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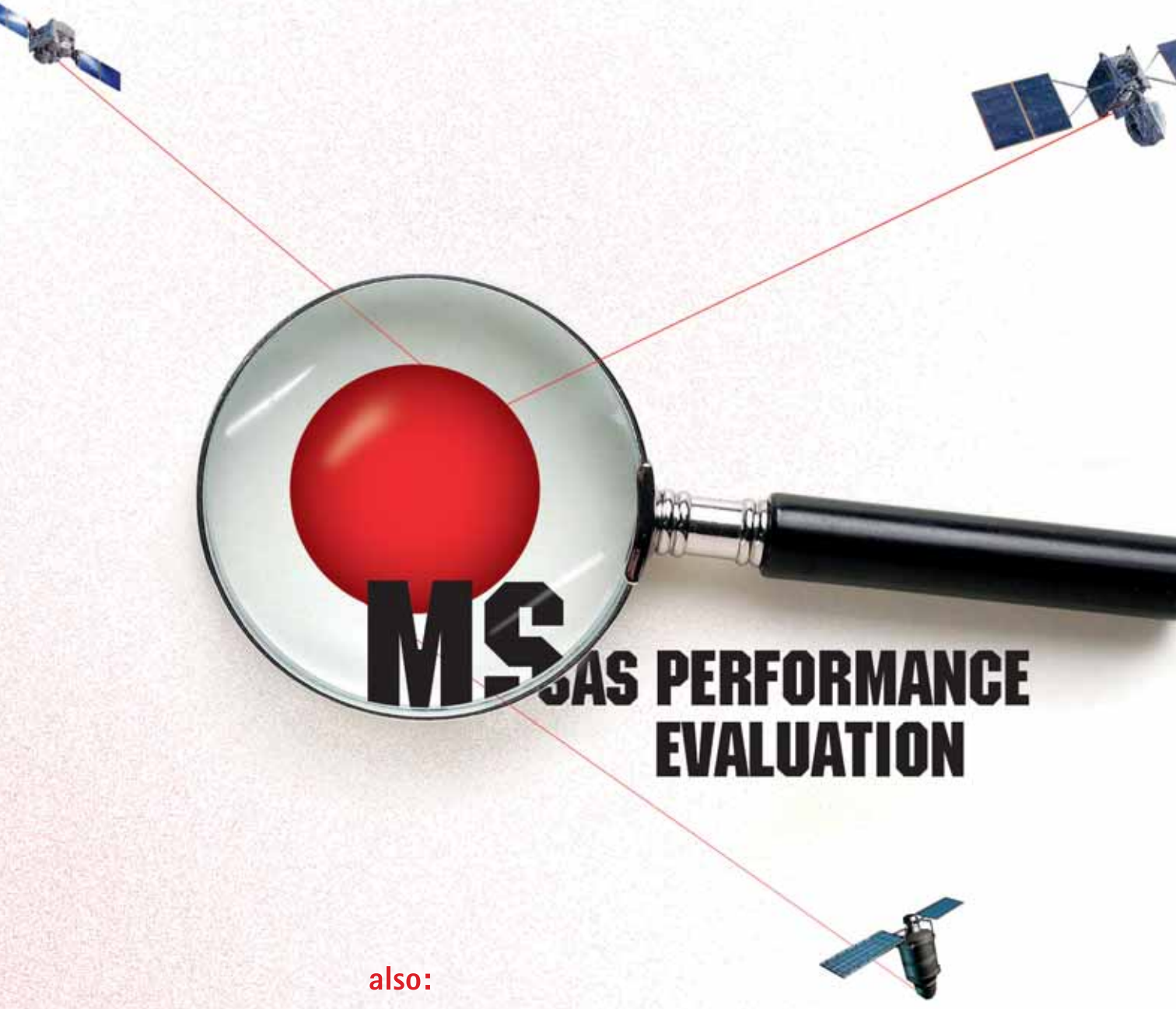

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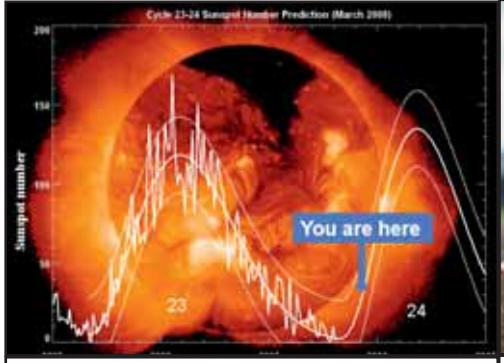

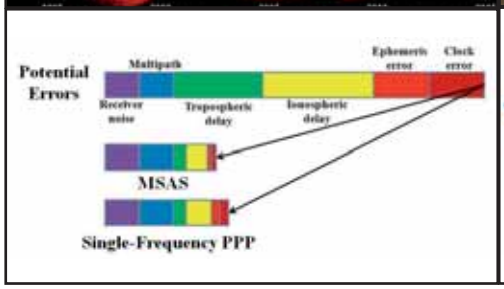

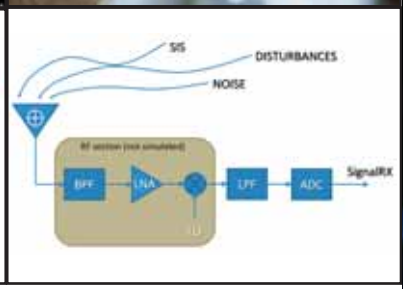

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The technology dilemma

Error in GPS coordinates led to wrong house demolition
(News GPS page 36, July 2009).

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'Total' dependence on technology may also sometime lead to mishaps

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Bal Krishna, Editor
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An interview with

Alexander Wiechert

CEO, Vexcel Imaging
on the present and future
trends in photogrammetry

"We have just scratched the surface of what photogrammetry will do for all of us in the future"

Could you highlight the strengths of Vexcel Imaging large and medium format camera's for our readers.

The strength of Vexcel is outstanding market knowledge, unparalleled technical experience and the attitude for innovation, all combined to maximize the customer benefit of our products. Vexcel entered the market of digital large format aerial cameras in 2004, about three years later than the competition with a new concept, the UltraCam. Since then we have increased our market share constantly and became the market leader quickly - we have sold more than 125 UltraCams and additionally quite some camera upgrades. Obviously the market has decided for frame cameras and has made the UltraCam the most successful large format camera series.

The UltraCamXp combines an excellent parallax free image, a pan-sharpen ratio of 1:3 with the industry leading collection capacity of 17,310 pixels across the strip. Due to the fast frame rate and the innovative storage system, large scale mapping can be performed at reasonable flight speed without any mission duration restrictions due to the camera system. The UltraCamXp reduces the number of flight lines, saves time, and lowers costs, without sacrificing any image quality.

In 2009, we transformed this winning concept into the medium format market with the UltraCamLp; another excellent example of our strive to maximize customer benefit. This camera comes in a medium format pricing package and delivers the same image quality such as geometric accuracy, radiometric dynamic and matching, and stereo capability as the UltraCamXp. This means, smaller companies which still operate analogue cameras have the possibility to go digital. The UltraCamLp utilizes a 92 Megapixel PAN channel for mapping and in addition RGB and NIR with a pan-sharpen ration of 1:2, all motion blur free due to FMC by TDI. This whole concept is new and unique in the medium format market.

This autumn, we will announce the UltraCamXp w/a (wide angle), which is offered in parallel to the UltraCamXp. With a new wide angle lens system, it delivers the same GSD at lower flight altitudes providing small-scale mapping capabilities for customers with lower-flying airplanes.

How is UltraMap different from other Photogrammetric software?

UltraMap is another excellent example of how Vexcel customers benefit from the acquisition of Vexcel by Microsoft in 2006. UltraMap introduces a completely new philosophy of image handling that results in a very high level of automatization and a market leading image processing efficiency. The graphical user interface has been designed by following the huge Microsoft internal experience. The distributed processing utilizes the latest Microsoft technology and the integrated workflow is based on more than a decade of experience in photogrammetry.

All this was combined for only one reason: to set a new standard in image processing and to enable our camera customer to deliver the highest possible quality in the shortest possible time. A new stitching methodology which we will implement with UltraMap version 2.0 improves the "one micron sigma naught accuracy" by a factor of five. UltraMap is fully workflow oriented and designed to process, handle and display projects with several thousand images. It also fully and seamlessly supports projects which have been flown with different UltraCam cameras.

"Vexcel Imaging Aerial Mapping products give amazing results for less." How do you manage this balance between quality and price?

Thank you very much for this very important question. The leading design goal at Vexcel is quality. We are proud that we understand very well how to develop industry leading high-end products and still be able to offer them for a reasonable market price. We achieve this by a balanced combination of proprietary high-end technology with standard components and the unique approach to how we look into technology and innovation.

We consider Vexcel as an innovation leader in the industry and constantly undertake significant investments into proprietary key components such as CCD technology, electronics, shutter and lens development. We also constantly monitor technology trends. Once a new development or a new technology has reached a stage where the customer would benefit from it, we integrate it into our product. By that, a Vexcel customer always benefits from the best technology for his business. To protect the investment of existing customers, we always offer an upgrade path which is highly appreciated and frequently used by our wide customer base.

Could you highlight some application areas where Vexcel Aerial Mapping products have an advantage over other geospatial products?

Vexcel products are serious tools for serious mapping. The combination of excellent image quality with unparalleled efficiency makes an UltraCam the tool for all mapping projects. In each market segment, Vexcel sets the standard - in the large format market: the UltraCamXp sets the standard with 17,310 pixels across and the pan-sharpen ration of 1:3 is best in class for the frame cameras in this segment making the UltraCam also the tool for classification projects. In the medium format market: 92 Megapixel PAN plus RGB plus NIR, integrated in one UltraCamLp camera head are unparalleled in this market segment, too.

Generally, the current Vexcel cameras are designed for large scale applications, driving the trend of the industry towards higher resolution. With the UltraCamXp w/a, we now announce an additional camera which adds small scale mapping capability to those customers with low-altitude planes.

With the proliferation of geospatial products from a variety of sources, how do you see the Aerial Mapping products making an impact in the coming years?

Aerial mapping products have played a dominant role since years and the importance will continue to grow. Aerial images support the trend towards higher resolution and can be collected quickly, flexible and with a high efficiency, compared to the resolution and content one gets. Due to camera capabilities and new software systems such as UltraMap, projects with ten thousands of images will become a commodity. Data processing of large projects will take some days only. All this will leverage the usage of aerial images over other geospatial products.

You have seen this industry grow in the last decade do you think the technological advances in the products have fully been utilized by the user community?

My answer depends on which part of the value chain one focuses on. Digital cameras and the related processing software provide a lot of benefit for the user and the transition from analogue to digital continues. We have customers flying 95% to 100% of their business in the digital world. I am sure that all UltraCam users have fully utilized the technology advances for their business. However, I strongly believe that further down the value chain the users of the images have only explored a fraction of the applications which could benefit from aerial imagery. There is still a lot of potential out and yet undiscovered for the usage of aerial images.

Aerial Mapping products have been used extensively in some parts of the world, but not so in others – which upcoming markets do you think have a good potential in the coming year?

We believe in a general growth of photogrammetry in all markets but with different speed and potential. In Europe digital photogrammetry is already established very well. We see significant growth potential in the USA, especially for the UltraCamLp, allowing the smaller companies to go digital. The same potential we see in Latin America. Asia is still quite underdeveloped and we are currently investing into sales and support structures there. We announced our new regional sales representative, Imagemaps based in Singapore, just recently.

What is your opinion about global sensor market, LIDAR and photogrammetry? What according to you are key points to enhance its growth?

