GNSS smart antenna and Stara Topper 4500 terminal providing total user management for precision agriculture. *http://www.digitaljournal.com*

Esri GPS base station joins CORS network

Esri recently set up a GPS base station to assist its GIS developers and to support surveyors, engineers, scientists and those in public works and public safety in the community surrounding the Esri campus in Redlands, California. The base station, named GISA, has been accepted by the National Geodetic Survey (NGS) and incorporated into the national Continuously Operating Reference Station (CORS) network. GISA stores GPS and GNSS signals in data files on a secure Esri server accessible to the public via the Esri. *www.gnss.esri.com.*

Leica announces ScanStation C10 and Cyclone v7.4

Leica Geosystems announces a faster, easier option for Leica ScanStation C10 laser scanner users to apply the brilliance of external camera imagery to laser scan point cloud data. The new option consists of a direct digital camera mount on the ScanStation C10 scanner and tight, automated integration of external camera images into the scanner's onboard controller and data storage system. Cyclone v7.4 supports this new option. ScanStation C10 users will continue to have the option of using the scanner's convenient, embedded camera for taking precisely aligned, high-resolution digital pictures of the surrounding scene. Leica ScanStation C5's with this internal camera option can also be used with the new external camera option. *www.leica-geosystems.com*

ECMG, Poland uses Spectra Precision

Okręgowe Przedsiębiorstwo Geodezyjno-Kartograficzne (OPGK) a major survey firm working on road survey contracts across Poland is achieving significantly improved efficiencies using a newly developed Electronic Center for Management of Geodata (ECMG) to link remote field technicians and the central office. The ECMG system begins with field technicians collecting data using fully integrated Spectra Precision Epoch GNSS receivers, Focus 30 robotic total stations and Nomad data collectors. Data is exchanged and full integration is achieved across the different units by using the same Survey Pro software running on all the units. With the Epoch receiver's static capabilities all base stations and backsight points are measured. After the project map is updated with the Focus 30, the data is transferred via either Wi-Fi or GSM /UMTS to a mobile connectivity center, typically located in the technician's vehicle, where it is transmitted to the office network and the central office via GSM (GPRS, EDGE) nor UMTS (HSDPA). At the central office, the geospatial database is

Tiny GNSS timing receiver by Trimble

Trimble has introduced a new embedded GNSS receiver with GPS and GLONASS capabilities for timing applications—the Trimble® Resolution-SMT™ GG receiver. The Resolution-SMT GG receiver enables system integrators to add precise GNSS to provide location, Coordinated Universal Time (UTC) and synchronization to many products or systems where cost or size had previously been a limitation. The receiver also supports Satellite Based Augmentation Systems (SBAS) and the Asian Pacific Quasi-Zenith Satellite System (QZSS). *www.trimble.com*

Trimble Navigation to buy Google's SketchUp

Trimble Navigation Ltd has agreed to buy SketchUp 3D modeling platform from Google Inc for an undisclosed price, the companies said. As part of the SketchUp platform, Trimble will partner Google in developing SketchUp's 3D Warehouse — an online repository where users can find, share, store and collaborate on 3D models, the companies said in a joint statement.

Trimble introduces DR+GPS module for asset tracking

Trimble introduced the Aardvark DR+GPS module that combines Dead Reckoning (DR) with GPS technology on a single, compact board. The company claimed that the Aardvark DR+GPS module provides accurate positioning information when GPS signals are limited or not available, such as in urban canyons and tunnels. It is a suitable solution for system integrators or OEMs who are adding dead reckoning capabilities to vehicle navigation, fleet management and asset tracking systems. *www.trimble.com*

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Watch-Out

Natural disasters are becoming more common, and we are spending a huge amount of resources to respond to them. Early warning systems using GPS and sensor networks are expensive and vulnerable. We need alternatives; how about using humans as sensors and social media as the infrastructure. A team from Centre for SDIs and Land Administration, Department of Infrastructure Engineering, the University of Melbourne developed a real-time hazard map application, "Watch-Out", that is powered by social media observations to help provide useful risk information in crisis situations. Led by Dr Mohsen Kalantari, Associate Director of the CSDILA the team included Amir Nasr (Research Associate, IE), and postgraduate students Davood Shojaei (PhD, IE) and Moein Ghodrati (Masters student, CSSE). The system uses people as sensors and social networks as the infrastructure for the early warning systems. Using this method, in less than a minute; citizens and governments of any country can be aware of disasters in any part of the world. It is a web based map that, in real time, reveals locations of natural disasters. The hazard data is sourced from social networks. The application detects hazards from dialogues in social networks such as Twitter.

automatically updated and post-processing calculations are completed. The data is reviewed with the clients and investors, decisions are made, and the new data is used to finalize design of the road. Design and stake out information is completed and with the fieldwork agenda it is wirelessly returned to the field unit for stakeout.