We see the global sensor market growing in the coming years and photogrammetry will continue to gain market share constantly. When Lidar became available, some said that photogrammetry will be replaced by Lidar. This did not happen; the opposite happened. What we currently see is the re-launch of photogrammetry, the digital multi-ray photogrammetry. Huge mapping projects such as Microsoft Bing maps (former Virtual Earth) have chosen digital multi-ray photogrammetry as the underlying production methodology because of the outstanding ratio between collection efficiency, achievable accuracy and processing automatization, and capability of DSM and DTM generation as well as classification results.

To drive this re-launch of photogrammetry ahead, we continue to invest into new camera hardware but especially we see a huge potential in the further development of the processing software. Looking into the research we are currently undertaking at Microsoft Vexcel, I can promise that we have just scratched the surface of what photogrammetry will do for all of us in the future.

MSAS performance evaluation under ionospheric conditions

In order to examine the capabilities of MSAS, we compare the positioning performance of MSAS and Single-Frequency precise point positioning (PPP) at 7 GPS reference stations from northern Japan to southern Japan selected from the network of over 1200 stations that make up the GEONET

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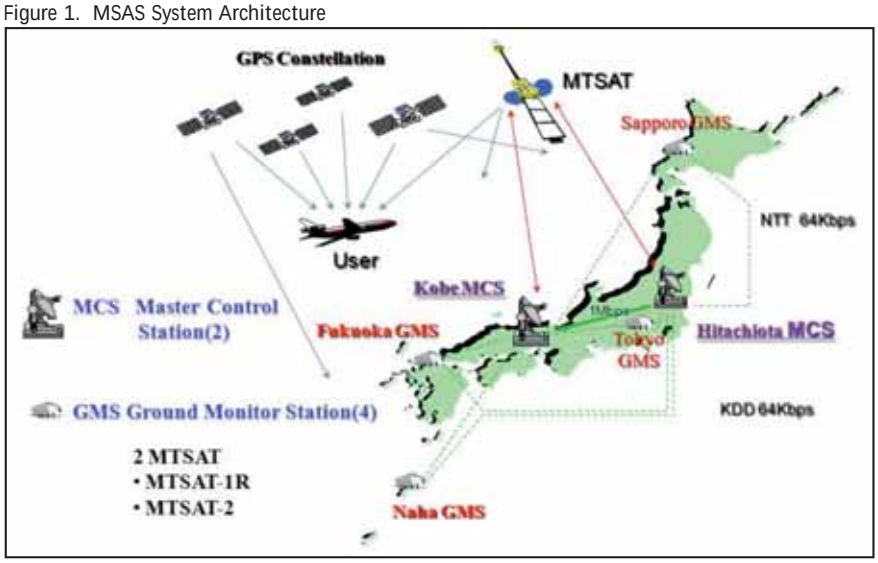
The Multi-functional Satellite Augmentation System (MSAS) is a Japanese Satellite Based Augmentation System (SBAS) [1] which provides Differential GPS (DGPS) corrections and is designed to supplement GPS by reporting and monitoring the reliability and accuracy of GPS signals in real time. MSAS consists of two satellites, (MTSAT-1R at 140E longitude and MTSAT-2 at 145E longitude), four Ground Monitor Stations (GMS), two Master Control Stations (MCS), and two Monitor and Ranging Stations [1]. The MSAS architecture is shown in Figure 1. Although it is designed for aircraft, the signals also can be received and used on land and sea. The primary MSAS coverage area includes a wide significant range of latitude (25N to 45N in geographic latitude; 15N to 35N in magnetic latitude) [2]. Similar services are provided in US by the Wide Area Augmentation System (WAAS) and in Europe by the European Geostationary Navigation Overlay Service (EGNOS). Through the use of SBAS, an individual GPS receiver is able to remove correlated errors from its measurements and thus, obtain much better accuracy.

Figure 1. MSAS System Architecture



The aim of this study is to evaluate MSAS performance under severe ionospheric conditions that were observed from 2001 to 2003, when the ionosphere was more active because the 11-year solar cycle was near its peak. Single-Frequency PPP (SF-PPP) was used instead of using MSAS correction data because MSAS was not yet fielded during the above period. Another reason that Single-Frequency PPP for was used for our evaluation was that the performance of MSAS and SF-PPP was approximately same in terms of theoretical error models. Many papers have been published for both Single-Frequency and Dual-Frequency PPP algorithm, while several papers related to pseudo-range based Single-Frequency PPP have also been presented [3]. In Section 2, the relationship between GNSS and solar activity is briefly described. In Section 3, the outline of MSAS and Single-Frequency PPP are described from the view point of error models. In Section 4, the actual performance of MSAS and SF-PPP were verified using raw data from 2008. From this data, it is found that, as expected, MSAS and SF-PPP performance were approximately the same. SF-PPP positioning performance was then investigated using raw data from 2001 to 2003, during the active solar period.

GNSS and solar activity

It is well-known that ionosphere is the largest error source in positioning for single-frequency GNSS users. Since solar activity has a strong correlation with ionosphere activity, positioning error can increase significantly at low latitudes (and elsewhere, to a lesser degree) during

periods of increased solar activity. During these periods, ionospheric delays at the L1 frequency are normally 5 to 15 meters in the zenith direction, and the delay can reach 100 meters at peak periods. Figure 2 shows the typical solar cycle given by NASA (http://weather.msfc.nasa.gov/). Major ionospheric effects correspond to the rise and fall in the number of sunspots. At present, we are in near solar minimum. In this paper, MSAS performance during solar maximum is estimated by using raw data from the previous solar maximum.

Error models [4]

For standalone GPS point positioning after the deactivation of Selective Availability (SA) in 2000, the dominant error sources consist of satellite orbits and clocks and, ionosphere and troposphere delays, resulting in 2σerrors of about 10 meters horizontally and 15 meters vertically. Satellite orbits and clock corrections are broadcast inside the GPS navigation messages and are typically accurate to 1 - 3 meters. Ionospheric delay varies with time and season up to 15 – 30 meters at zenith and is about 3-4 times larger at low elevation angles. Using the Klobuchar ionospheric model together with the parameters included in the navigation messages can remove about 50 % of the ionospheric delay. The other part of the atmosphere, the troposphere, causes a delay of about 2.5 meters at zenith and can be as large as 20 meters at a low elevation angle. However, this can be reduced greatly by using one of the various tropospheric models. In the following sections, two approaches to reduce these errors are shown. The first method is MSAS, and the second method is Single-Frequency PPP. In this paper, only pseudo-range measurements and corrections are used for MSAS and Single-Frequency PPP positioning.

MSAS [5]

In order to support a large service area, MSAS provides vector correction information, which consisting of separate correction messages that include satellite clock, satellite orbit, and ionospheric propagation delay. The MSAS 250-bps message contains an 8-bits preamble, a 6-bit message type ID, and a 24-bits CRC parity check code. The remaining 212 bits are defined with respect to each message type. When we look at the messages to correct user errors models, several message types are particularly important. Message Types 2-5 contain fast corrections to satellite clock that are updated frequently. Message Type 25 contains long-term corrections to satellite orbit and clock. Message Type 26 provides ionospheric corrections by specifying the MSAS-estimated vertical delay in meters at ionospheric grid points (IGP) located every 5 degrees in latitude and longitude. User receivers perform spatial bilinear interpolation and vertical-to-slant conversion using algorithms defined by the SBAS SARPs to obtain the estimated line-of-sight delay at the nearby user's ionospheric pierce point (IPP) [6]. For SBAS, tropospheric correction is not broadcast; hence they are computed using a pre-defined model. Averaged meteorological parameters are used for this tropospheric correction, and a simple mapping function is used to calculate the line-of-sight tropospheric error.

Single-Frequency Precise Point Positioning (PPP) [3]

Since 1994, The International GNSS Service (IGS), has been providing several types of precise satellite orbits and clocks, including Ultra Rapid, Rapid, and Final ephemerides. They are different in latency and accuracy but have the same sampling interval of 15 minutes. The "Final" product was used in this paper because it has the best performance. Its accuracy is within 5cm and 0.1 ns in both the satellite orbit and the satellite clock. All these products are distributed in SP3 format in which combined satellite positions and clocks (http://igscb.jpl.nasa.gov/components/prods.html). In order to correct for antenna phase-center offset, estimates of the offsets in each satellite were obtained from the internet (ftp://igscb.jpl.nasa.gov/pub/station/general/).

As noted earlier, the ionosphere is the dominant source of error after the elimination of S/A. Although dual-frequency users can easily resolve this problem by directly estimating ionospheric delay, ionospheric models still need to be developed for single-frequency users. Since 1996, Global Ionospheric maps (GIMs) have been available from the Center for Orbit Determination in Europe (CODE). In GIMs, the total electron content (TEC) of the ionosphere is given

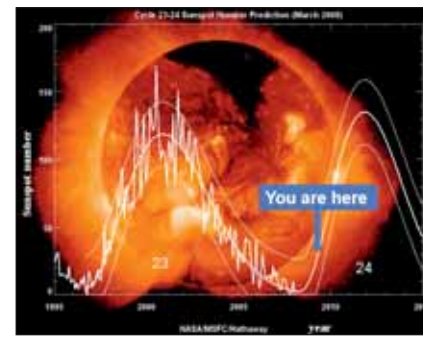


Figure 2. 11-Year Solar Activity Cycle (NASA/MSFC Illustration)

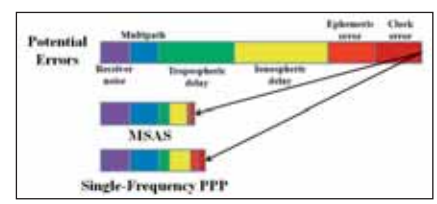


Figure 3. Expected Mitigation of the Errors

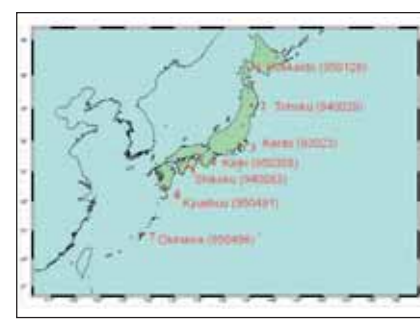


Figure 4. Locations of Seven Selected GEONET Stations in Japan.

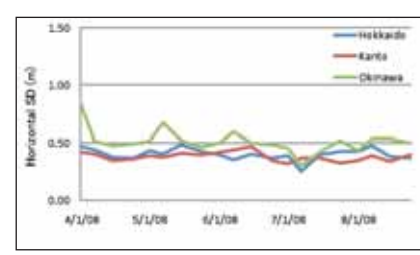


Figure 5. Horizontal Standard Deviations (MSAS)

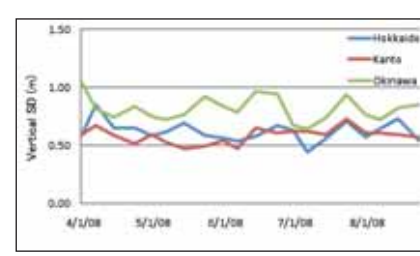


Figure 6. Vertical Standard Deviations (MSAS)

as a 2-dimensional map that is supplied in IONosphere map EXchange (IONEX) format. The resolution of the map is 5° in longitude and 2.5° in latitude. Each daily IONEX file contains 13 maps with 2-hour time spacing (ftp://ftp.unibe.ch/aiub/CODE/). From GIMs, only the vertical TEC (VTEC) can be derived. Hence, a mapping function is deployed to map the vertical TEC value to the slant TEC value. This technique is based on a single-layer model which models the ionosphere as a shell of infinitesimal thickness. Although the accuracy of ionospheric estimation strongly depends on the solar activity, the standard accuracy is within a decimeter under quiet solar conditions.

The Saastamoinen model was used to estimate tropospheric delay in this paper [4]. This model was derived using gas laws and simplifying assumptions regarding changes in pressure, temperature, and humidity with altitude and estimates two separate components of tropospheric delay.

The "dry delay" in the zenith direction comprises most of the delay and can be predicted with an accuracy of a few millimeters from accurate surface pressure measurements. The smaller "wet delay" depends upon the distribution of water vapor along the signal path and is much more variable. Use of average meteorological conditions rather than actual measurements introduces additional modeling errors in both dry and wet delays, resulting in a total zenith delay error of 5-10 cm. One of the mapping functions was used to calculate the line-of-sight tropospheric error [4]. In this paper, L1-L2 biases are compensated because satellite orbits and clocks always refer to the ionosphere-free linear combination between L1 and L2 codes.

Comparisons

Table 1 shows an error model comparison between MSAS and Single-Frequency PPP. There are few differences for the error models regarding accuracy. Figure 3 shows the expected degree of error mitigation for both methods. To generate Vertical TEC (VTEC) corrections, MSAS uses 6 sites in Japan and GIMs uses fewer. From a theoretical point of view, MSAS performance should be slightly better than Single-Frequency PPP, but Single-Frequency PPP can be used to estimate MSAS performance with fairly good accuracy.

Table 1. Error Model Comparisons

	MSAS	Single-Frequency PPP
Measurement used	Pseudo-range measurement	Pseudo-range measurement
Satellite orbit and clock	Broadcast ephemerides and MSAS long term and fast clock corrections	IGS final precise orbit and clock
Ionosphere modeling	MSAS ionosphere correction	CODE GIMs (IONEX)
Troposphere modeling	model	Saastamoinen model
Multipath and Noise	No model	No model

Testing and results

First, MSAS performance during the recent solar-minimum period was evaluated. Single-Frequency PPP performance was also evaluated using the same period fro comparison. Next, Single-Frequency PPP performance was evaluated using raw-data from the solar-maximum period. Finally, dual-frequency-based ionospheric error estimation was tested using the raw -data from a known large solar-flare event.

User stations for evaluation

Seven stations were selected out of the GPS Earth Observation Network (GEONET) stations operated by the Japanese Geographical Survey Institute (GSI) from Hokkaido (Northern Japan) to Okinawa (Southern Japan) (http://www.gsi.go.jp/). These seven stations cover the whole domestic area of Japan. Figure 4 shows the locations of these seven stations. The name for each station represents the geographic region in Japan. The number in each parenthesis is the specific ID for each GEONET station. Raw data from each of these stations was collected every 30 seconds during the periods examined.

MSAS and Single-Frequency PPP performance during solar-minimum period

In this analysis, three stations were chosen from the set of seven shown in Figure 4: Hokkaido, Kanto, and Okinawa. Figure 5 shows the temporal variations of the

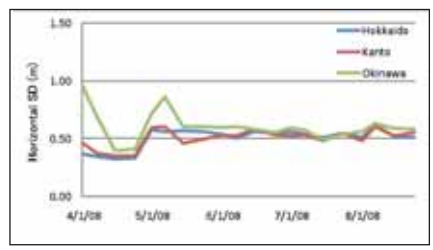


Figure 7 Horizontal Standard Deviations (SF-PPP)

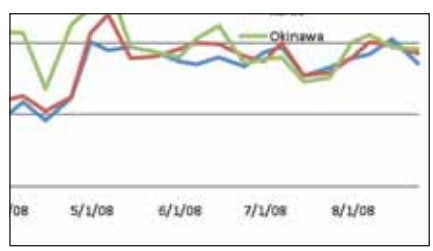


Figure 8. Vertical Standard Deviations (SF-PPP)

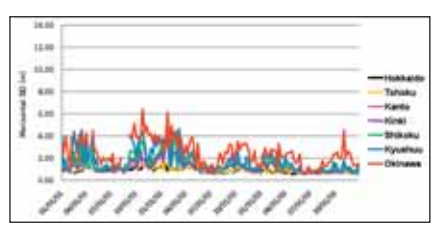


Figure 9. Horizontal Accuracy Standard Deviations During Solar Maximum Period (SF-PPP)

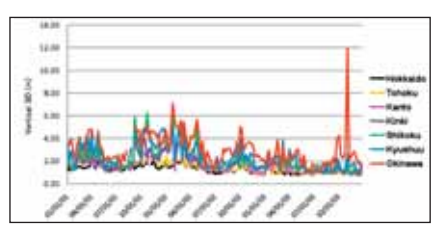


Figure 10. Vertical Accuracy Standard Deviations During Solar Maximum Period (SF-PPP)

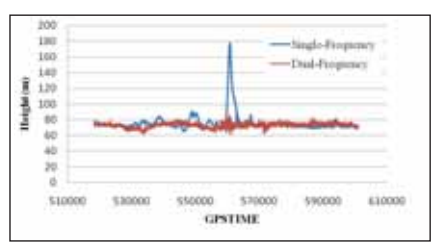


Figure 11. Height Profile at Okinawa Station on 1 November 2003 (During Ionospheric Anomaly)

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standard deviations of MSAS horizontal accuracy for these three locations from 1th April 2008 to 24th August 2008. Figure 6 provides the same information for MSAS vertical accuracy. Figures 7 and 8 provide the same results for Single-Frequency PPP. The estimated (sample) standard deviations shown in these plots were calculated every week. The results were mostly as we expected. The horizontal and vertical standard deviations for MSAS were almost always below 1 meter, whereas SF-PPP vertical standard deviations were often near and sometimes above 1 meter. As can be seen the results in Okinawa, Okinawa station is affected by equatorial ionosphere even during solar minimum. While MSAS accuracy in these figures is somewhat better than that of Single-Frequency PPP, the difference is not large and is now fairly well understood. Therefore Single-Frequency PPP can be used to roughly estimate MSAS performance.

Single-Frequency PPP performance under solar maximum period

Figure 9 shows the temporal variations of the standard deviations of horizontal accuracy from Single-Frequency PPP for all seven stations in Figure 4 from 1th January 2001 to 24th December 2003. Figure 10 provides the same information for the vertical accuracy of Single-Frequency PPP over this period. As can be seen from these results, positioning performance was clearly degraded during significant fractions of this three-year period compared with the results during the recent solar-minimum period shown in Figures 7 and 8. As the latitude moves southward, positioning accuracy degrades because the southern part of Japan is closer to the equatorial region of the ionosphere and is more affected by the intense solar activity. When we examine seasonal changes, we found that the error decreased in summer, especially at the southern stations. This tendency partially coincides with the results given in [7].

Dual-Frequency based ionospheric error estimation

As can be seen in Figure 9 and (particularly) Figure 10, very large errors can be seen around 1 November 2003 due to a very large solar coronal mass ejection (CME). This event created very large ionosphere errors several times during October and November 2003. Currently, it is impossible for single-frequency users to reduce ionospheric errors due to unusual events like this one. One solution is to use a dual-frequency receiver that can estimate and remove ionospheric delays in real time. We examined the positioning errors on this day using dual-frequency based ionospheric error estimation and compared these results to those derived from the IONEX file. Figure 11 compares the height (vertical) profile at the Okinawa station on 1 November 2003 for these two methods (note that the actual height of the antenna at this station is about 71.5 m). Since only ionospheric error estimation differs between the two lines shown in Figure 11, it is clear that ionospheric error for standalone single-frequency users exceeded 100 meters at the peak of this event, but dual-frequency estimation dramatically reduced the effects of this anomaly.

Conclusion

MSAS and Single-Frequency PPP positioning were analyzed using raw -data covering the Japanese islands in 2008. The performance of these two systems was similar, although MSAS accuracy was somewhat better than that of Single-Frequency PPP. Single-Frequency PPP accuracy was analyzed during the more active solar conditions of 2001 to 2003, and its accuracy was significantly degraded at times. Therefore, it is predicted that MSAS performance may also be degraded during future periods of high solar activity, although the degree of accuracy degradation depends on locations, season and time of date. The likely cause of this accuracy is mis-modeling of Vertical TEC by MSAS and GIM during very active solar conditions. Dual-frequency based ionospheric estimation can be used to remove most of these increased errors.

Acknowledgments

The authors are very grateful to the Geographical Survey Institute, Japan (GSI) of Japan for providing the raw data used in this research. The authors also wish to thank Dr. Takeyasu Sakai of ENRI for providing post-processing software for MSAS analysis. The first author gratefully acknowledges the Japan Ministry of Education, Culture, Sports, Sciences and Technology.

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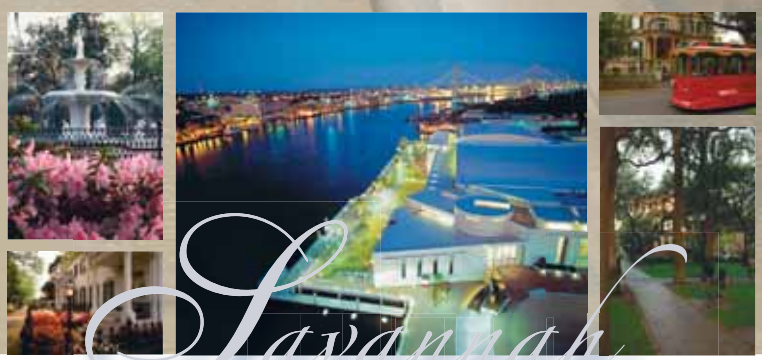

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- GNSS Spectrum Protection Issues
- GNSS in Uninhabited Vehicles

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The 22nd International Technical Meeting of the Satellite Division of The Institute of Navigation

NLRMP: Mission possible

We presented draft guidelines on implementation of National Land Records Modernisation Programme by the Government of India in May -09 Issue of Coordinates. Following are some experts' comments.

Building Capacity

Maj Gen (Dr) B Nagarajan, Additional Surveyor General and Director,
Indian Institute of Surveying and Mapping, Hyderabad
ngeoid@yahoo.com

Indian Institute of Surveying and Mapping (IISM) is the country's premier institution for human resources development in the realm of surveying and mapping in its modern incarnation.

IISM recognizes that the cutting edge in the process of development is information dissemination. Hence, its efforts of generating awareness among various organization and training its manpower in modern trends in Surveying & Mapping like GPS, Total Station , Digital Photogrammetry, Digital Mapping & GIS.

By taking this motto into account a understanding has been reached between Survey of India and the Ministry of Rural Development, Department of Land Resources to train various State revenue and land records department officials to meet their needs for modern technology in Computerization of Land records. A programme titled "Capacity Building" under National Land Records Modernization Programme has been designed to train and the updating the knowledge of

- Decision makers level officers of two week duration
- Supervisory level officers of two months duration
- Working level officers of 4 months duration

On the following subjects

Concept and application of GPS, TOTAL STATION

An old revenue map taken as input material has been scanned and over that 10 sharp & well distributed points (i.e. both in map & ground) selected for giving Ground Control Point (GCP) by GPS Trimble 5700. Geo-referencing has been done by taking above 10 GCPs' .

Concept of digital mapping, datum and Projection, Coordinate System

Geo referenced map has been put through UTM projection , WGS84 horizontal Datum & MSL as vertical datum. Digitization / vectorization has been done by taking suitable symbols, specially generated for the purpose. Insertion & deletion guide prepared and loaded into Total Station for further densification of control points & update the map as well.

Data base, DBMS, GIS and its application

A special attribute data collection form has been made & taken to the field . The attribute data as collected has been tagged to the spatial data using Arc GIS 9.2 software. Query and analysis has been carried out for the tagged data using Arc GIS 9.2 Tools and final out put for Query analysis has been taken out.