NexTraq inks deal with Novatel to enhance fleet tracking

Novatel Wireless, Inc., a wireless networking solutions provider, and NexTraq, a GPS fleet tracking and vehicle management solutions provider, signed a supply agreement for mobile tracking devices. Under the agreement, Novatel Wireless will supply its MT 3000 device for NexTraq's GPS fleet tracking solution. *www.novatelwireless.com*

Racelogic wins two Queen's Awards for Enterprise

Racelogic, UK has been honored with two 2012 Queen's Awards for Enterprise. The awards were given April 21 to 209 companies to mark Queen Elizabeth's birthday. Racelogic was one of four companies to be honored with the awards for both Innovation and International Trade. Racelogic won the Innovation award for advances in GPS/GLONASS test simulation, with customers such as Broadcom, ST-Ericsson, and Telefonica using LabSat to test their devices.

Tianjin Waterworks Group Chooses Bentley WaterGEMS

Bentley Systems has announced that Tianjin Waterworks Group Co. Ltd., China, has chosen Bentley's WaterGEMS and HAMMER software to improve its water supply service, decrease operational costs, and extend the life of its water infrastructure. WaterGEMS enhances water distribution and modeling capabilities and HAMMER provides transient analysis to limit water loss. *www.bentley.com*

Leica GM10 – the All-in-one GNSS Sensor for deformation monitoring

As part of its unique Monitoring Solutions Portfolio, Leica Geosystems has announced the Leica GM10 GNSS Sensor. It can be used for a broad range of monitoring applications, including structural monitoring, landslides, seismic studies and offshore infrastructure. It takes advantage of a powerful GNSS receiver for the highest quality measurements. It is fully integrated into Leica Monitoring Solutions and can be combined with Total Stations and geotechnical sensors. *www.leica-geosystems.com*

Use of satellite navigation for asphalt machines

The Fraunhofer IIS, together with MOBA and other partners, has successfully concluded the „ASPHALT" project (Advanced Galileo navigation System for asPHALt fleeT machines). With the aid of satellite navigation, road construction can be significantly improved in the future. To this end, the IIS has developed a special Galileo/ GPS/EGNOS receiver. *www.moba.de*

Leica Geosystems updates its Zeno GIS series of GNSS/GIS products

Leica Geosystems has announced Leica Zeno Field v3.0, Zeno Office v3.0, and Zeno Connect v1.2 software updates for the Zeno GIS series. The main improvements are the support of Esri ArcGIS 10, and simplified use of transformations in the field. The revolutionary Leica Zeno GIS offers professionals and newcomers around the globe a multi-functional and easy-to-use GNSS/GIS solution with superior performance. *www.leica-geosystems.com*

Global Mapper 13.2 by Blue Marble

Blue Marble has released Global Mapper version 13.2. It features updated DigitalGlobe premium imagery with access to its servers. This service will give users faster access to more up-to-date and higher resolution imagery in most locations. *www.bluemarblegeo.com*

Free modeling & simulation terrain databases

The U.S. Army Geospatial Center (AGC) is now distributing Modeling and Simulation (M&S) terrain databases along with operational geospatial products on its Common Map Background (CMB) website with the goal of providing a single repository for all geospatial products. There are 161 free synthetic

terrain databases that support Live, Virtual, & Constructive (L/V/C) simulations used in training, testing and experimentation hosted on CMB. The terrain databases are available for download for free to the Department of Defense users with Common Access Cards at *https://agcwfs.agc.army.mil*

Snow Grooming Guidance and Depth System by Hemisphere GPS

Hemisphere GPS has announced the EquiPiste™ integrated snow grooming management system. It provides visual guidance, snow depth status and event logging for snow grooming operators, mountain managers and snow road operations. Designed with an integrated touchscreen terminal and proven Crescent® GPS, Hemisphere GPS' EquiPiste graphically displays to the operator the areas groomed, boundaries, assets, points of interest and hazards. *www.hemispheregps.com*

RiMINING and RiMONITOR Software Products by RIEGL

RIEGL has developed software for mining and monitoring applications: RiMINING and RiMONITOR.