Digital Photogrammetry and Remote Sensing

The modern trends in Digital Photogrammetry & Remote Sensing and their application has also been included to give an overall idea about updating of spatial data directly in a digital mode very quickly & economically by using suitable aerial photographs and/or satellite imagery of suitable resolution. So we can say that the modern instruments like GPS, Total Station along with attribute data

integration for GIS is the only means to solve the complexity of the over volume and huge resources of land information for better assessment, planning and a quick decision in every field.

A little exposure is also given to quickly update the old map using Mobile Mapping System.These subject has been covered as per the requirement of the various level of officers. Till this month training for two batches of decision maker level officers (14+17 No's) and one batch of supervisory level officers (20 No's) has been completed.

The states participated in the training programme till now are Assam, Meghalaya, Arunachal Pradesh, Nagaland, Orissa, Kerala, Tamil Nadu, Maharastra, J & K, Bihar, - Rajasthan, Punjab, Madhya Pradesh and Himachal Pradesh. At the end of each course of supervisory level officer a project has been given to make them capable to handle the land modernization programme in their respective state and decision maker level officers has been trained in all the subjects mentioned above to equip them to manage and fulfill the managerial requirements of the state revenue and land records. As per the feed back received from various target group , we can say that they are well acquainted with aforesaid techniques in its entirety and confident of undertaking any project / job that is assigned to them in their ambitious NLRMP.

Put NLRMP on national agenda

Sharad Raval
Ex- Deputy Director and Chief Information Officer State Monitoring Cell, Revenue Department Sachivalay Gandhinagar, Gujarat

Land is the primary source of sustenance for mainstream population in our country. There are intermittent changes in the land-holdings and land parcels. There have been several mutations such as acquisition, grants, subdivisions, sale, court decree, alienation, land type conversion, inheritance etc. Therefore, full-proof land administration and land record management have become immensely important. A full-proof land administration can only be had by implementing a real-time conclusive land-titling system powered by the information and communication technology. This requires replacement of the present manual presumptive land-title system. The primary base of the land administration is land records. The present manual land records are old, insufficient, not duly updated, not agreeing among and within the corresponding records. The manual system of record keeping has become cumbersome, opaque, susceptible to manipulations and hard to administer by the administration. For the Collector, the district head of the land administration, it is difficult to have, on-hand clear idea of the land under his domain.

The MoRD and the States have gathered a vast, strong, directing experience of 20 years in such erstwhile program, but in fragmented and not all-inclusive formats of CLR & SRAULR centrally sponsored schemes. Fortunately, the MoRD invested efforts in massive/ marathon exercise for envisioning, conceptualising and designing a revamped program named NLRMP, which the States could hardly bring to bear on their own. The NLRMP program outline and the detailed guideline ascertain the required base principles of Torrens System of conclusive land titling viz. single window, mirror, curtain and title insurance. The scope of the program neatly encompasses the preparatory activities viz. Computerisation of land records work covering data entry of all textual records, mutation records, other land attributes data, digitisation of cadastral maps and their integration, developing of Tehsil/ sub-division and district level data centres, Digital network connectivity among revenue offices. The program encompasses survey/resurvey and updating of the survey & settlement records using operational pure ground, hybrid methods and their relevant combination of TS, DGPS, AP, HRSI technologies. Registration was left-out from the erstwhile fragmented and not all-inclusive CLR & SRAULR schemes of the program. Registration is the initiator for transactional change in a particular land record. Now activities like - Computerization of the SRO, Data entry of valuation details, Data entry of legacy encumbrance data, Scanning & preservation of old documents, Connectivity of SROs with revenue offices – have been covered in the NLRMP.

Modern record rooms, land records management centres, Training & capacity building, Strengthening of the survey and revenue training institutes have been continued from the erstwhile program to the new NLRMP. Using the GIS platform for the land-titling system would be an all-inclusive and wide-ranging feature of the NLRMP. This activity covers geo-referencing of the cadastral maps as base maps with RS data. Further integration with HRSI, SOI, FSoI map data would enable NLRMP for micro and macro planning and other relevant administrative and decision support applications.

Legal changes by Amendments to The Registration Act, 1908, Amendments to The Indian Stamp Act, 1899, Model law for conclusive titling and Program management the new indispensable, important, necessary and vitally central aspects have been included in NLRMP.

Observation:

Computerisation of land records is one of the components of the ICT powered real-time conclusive land-titling system, the new NLRMP. This scheme was kicked-off in the year 1988. During 20 years of this erstwhile land records program (1988-2009), Karnataka, Gujarat, Goa like 3 to 4 states have reached a stage, where manual system of maintaining fiscal cadastre (registers for all parcels containing basic data such as ownership, location, area, land use, improvements and assessed value - used for tax purposes) has been replaced by computerised system with discontinuance of manual system. Even these 3 to 4 states have a long long way to go for attaining the stage of ICT powered on-line conclusive land-titling system. A continuous drive from the central government in terms of planning, finance, and guiding, coordinating, monitoring has shaped and helped the 3 to 4 states to achieve this stage. The other states are in process of reaching this stage. There can be no doubt about the sincere efforts by the other states. But, the argument here is, that every stake-holder of the NLRMP has to have clear understanding that this area of e-governance is the most complicated, intricate, difficult and tricky. This program is not easy than any other e-governance program. This program has multi facets viz. techno, legal, administrative, behavioural, attitudinal, political will.

The most key and central concerns in implementation of the NLRMP would be:

- Putting up the program on national agenda
- Achieving NLRMP would involve, getting across many serious political, logistical, administrative, attitudinal and change management hurdles.
- Doing away with the old and insufficient records, cumbersome, opaque and susceptible to manipulations record keeping system is an excellent effortal idea the MoRD has engrossed.
- When the NLRMP would become reality, the stress faced by the 950 million grass-root citizen would be significantly reduced, problems associated for a citizen facing and approaching multiple windows and the red-tape attitudinal flavor would cease to exist.
- Authorities at the state and Central level, pulling together, would achieve the aim and would change the can-not happen mindset to make them happen.

A great step in right direction

N K Agrawal
Geodesy & GPS Services, Hyderabad
nande@rediffmail.com

NLRMP is a great step in the right direction. Guidelines document has been well prepared. It is hoped that NLRMP will be implanted expeditiously. My comments/ suggestions are as given below which pertain to my field of expertise only: -

Datum. It is good to note that WGS 84 has been recommended. This will however require conversion of all cadastral maps and other maps to WGS 84. All existing maps are in Indian system with Everest Spheroid as the reference surface.

Projection/Grid system. UTM (Universal Transverse Mercator) has been adopted. In my opinion, Transverse Mercator and/or Lambert Conformal Conic with individual states as zones and origins nearly at geographical centers of the states will be more suitable. Many existing cadastral maps are on Cassini projection and some others arbitrary. These will have to be converted to adopted projection system.

Method of Survey/Data Capture. All the three methods suggested in the guidelines are feasible. Concrete experiments can only show cost effectiveness, ease and quality comparison between the three methods. Combination of these and different methods depending upon area and type of terrain can be adopted.

It will be better if all districts are surveyed/resurveyed afresh gradually.

Accuracy. Accuracy for horizontal and vertical control and for survey/ data capture have not been defined clearly. Suggestions are given here: -

Horizontal control: - Instead of specifying type of GPS to be used and duration of observation for GPS, accuracy of different requirements should be specified.

- Points 50 km apart with 1 in 50000 accuracy.
- Points 10 km apart with 1 in 20000 accuracy.
- Points 02 km apart with 1 in 2000 accuracy.

It is suggested that horizontal and vertical control points should ultimately be provided at every 2 km. This will be of great help in surveying with ETS (Electronic Total Station) and other instruments. Combination of GPS/ETS is suggested for horizontal control.

Vertical control: - Tertiary accuracy ($24mm\sqrt{K}$ where K is in kilometers) between Survey of India primary/secondary benchmarks. The accuracy is achievable by tertiary leveling using Dumpy/Auto levels/ETS.

Survey: - Accuracy of all corners of land holdings in rural areas where scale of survey is 1:4000 can be 1 in 1000. Accuracy of all corners of property holdings in urban areas where scale of survey is 1:2000 can be 1 in 2500.

Training: - Training of teachers is essential who in turn can impart training to work force. It is good that training institutes are proposed to be strengthened.

Sheet Indexing: - It will be better to index the sheets state wise. One grid for one state and grid reference can guide sheet indexing. It should be indexed from bottom to top and not from top to bottom as we are in Northern hemisphere and Coordinate system is also from origin to East and North.

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TRIUMPH – 4X
216 channels

JAVAD ArcPad Extension
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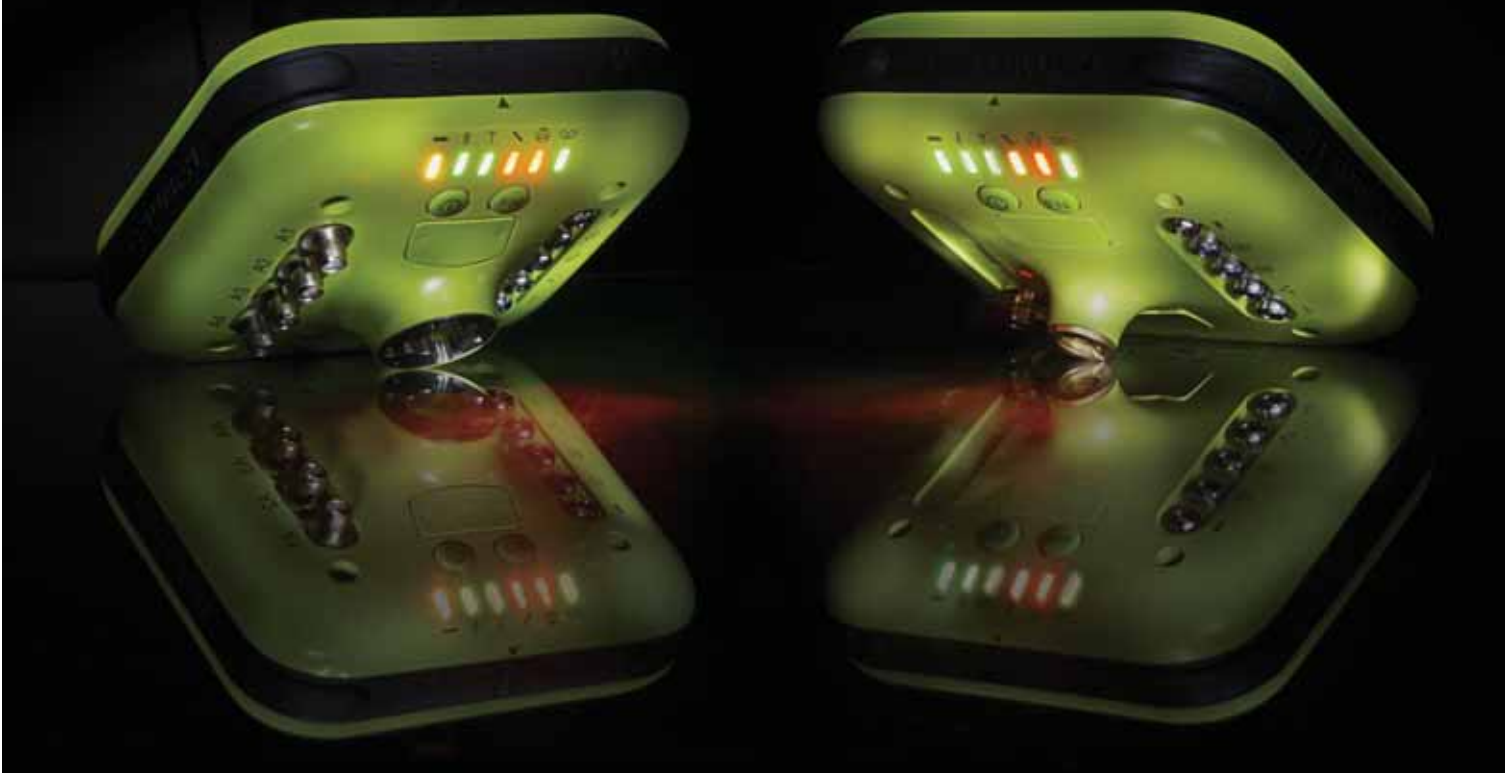

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JAVAD ArcPad Extension enhances the spectrum of ArcPad's surveying capabilities by adding state of the art JAVAD GNSS solutions. JAVAD ArcPad Extension provides a full range of functions to control the GNSS receiver and manage the surveying process. Broadcasting/Receiving differential corrections and synchronizing ArcPad with ESRI's GIS server is enabled by utilizing advanced wireless communication technologies such as Bluetooth, GPRS, and UHF. Note that JAVAD ArcPad Extension uses the receiver's internal GSM modem so no additional devices (external radio) or settings are required.

JAVAD ArcPad Extension establishes a connection to the receiver via serial, USB, or Bluetooth. Users will find software dialogs familiar as they are similar to the mapping/surveying software tools they have used in the past.

Only three buttons are needed to control data logging, configure the base station parameters that govern the RTK and UHF radio setups, and GSM modem settings.

Quality control of real-time positioning results are assured in the field. The JAVAD GNSS Victor PDA displays the status/process progress continuously via the Bluetooth connection to the receiver. With the Victor's graphical user interface, the operator can perform basic file manipulation operations such as start/stop data logging, delete files, initialize the internal file system, etc. Should the user need customization of the receiver's parameters, a terminal software emulation utility allows executing individual commands or entire scripts written in the GREIS interface language.

Actual size

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2. Bluetooth/GSM Antenna
3. GNSS Receiver, Power Board, GSM/Bluetooth and Memory
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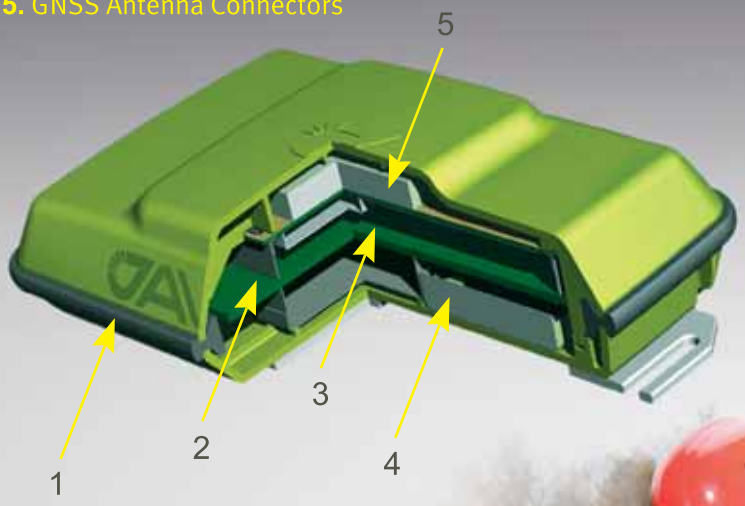

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- GLONASS L1
- 100 Hz update rate
- 100 Hz update rate
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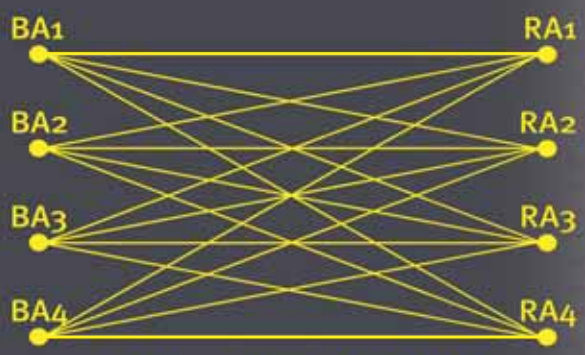

4 base — 4 rover, 16 baselines

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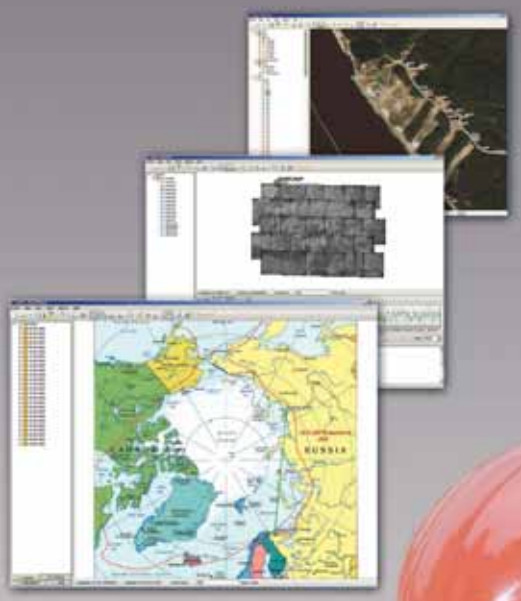

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It can import data files as well as whole folders. Justin employs special technique to process high rover data rates (up to 100 Hz) using low base data rates. Other features include single epoch static solution, manual postprocessing with time line chart, using vertical profile to filter out suspected data and scientific data analysis and viewer.

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Victor is pre-loaded with our Tracy field software. When turned on, Victor automatically connects to TRIUMPH-1, TRIUMPH–4X or GISmore via its internal Bluetooth and guides you through field operations. It manages the GNSS receiver and modem operations automatically.

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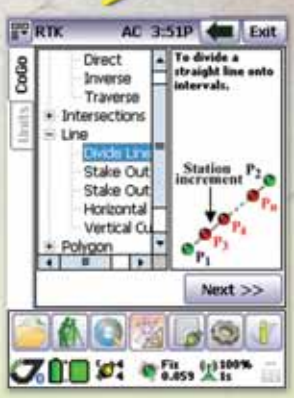

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Software for Windows Mobile OS to control receivers, automated GNSS post processing surveying tasks (Static, Fast Static, Stop&Go, Data Acquisition), and to perform RTK survey and stakeout tasks.

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- **Real time kinematic can provide high-accuracy positioning (precise to a few centimeters) by using differential corrections (in RTCM or CMR) transmitted by the NTRIP and CRTN services via GPRS or UHF.**
- **Dual frequency GPS+GLONASS receivers deliver high accuracy on longer baselines.**

Other Receivers

ALPHA

- Internal battery
- Charger
- GSM
- Bluetooth

for: TR-G3, TR-G2T, TR-G3T

Front panel connectors:

Power Input + serial port A + USB + Antenna

Back panel connectors:

Can have up to 3 connectors of 1-PPS · Event Marker · IRIG · GSM Antenna (without Bluetooth antenna).

When Bluetooth antenna is installed only one extra connector can be installed.

Example 1: BT Antenna + GSM Antenna
Example 2: 1-PPS output + Event Marker + GSM Antenna

DELTA

for: TRE-G2T, TRE-G3T, Duo-G2, Duo-G2D, Quattro-G3D

Front panel connectors:

Option 1: Power Input + Serial A + Serial B + Serial C + Antenna

Option 2: Power Input + USB + Serial A + Serial C + Antenna

Options 3: Power Input + USB + Serial A + Serial C + Ethernet

Back panel connectors:

Can have up to 4 connectors of 1-PPS A · 1-PPS B · Event A · Event B · Antenna · CAN · IRIG B

Example: 1-PPS A + 1-PPS B + Event A + Event B

SIGMA

- Internal battery
- Charger
- Modem
- GSM
- Bluetooth

for: TRE-G2T, TRE-G3T, Duo-G2, Duo-G2D, Quattro-G3D

Front panel connectors:

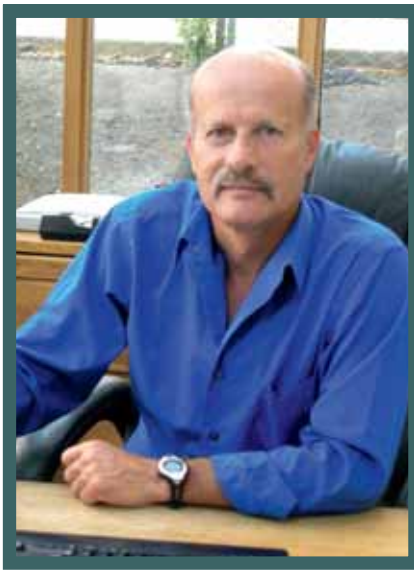
Can have Power Input · Second Power Input · USB · Serial A · Serial B or C · Ethernet

and up to 4 connectors of 1-PPS A · 1-PPS B · Event A · Event B · Antenna · CAN · IRIG · RS422

Back panel connectors:

Can have SIM door and GSM Antenna connector and up to 4 connectors of 1-PPS A · 1-PPS B · Event A · Event B · Antenna · IRIG · Modem Antenna · Bluetooth Antenna

Example: GSM Antenna + SIM door + 1-PPS A + 1-PPS B + Event A + Modem Antenna



"Software development is our main focus"

Says Jeff Yates, General Manager, DAT/EM Systems

Is the name DAT/EM an acronym, or is there some other significance behind it?

DAT/EM (pronounced dāt'-əm) is an acronym for Digital Automated Technology / Engineering Mapping. The software was developed internally between 3 production mapping firms located in the United States in the mid 1980's. As such, our software was conceived in a production environment to meet the demanding technical needs of top-flight photogrammetric organizations. Since the first data collection licenses were sold in 1987 (on analogue stereoplotters), we have never lost sight of the need for constant improvement of the software. We have always understood if the software tools can save a user one key-stroke (or more!) on a repetitive command, this will have a direct and positive influence on the company's profitability.

How is the SUMMIT EVOLUTION™ stereoplotter different from other stereoplotters?

Summit Evolution has by far the best user interface, the most active update schedule, and the most attentive support of any stereoplotter on the market today. Summit Evolution's great user interface means a very fast learning curve and easy-to-remember processes. The workflow is intuitive and robust. Only two days of training is enough to get most new users ready to start their projects.

Summit Evolution has the advantage of digitizing directly into the AutoCAD®, MicroStation®, or ArcGIS® environment. Since these are the most-used CAD/GIS formats, that means none of the time-consuming file translations that some other stereoplotters require. Our update schedule is between three and four updates per year. We're always working on keeping up with new stereo viewing technology and incorporating user ideas and recommendations. For example, when customers started to work with the newest more-than-three-band imagery, we enhanced Summit Evolution to be able to display the infrared, false infrared, or any other spectrum bands in the normal visible display channels on the monitor.

Our technical support is world-class. Clients are always amazed at the quick response from our customer support, especially when they've suffered inadequate support for other-brand products in the past. DAT/EM makes sure to respond right away, whenever possible, and in under 24 hours (weekdays) for clients in opposite time zones.

SUMMIT EVOLUTION™ has been described as a 'digital phogrammetric workstation', what end products are possible with it?

The purpose of a digital photogrammetric workstation is to use digital imagery to view the images in stereo, orient the images to a ground coordinate system, and collect (X,Y,Z) coordinates. The most common end product is a map file containing 3D information, such as topographic (contour) maps or planimetric (roads, buildings, etc.) maps. There are also many less standard projects such as measuring vegetation, archaeological sites, historic buildings, art, ice caves, and glaciers.