RiMONITOR is a software package for monitoring terrain deformations by analysis of surface differences. RiMINING is a software package for optimized and simplified scan data registration and processing in open pit mining. It offers, e.g., a powerful vegetation and object filter, automatic break line, contour, and profile extraction as well as volume calculation.

CHC opens its European Repair Center

CHC Navigation extends its Customer Service by opening its European Repair Center. Located in Poland and managed by CHC's partner GPS.PL, the Repair Center is fully equipped to meet the needs of EU partners and customers that require fast, flexible and reliable repair services. *www.chcnav.com*

MARK YOUR CALENDAR

July 2012

COM.Geo 2012
1-3 July
Washington DC, USA
www.com-geo.org/conferences/2012/index.htm

2012 Brisbane International Geospatial Forum
8 - 11 July 2012
Queensland, Brisbane, Australia
www.imtamaps.org/events/

ESA – International Summer School on Global Satellite Navigation Systems
16 – 26 July
Toulouse, France
www.munich-satellite-navigation-summerschool.org

Exploration and Mapping in Mining
17 - 19 July
Perth, Australia
www.explorationinmining.com

Survey Summit
21–24 July
San Diego, USA
www.surveysummit.com/index.html

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

2012 International GNSS Service (IGS) Workshop
23 – 27 July
Olsztyn, Poland
www.uwm.edu.pl/kaig/igs_workshop_2012/

August 2012

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

September 2012

ION GNSS 2012
September 17-21, 2012
Nashville, Tennessee, USA
www.ion.org

October 2012

IAIN 14th Congress & Melaha 2012 Conference
1 – 3 October
Cairo, Egypt
www.ainegypt.org

UPINLBS 2012 Conference and Exhibition
3 – 4 October
Helsinki, Finland
http://217.152.180.26/upinlbs/

INTERGEO 2012
9-11 October
Hanover, Germany
www.intergeo.de/en

19th ITS World Congress
22 – 26 October 2012
Vienna, Austria
http://2012.itsworldcongress.com/content/congress

19th United Nations Regional Cartographic Conference for Asia and the Pacific
29 October - 2 November
Bangkok, Thailand
http://unstats.un.org/unsd/geoinfo/RCC/unrccap19.html

November 2012

Trimble Dimensions User Conference
November 5-7
Las Vegas, USA
http://www.trimbledimensions.com/

2012 International Conference on Indoor Positioning and Indoor Navigation (IPIN)
13-15 November
Sydney, Australia
www.surveying.unsw.edu.au/ipin2012

The 33rd Asian Conference on Remote Sensing
26 - 30, November
Pattaya, Thailand
http://acrs2012.gistda.or.th

December 2012

European LiDAR Mapping Forum
4 - 5 December
Salzburg, Austria
www.lidarmap.org

NAVITEC 2012
5 - 7 December
Noordwijk, Netherlands
www.congrexprojects.com/12c13/introduction

January 2013

ION International Technical Meeting
27 – 29 January
San Diego, California, United States
http://ion.org/meetings/

February 2013

Second High Level Forum on Global Geospatial Information Management
4-6 February
Doha, Qatar
http://ggim.un.org/

The International LiDAR Mapping Forum
11-13 February
Colorado, USA
www.lidarmap.org

The Munich Satellite Navigation Summit 2013
26 – 28 February
Munich Germany
www.munich-satellite-navigation-summit.org

June 2013

TransNav 2013
19 - 21 June
Gdynia, Poland
http://transnav2013.am.gdynia.pl

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The HDS800 is a rugged dual board GNSS system that delivers state-of-the-art RTK accuracy, including heading and relative positioning. Designed for seamless onboard system integration, it is available in a variety of configurations. Embedded Z-Blade™ technology ensures powerful RTK performance and a patented way to use multiple GNSS constellations for high-accuracy positioning and surveying solutions.

MULTI-CONSTELLATION, MULTI-FREQUENCY BOARD

With the new MB 800 multi-constellation board, Ashtech brings to the OEM market a unique blend of technologies which increases RTK availability and data integrity. Embedded Z-Blade™ technology ensures powerful performance and a patented way to use multiple GNSS constellations for high accuracy positioning, and surveying solutions.

Z-Blade

Ashtech's Z-Blade™ Technology is a unique patented method using multiple GNSS constellations for high-accuracy positioning. Z-Blade technology secures the best possible measurements from the GPS, GLONASS and SBAS constellations and mixes multiple observables with no compromise between quality and availability. This leads to an incredibly robust and dependable measurement processing resulting in optimized productivity.

- New Ashtech GNSS centric signal processing:
  Fully independent GNSS satellites tracking and processing
- Fully independent code and phase measurements
- Ability to work in GLONASS-Only mode
- Outstanding reliability in urban canyons and under tree canopy
- Multi-frequency and multiconstellation ready
- Advanced multi-path mitigation

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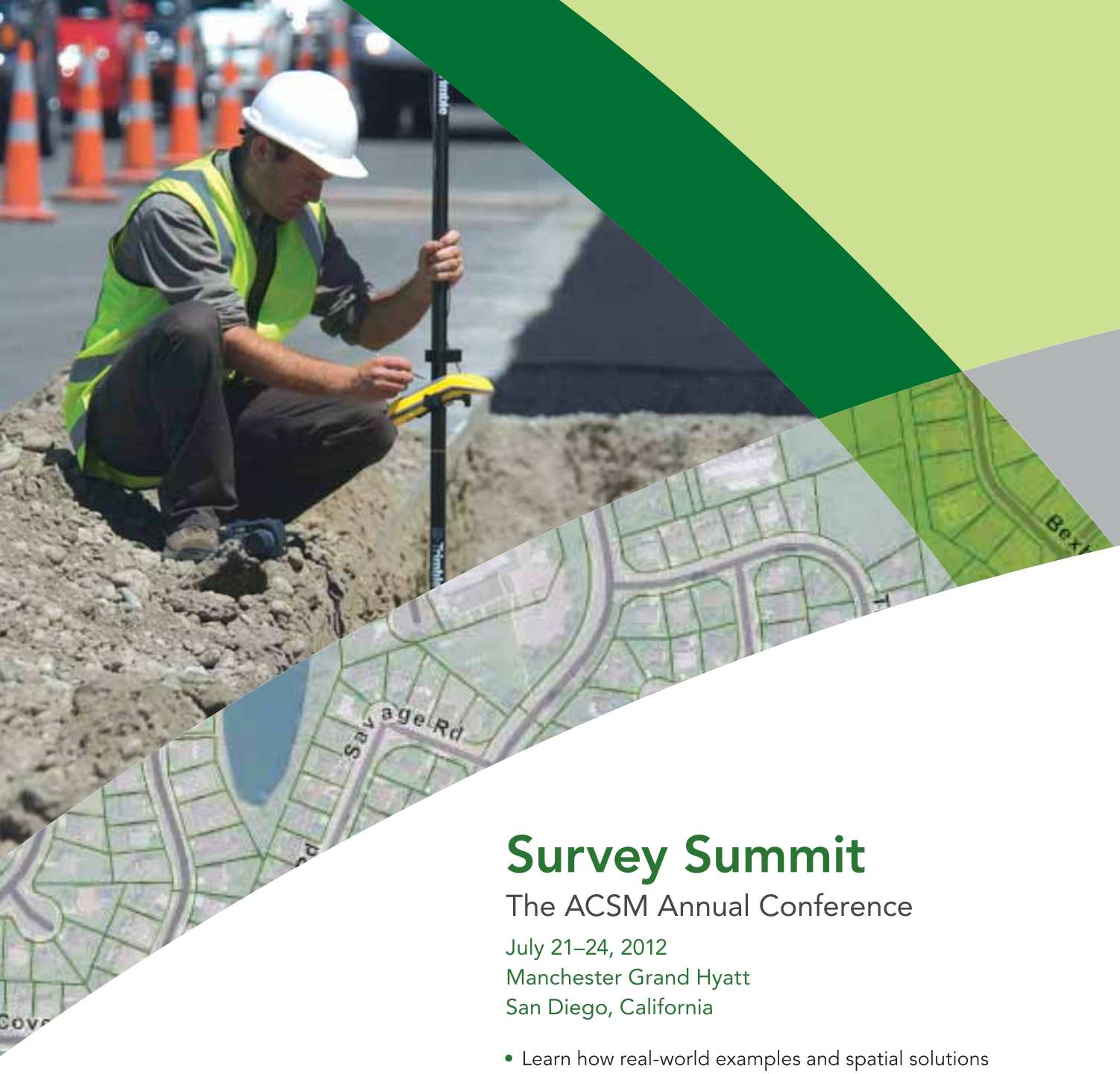

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