The majority of clients who work with Summit Evolution collect vector information directly into AutoCAD, MicroStation, or ArcGIS ArcMap. Summit Evolution can also generate elevation contours and output them directly into these CAD/GIS formats. Summit Evolution also offers orthophoto generation, in which stereo aerial images are converted into a set of orthorectified images or mosaics.

Another new use for Summit Evolution is to work together with the new DAT/EM Landscape module, which is a LiDAR (Light Detection and Ranging) point viewing and editing application. While Landscape shows the LiDAR points, Summit Evolution shows stereo aerial images of the same area with the Landscape points superimposed over the 3D view. This "power duo" can be used to help identify points that need reclassification. This is an area that has huge potential for growth as more and more governments are mandating LiDAR acquisition.

DAT/EM systems products are available globally, but are there any regions which you are focussing on for your products?

Currently DAT/EM Systems International is more heavily focused in the Middle East, Europe, and Asia, as well as South America. We have a strong client base in the Orient and we will continue to nurture this important market. South Asia and specifically India, has become a very important region for us. Over the past 10 years, we have developed an extensive client base in this region. We will continue to promote our products by attending the local technical conferences, visiting potential clients and strongly supporting our local representatives.

How is DAT/EM systems placed vis-à-vis the rising mapping needs in the upcoming markets in Asia?

We are very well positioned at this time. This is because of our existing installed base along with the existence of our local resellers, who can provide timely

cost quotations and pre-sale support. Our representatives understand the very important need to provide expert technical support following a sale. As mentioned, we have been travelling to Asia for many years and stay in close communication with our clients. We do not develop technical capabilities in a vacuum. We strive to listen to the current needs of our existing clients which allows them to do their work ever-more efficiently. This feeds the sale of new licenses.

With your partners, is the focus more on software development or also on product marketing?

Software development is, of course, our primary area of focus; however DAT/EM Systems has a strong marketing campaign as well. DAT/EM Systems participates in approximately ten to fifteen conferences and user groups yearly to promote our software and hardware. Along with our web presence and quarterly newsletter, DAT/EM Systems also sends out press releases on our updates and new software and hardware options.

Is the future development at DAT/EM more geared towards GIS mapping?

Overall, DAT/EM gives equal emphasis to its AutoCAD, MicroStation, and ArcGIS data capture products. We sometimes focus on one in particular when a new version of its CAD/GIS software is released, so that we can become compatible with it. In fact, that's just about to happen for our ArcGIS interface, and we're very excited about it. DAT/EM is working together with ESRI(R), makers of the world-renowned ArcGIS software, to create a smooth workflow between ArcGIS Image Server, Summit Evolution, and DAT/EM Capture to ArcGIS. ESRI ArcGIS Image Server will soon be able to store and retrieve photogrammetric projects, and Summit Evolution will take these 3D projects directly into digitizing and editing in ArcGIS ArcMap. That's just a little glance into the future of 3D mapping with ArcGIS! So, yes, we are very aware of the growing needs of the GIS community for engineering-quality mapping products and will continue to develop the tools for this large and important market segment.

Un-Earthly Coordinates

When GPS helped Explorer Avery to the GEODETIC North Pole!

Muneendra Kumar
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Of course, it would be extremely rare, when any GPS surveying and/or "navigating" to the North Pole is undertaken. One such opportunity occurred In April 2005. British explorer Tom Avery in his effort(s) to recreate Adm. Robert Peary's epic journey of April 1909 to North Pole took GPS to navigate himself.

During his journey, Avery's team observed the GPS surveyed positions from the starting point, enroute, near the extreme vicinity, and at the North Pole (Note: Unfortunately, no repeat and along the return tracking observations were made). These geodetic positions have allowed examining GPS surveying performance near and at the North Pole.

As the GPS positions appear at two places in Avery's book ("To the End of the Earth", St. Martin's Press, NY, 2009), 8 positions (near and at the Pole) have been copied (Barclay Capital's Log and Page 271) into one table to "produce" a continuous sequence.

Date	GPS Position	
	Latitude	Longitude
Barclay Capital's Log -		
4.23.05	89 25.472	57 14.062
4.24.05	89 44.044	51 42.595
Page 271 -		
4.25.05	89 59.989*	"?"
	89 59.994*	"?"
	89 59.997*	"?"
	89 59.998*	"?"
	89 59.999*#	
Barclay Capital's Log -		
4.25.05}		
4.26.05}$	90 00.000**	00 00.000**

* These 5 positions are NOT in Barclay Capital's Log.

The most northerly coordinate a GPS can register (As per comment on Page 271).

$ It is not clear "How 1 position is attributed 2 days".

** In view of the remark (#) vide Page 271, from whom Barclay Capital logged this latitude and longitude coordinates for the North Pole.

Un-Earthly Coordinates – Did GPS survey the "ZERO" longitude, which does NOT exists on the Earth, at the North Pole?

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Educational library of GNSS signals for navigation

N-FUELS (FUll Educational Library of Signals for Navigation) is a MATLAB®-based GNSS signal generator and analyzer that allows the simulation of physical layer signal structure for GPS, Galileo and EGNOS systems in all the current and future bands

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The current panorama of navigation satellite systems is rich of proposals for novel modulations and bands, to be prospectively used in the current and incoming systems. In this perspective, the know-how on the inherent nature of signals and systems is a fundamental resource to proactively cope with the multiple aspects of interaction and integration among signals, services and applications.

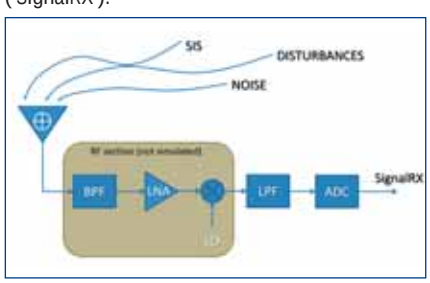
Aside to the fundamental theoretical analysis, rooted onto the mathematical description and resolution of problems, the main tool in the researchers' hands is nowadays computer-aided simulation. For this reason, a plethora of GNSS system/signal simulators has been created worldwide, from home-made very simple signal simulators to professional, complete and very expensive, system emulators [1].

This paper presents a MATLAB®-based simulator designed to offer a flexible but complete tool able to off-line reproduce GNSS signals at the ADC (Analog to Digital Converter) output of a navigation receiver, either at intermediate frequency (IF) or at baseband (BB). The signal generator can account for the effects of multipath, Doppler, interferences of different nature (i.e., intra-system, inter-system, bandlimited, continuous wave, etc...) on all the bands of interests for the future GNSS, as well as AWGN (Additive White Gaussian Noise) and receiver front-end characteristics (equivalent receive filter, ADC). Thereby, a reliable, though non-real time, simulation of the received signal samples after ADC conversion is made available at a sampling frequency open to the user's setting. This allows the test of any reception algorithm that processes digital samples in a completely controlled signal/environmental scenario, e.g. acquisition algorithms, code and carriers tracking loops, C/N0 estimation algorithms, interference or multipath detection and mitigation algorithms and so on.

The signal generator is only a part of a more complete signal generation and analysis tool called N-FUELS (FUll Educational Library of Signals for Navigation), which includes also a set of signal analysis functions for testing and monitoring several signal metrics: for example, power spectral density estimation applied either to the signal generator output or to any sample stream at the IF or BB stages, group delay estimation associated to a certain receiver configuration, discriminator curves, multipath error envelope and running average curves, spectral separation coefficients, etc...

For these reasons, the tool represents an appealing, low-cost, quick instrument for a wide variety of educational and research analyses that can be developed and performed onto GNSS signals. The relevance of the tool can be individuated in its software modularity and then versatility, its use easiness, being a collection of MATLAB® modules, and its incomparably low cost with respect to other hardware devices on the market, undoubtedly traded off with off-line processing and comparatively long simulation times.

Figure 1. System elements simulated by the signal generator. The output are the samples of the digitalized signal at the receiver ('SignalRX').



Signal Generation Tool

The MATLAB®-based N-FUELS signal generator allows simulating the physical level signal structure of GPS, Galileo, and EGNOS systems in all the current and future bands (L1, L2 and L5 for GPS, E1, E5 and E6 for Galileo), as seen at the front-end output of a digital receiver,

right after analog-to-digital conversion. The signal samples are possibly impaired by noise and/or interference, multipath and Doppler effect, and can carry the navigation message read from an ad-hoc file. A conceptual scheme of the elements included in the signal generator is sketched in Figure 1, where

- 'SIS' indicates the generation of the Signal-In-Space (SIS) for one or more satellites;
- 'DISTURBANCES' indicates the generation of the disturbing signals (e.g., interference or multipath);
- 'NOISE' indicates the generation of the AWGN.

In order to guarantee use versatility and fully controlled simulation conditions, the user is allowed to set a wide range of simulation parameters, reported in the six panels of Figure 2: general simulation parameters, definition of the SIS components, interference/multipath scenario, thermal noise, receiver front-end model and quantization bits. For the disturbances scenario, in particular, the user can select the type of disturbance affecting the SIS, among Continuous Wave (CW) or wideband interference (WB), multipath (MP), and intra/inter-system interference (IS). The latter represents the case where one or more "desired" SIS are subject to the interference from other GNSS signals, from the same or another constellation among GPS, Galileo and EGNOS.

Figure 2. Signal generator. User's settings panels.


Figure 3. (a) Main window of the signal generator's GUI; (b) disturbances panel.

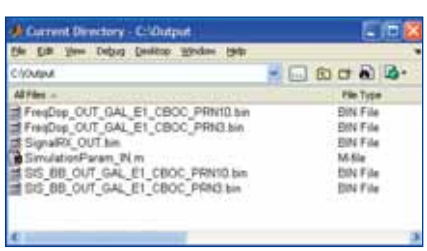


Figure 4. Signal generator. Output files.

All the parameters can be set by a graphical user interface (GUI, Figure 3), which allows a quick and intuitive introduction of signal, noise and disturbance characteristics.

An example of the output directory produced by the signal generator is shown in Figure 4, where it is possible to observe:

- the presence of the binary file containing the signal samples at the ADC output (output file 'SignalRX_OUT.bin'),
- the simulation parameters file ('SimulationParam_IN.m'),
- the files containing the SIS PRN codes (one file for each satellite, e.g., 'SIS_BB_OUT_GAL_E1_CBOC_PRN10.bin', for the PR sequence 10 of Galileo in the E1 band), and
- the files containing the sequence of values of the Doppler frequency shifts (one file for each satellite, e.g., 'FreqDop_OUT_GAL_E1_CBOC_PRN10.bin').

The stored code samples are shown in Figure 5(a), drawn with 16.3676 MHz sampling frequency, while the corresponding IF modulated signal, at fIF = 4.1304 MHz, is shown in Figure 5(b)

Signal Analysis Tool

The signal analysis tool contains several routines able to perform a detailed analysis of navigation signals, thus acting as a set of software instruments enabling to perform a modular and homogeneous "check-up" of the characteristics of every GNSS signal as received by a digital receiver. Homogeneity is desirable in the sense that the set of instruments emulated by the tool functions operates as a sort of jointly-calibrated toolbox, guaranteeing a complete agreement of the results obtained from different measurement functions, so that they can be related, compared and possibly inferred to one another. Modularity, on the other hand, is another desirable characteristic, enabling a very flexible software architecture made of independent blocks that can be added or removed from the current signal analysis without impacting on the functionalities of the whole tool.

The natural input of the signal analysis

tool is evidently the output produced by the signal generator, but it is not limited to that: any sequence of samples generated by a digital receiver can be off-line processed by the signal analysis tool, once the correct information about the employed receiver setup is passed to the software modules.

The functionalities inserted into the tool account for a significant portion of the whole family of measurements commonly employed in the fields of GNSS signal analysis and GNSS digital receivers. They can be assigned to five logical panels, as reported in Figure 6:

Modulation analysis, including spectral analysis, code correlation estimation, DLL discrimination function analysis, RMS bandwidth computation. This set of functions is intended to measure the intrinsic characteristics of a given modulation. For this reason, these measurements are not observable in a real receiver, but they are obtained in simulation from the noise-free and impairment-free signal samples generated by the signal simulator.

Signal-in-noise analysis, including C/N0 estimation, pre-correlation averaging [2], and spectral analysis. This set of functions replicates some of the functionalities a signal receiver can implement. These functions are dedicated, but not limited, to the analysis of satellite signals buried in thermal noise.

Interference analysis, including spectrum threshold, Spectral Separation Coefficient (SSC), Interference Error Envelope (IEE). SSC is a widely recognized theoretical method to analyze the expected interference impact on a given modulation [3], while the interference error envelope is a novel metric that allows a more detailed analysis of specific interference parameters, taking into account also the receiver setup [4,5]. Both SSC and IEE are numerical evaluations of analytical formulations; on the contrary spectrum threshold is a simple detection method that exploits the noise-like spectral property of the received signal-in-noise, opposite to the interference spectrum, generally much higher than the background noise.

Multipath analysis, including multipath error envelope and running average [6], implemented for different discrimination functions.

Miscellanea, including group delay estimation, measured on the basis of the digital model of the front-end filter. For each function, a specific set of open parameters allows the user to select and refine his/her "virtual test-bench" setup (see Figure 6).

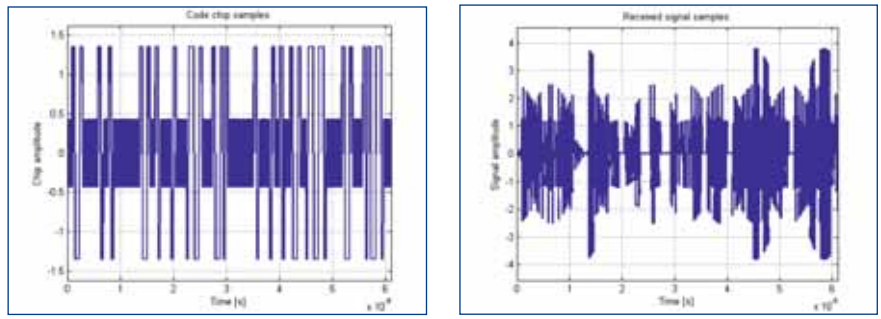


Figure 5. Signal generator. Output samples: (a) Galileo E1-B-C CBOC chips; (b) modulated samples @4.1304 MHz IF frequency with linear Doppler model.

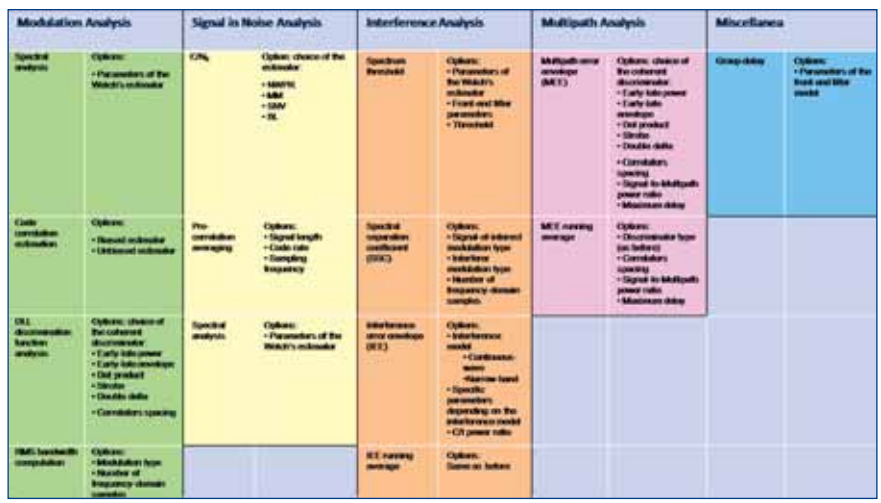


Figure 6. Signal analysis tool. User's settings panels.

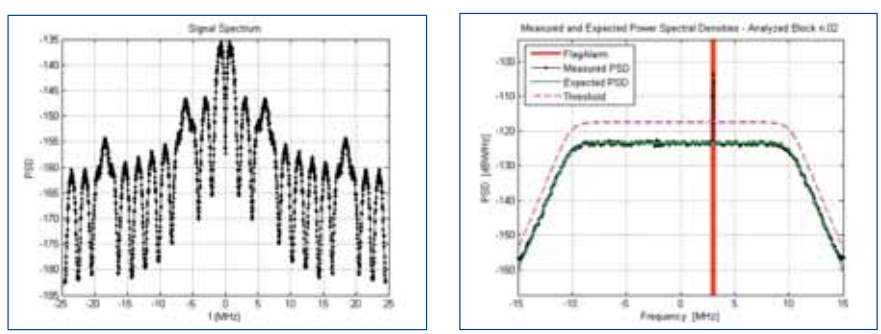


Figure 7. Spectral estimation: (a) noise-free GPS L1C signal (b) interference detection in noisy signal using spectrum threshold.

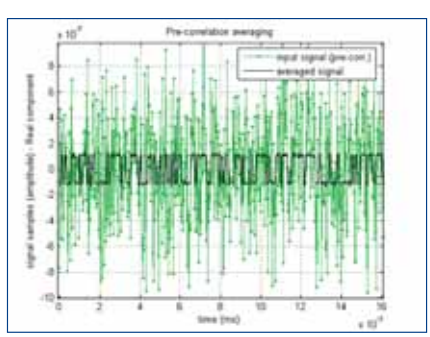


Figure 8. Pre-correlation averaging (GPS L5).

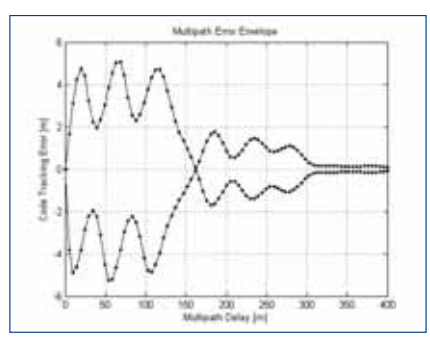


Figure 9. Multipath error envelope.

Analysis of received signals

Two examples of spectral analysis realized with the tool are shown in Figure 7. In part (a), the power spectral density of the TMBOC signal (GPS on L1C band) is shown, while in part (b) the same signal is analyzed in the presence of AWG noise (C/N0 = 40 dBHz) and a CW interferer appearing with -30 dB signal-to-interferer power ratio. The spectrum threshold function allows detecting the presence and the spectral location of the interferer, thanks to the fact that, in the presence of AWGN, the signal spectrum is completely buried into the noise so that the resulting power spectral density is shaped by the front-end transfer function. The interferer is identified by the red vertical stripe.

In Figure 8, averaging of directly observed pre-correlation signal samples [2] is applied to a GPS L5 signal in noise (C/N0 = 65 dBHz). As it is possible to observe, the code waveform can be recovered from the superposition and average of a large set of noisy samples (1.82 seconds of simulated samples, at the sampling rate 40.92 MHz). Only the real component is shown in the figure.

Finally, an example of multipath analysis for the Galileo CBOC signal on the E1 band is reported in Figure 9, based on the multipath error envelope computed for a dot-product discriminator (0.1 chip spacing) and a receiver bandwidth of about 20 MHz.

Conclusions

N-FUELS in a toolbox of MATLAB® modules for in-lab generation and analysis of all GPS and Galileo signals today in use (or in perspective use). Its relevance for educational and research activities appears in the fact that it prevents the user to deal with a wide variety of problems related to the realistic simulation of satellite signals (e.g., PRN codes and modulations), environmental effects (e.g., Doppler shift of the carrier frequency and on the code, Doppler rate, multipath), interference, and receiver effects (e.g., received thermal noise, front-end filters, incommensurable sampling frequency, quantization), still maintaining an extreme versatility in the definition of scenarios.

Furthermore, it offers a set of the most common signal analysis procedures used to monitor the quality and performance of GNSS signals, thus complementing the signal generation tool with a modular and homogenous analysis tool. The N-FUELS toolbox has already been fruitfully and successfully used in several simulation campaigns to test and validate various receiver architectures and algorithms [4, 5, 7-11], as well as an educational tool for post-graduate students.

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SatGuide PND Moov 300

SatNav Technologies launched the SatGuide PND Moov 300 in India. It will provide road navigation with features like voice prompted directions and a 4.3-inch touch screen. *www.satnavtechnologies.com*

4.7-inch Maestro PND by Magellan

Magellan announced the Maestro PND with new design, 4.7-inch Display, voice command capabilities, hands-free Bluetooth calling and highway lane assist. It has new feature "Find Your Car" which remembers the location of your car. *http://promagellangps.com*

RoadPilot agreement with Nokia

RoadPilot Limited has signed a 3-year agreement with Nokia to supply safety camera location data for the GPS-enabled mobile devices. The data will be included in a safety camera and traffic alert bundle for the latest version of Nokia Ovi Maps. *www.roadpilot.com*

Tele Atlas delivers new standard in Real Time Traffic

Tele Atlas HD Traffic is a solution for navigation and location based solutions designed to find the quickest routes to destinations using "live" road conditions. It contains up-to-the-minute information from multiple data sources, including anonymous GPS. When HD Traffic is added to a navigation solution, end users can be automatically rerouted. *www.teleatlas.com*

Garmin and BMW launch new bike-friendly satnav

Garmin and BMW Motorrad have developed a new motorcycle friendly satnav. The new BMW Navigator comes with an exclusive four-button motorcycle mount. The mount and GPS device are vibration-tested, waterproof and designed to withstand fuel sprays and UV rays. *www.garmin.com*

CosmicNavigation deals with TomTom for content

TomTom has partnered with CosmicNavigation to sell cycling, marine and touring content to its customers. The Atlasses will be first sold to Dutch TomTom users and the international editions of these databases will be developed later. *www.tomtom.com*

People avoid too much automatic location information in mobile services

Researchers at Helsinki Institute for Information Technology (HIIT) found out in a study that people start using automatic location information services only if the services are clearly useful to users and if the users can easily control the information flow. *http://www.hiit.fi*

Veriplace launches off-deck location-enabled application

uShip have been certified and launched on WaveMarket's Veriplace Location Aggregation platform. It is a web-based service that does not ask users to download anything onto their phones. Using Veriplace, uShip customers can now track the exact location of their shipments *www.veriplace.com*

Mobile GIS Locator for field personnel

BlackBerry® users will now be able to view their location and the location of their co-workers on GIS maps using the latest release of Freeance Mobile software. *www.freeance.com*

GPS can lead walkers astray

The Mountaineering Council of Scotland (MCofS) has warned that walkers who splash out on expensive GPS equipment are often putting their lives at risk because they have no idea how to use it. To overcome this, they are to run a series of GPS training courses to put climbers 'on the right track'. *http://news.scotsman.com*

At a Glance

Mergers, Acquisitions and Partnerships

- Vexcel Corp. has upgraded to the recently commissioned Apex remote sensing ground station in Santiago, Chile. First sale of an UltraCamX to Istanbul-based Foto Havicilik
- SiRF Technology has merged with a wholly owned subsidiary of CSR plc.
- RapidEye appoints MDA Federal to be one of their US distributors.
- GVS Agrar will distribute automatic GPS auto-steer guidance systems from Leica in Switzerland.
- LocatioNet's "amaze" GPS navigation service on Huawei's GPS-enabled mobile handsets.
- Eniro's local content to be available in navigation devices using the NAVTEQ map.
- Intermap in a new agreement with the Sarawak Lands and Surveys Department in Malaysia.
- Intermap in a new agreement with the Sarawak Lands and Surveys Department in Malaysia.
- ITT signs international distribution agreements with six companies for ENVI.
- Woolpert partners with Pelydryn.
- Rolta Canada and ESRI Canada partnership for North America
- The GeoInformation Group Partnership with STAR-APIC
- ImageTree agreements with GeoEye Inc. and MJ Harden Associates
- Location Based Technologies implements u-blox' GPS software

Contracts Awarded

- GeoEye, gets a government order for more than $25 million
- China Information Security Technology contracts valued at US$26.28 million in 2nd quarter of 09.
- Astrium and JSC National Company "Kazakhstan Gharysh Sapary" to build a satellite integration centre.
- MacDonald, Dettwiler and Associates Ltd. awarded a multi-million dollar contract from DigitalGlobe Inc.
- DigitalGlobe contract with NGA for $12.5 million a month.
- Maptel has secured a five-year; $600 million contract to digitise data collection for US authorities.

Galileo update

Telespazio takes control of Galileo Ground Facility

Telespazio has taken over management of a Galileo satellite constellation control centre. The company will begin cabling the entire structure as well as installing and integrating required systems and equipment for the satellite constellation and mission. Telespazio said its work will begin on the areas dedicated to security, navigation signal generation systems, orbital management and atomic clocks. The control centre is expected to be fully operational and will be inaugurated this fall. *www.telespazio.it*

GIOVE-A operations extended for another year

GIOVE-A, the first test satellite for Europe's Galileo navigation system, is to remain in service for a further 12 months. The satellite built by SSTL for ESA and already in orbit for 41 months - 14 months beyond its original mission design life - will continue to provide critical data to all of the ground users experimenting with Galileo navigation signals. The ESA recently approved an extension of the GIOVE-A mission. *www.sstl.co.uk*

Europeans fight over the Galileo Satellite Network

The politicians want one thing, economists another, and the ESA something completely different. The agency's Director of Navigation, Rene Oosterlinck, said that it would be nothing more than good economics to launch all 28 satellites whose contracts would be awarded this year from the Kourou Space Centre, in French Guyana, South America, aboard Russian-built Soyuz delivery systems. However, others show that Arianespace's Ariane 5 heavy-lifting rockets are more than capable of handling the delivery of up to four Galileo satellites at the same time. Right now, such a rocket can only take three satellites to orbit, but with $50 million worth of modifications, it could easily accommodate four. Oosterlinck explained he favoured a plan where the Ariane 5 would be kept in reserve, in case the Soyuz became unavailable. But critics argue that using Russian rockets would only go to show that Europe is not as autonomous as it would like to think, and would fail to prove the idea that started the project. *http://news.softpedia.com*

EU satnav project ill-conceived

The EU's much delayed project Galileo has been ill-prepared and badly managed, the European Court of Auditors charged."The programme lacked a strong strategic sponsor and supervisor: the (European) Commission did not proactively direct the programme, leaving it without a helmsman," the auditors' court opined after carrying out an audit of the ill-starred project. As well as the commission -- the EU's executive arm -- the 27 member states came into criticism for promoting their own industries first and foremost. "Owing to their different programme expectations, member states intervened in the interest of their national industries and held up decisions. The compromises made led to implementation problems, delays and, in the end, to cost overruns," the official auditors declared. The audit examined the factors in the failure of the concession process and for delays and cost overruns of technological development. It concluded that the original public-private partnership plan was "inadequately prepared and conceived" not to mention "unrealistic". *AFP*

Indian GPS augmentation goes ahead

ISRO has awarded an $82 million contract to Raytheon to build the ground stations for the GPS-Aided Geosynchronous Augmented Navigation (GAGAN) System. GAGAN will provide satellite-based navigation - nominally for civil aviation, but in practice for all users - over Indian airspace and adjoining areas in South and East Asia. It is a satellite-based augmentation system (SBAS) for GPS and other operational satellite navigation systems giving differential corrections. It is scheduled to be fully functional by 2013. *http://raytheon.mediaroom.com*

METIS demonstrates benefits of EGNOS in Civil Aviation

The Euro-Med GNSS project named METIS shall demonstrate EGNOS benefits in the Civil Aviation domain in October- November 2009. First one shall prove the use of EGNOS for the monitoring of moving assets in the airport of Casablanca (Morocco). Second one will be aimed at performing flight trials consisting of EGNOS Approach with Vertical Guidance (APV) operations in the airports of Perugia (Italy) and Çanakkale (Turkey). *www.metis-project.eu*

New Jersey may ban manual GPS

New Jersey legislator in USA is hoping to ban in-car navigation systems that rely on manual input. Violators would face $100 fine per offence that applies to improper cell phone use. Under the proposed law, drivers would be allowed to only use voice-activated systems to program the devices while a vehicle is in motion. *Fox News*

Boeing's GPS satellites on schedule

Boeing Co. confirmed the launch of its new GPS satellites to be on schedule. The satellite is the second of 12 satellites called GPS IIF satellites, which will undergo ground tests that are part of the preparation for the first launch, and then will be returned to El Segundo, California for further preparation for its own launch at a later date. *www.boeing.com*

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GPS Satellites exceed 100 years On-Orbit service

The US Air Force's fleet of GPS Block IIR and IIR-M satellites, designed and built by Lockheed Martin, has accumulated 100 years of successful on-orbit operations. The 12 Block IIR and seven IIR-M satellites in service within the overall 30-spacecraft constellation have provided a reliability record of better than 99.9%. In over 100 cumulative years of on-orbit life, this translates to less than one minute of unscheduled outage for every month of operational service. *www.lockheedmartin.com*

SVN-49 still not usable

The latest GPS satellite - SVN-49 or IIR-20(M) launched on 24 March - has still not been set 'healthy' due to errors of up to 150m which are dependent on its observed elevation. Its primary aim was to reserve the new L5 frequency with the International Telecommunications Union - time to do this was rapidly running out. Initial fears were that the L5 (1,176.45 MHz) transmissions were interfering with the normal L1 (1,575.42 MHz) and L2 (1,227.60 MHz) broadcasts. This could have upset the entire programme to introduce the third frequency. *www.rin.org.uk*

Cause identified for error from SVN49

The GPS Wing and its contractors have traced the cause of pseudorange errors on L1 and L2 broadcast by the newest GPS satellite, SVN49, to the manner in which the L5 signal demonstration payload was added to the satellite. Signal leakage between the two input ports of the antenna coupler network for the satellite's array of 12 helical antenna elements, reflected from the L5 filter and then transmitted, creates a second signal with a delay of approximately 30 nanoseconds, and the appearance of a multipath component. While testing an adjustment to the signal-in-space to minimize the effect of the problem on receiver navigation solutions on Earth, the GPS Wing is interested in hearing from manufacturers and the user community concerning the different impacts of SVN49 signals on the wide range products and applications in operation, before reaching a final decision on what to do with the satellite prior to setting it healthy. *www.losangeles.af.mil*

Russia plans to hike GPS duty

Russia plans to raise by 25% duty for satellite navigation equipment operating with the US GPS, says Deputy Prime Minister Igor Ivanov. He said the duty hike was needed to encourage production of GLONASS-enabled devices. "We need measures to stimulate production of domestic satellite navigators so that they can compete with foreign GPS devices," *Interfax News Agency*

75% subsidy to fishing vessels

To ensure the safety of deep-sea fishermen, the Indian government shall extend financial assistance amounting to 75% of the cost of the GPS kit with echo sounders, search and rescue beacons and other communication equipment. *www.dailytimes.com*

Measuring the Great Wall of China

Recently, the ISPRS sponsored a project to determine the true length of the Great Wall of China. ISPRS president Chen Jun led a team of about 800 professionals. The team used 1:35,000 air photos to generate a 3D digital model of the topography. This allowed the team to measure the slope length using digital photogrammetric tools. They revealed that the Great Wall built in the Ming Dynasty era stretched 8851.8 km, further than the previous estimate of around 6000 km. It consists of 6259.6 km of stone wall, 359.7 km of trench wall, and 2232.5 kilometres of natural defensive barriers such as hills and rivers. *www.isprs.org*

OGC calls for Industry input on Geospatial Fusion

The Open Geospatial Consortium (OGC®) has issued a Request for Information to solicit industry input into a Fusion Standards Study to be conducted in preparation for the planned OGC Web Services, Phase 7 (OWS-7) Testbed. It will also partner with other Standards Development Organizations (SDOs) having technology relevant to fusion. *www.opengeospatial.org*

Delhi 3 months away from geo-governance

For the first time ever Delhi city will have a utility map through aerial photographs and also real-time monitoring of the ground situation throughout the city with the help of 64 wireless internet protocol cameras. 31 departments and agencies will be able to access this data in real time. The Rs 120 crore project called the Delhi State Spatial Data Infrastructure (DSSDI) project is in the last stages of completion. It is being done by Delhi government along with Survey of India (SOI). Times of India

Google shows properties for sale

Homebuyers will be able to find houses and units listed for sale or rent across Australia through Google Maps. Listed properties will be marked on an interactive map, along with prices and descriptions supplied by a range of real estate agents. *www.thewest.com.au*

Bangladesh digital mapping project

The 'Improvement of the Digital Mapping System of Survey of Bangladesh' at an estimated cost of Tk 181.43 crore, will be launched soon by the Bangladesh Survey Department at all divisional headquarters across the country. *http://bdnews24.com*

Swine flu pandemic planning

NHS emergency planners in Bristol and the Avon region are developing their swine flu

pandemic response strategy with spatial data from Dotted Eyes. The data has been used to identify the optimum number and locations of antiviral collection points. Key factors are population statistics and travel times to community pharmacies. *www.dottedeyes.com*

Pune to use GIS for mishaps

A GIS-based Accident Report and Analysis System (ARS) is to be launched in Pune, India. It will have details of every accident taking place on the roads will be plotted on the city's geographical map, which would make it possible to generate analytical reports. *http://timesofindia.indiatimes.com*

JDA to use Google earth

Jaipur Development Authority (JDA) will take a bird's view of Pink City to ensure that it drafts city's development plans to perfection. It plans to buy aerial pictures of the city and has applied for license to acquire the pictures. *http://timesofindia.indiatimes.com*

GIS to monitor greenhouse gas

The New Zealand Ministry for the Environment shall soon use GIS to monitor gas emissions and land-use change. Built on ESRI's ArcGIS software, Land Use and Carbon Analysis System (LUCAS) combines carbon assessment calculations with core geospatial change analysis and forest plot sampling to produce the carbon-per-hectare report for Kyoto land-use classes. *www.esri.com*

ITT Corporation announces a new image processing product

ITT Corporation and ESRI shall integrate their respective software to deliver image processing and analysis capabilities to the ArcGIS platform ITT has introduced a new product, ENVI EX, an image processing and analysis solution integrated with ArcGIS has been designed specifically to meet the needs of GIS professionals. *www.itt.com*

ISRO gets 40% more funds

India's space research programme recently got a significant 40% boost from the union budget for 2009-10. The bulk of the funds will be used in ongoing projects like development of the GSLV Mark III. *www.domain-b.com*

Chandrayaan-1 develops fault

India's first moon mission Chandrayaan-I has lost a major sensor. According to ISRO Spokesperson S Satish the mission is not crippled adding, "it is continuing satisfactorily." ISRO has devised innovative technology and is using antenna pointing mechanism and gyroscopes to overcome the problem.*http://timesofindia.indiatimes.com*

WorldView-2 to launch on October 6

DigitalGlobe WorldView-2 high-resolution 8-band multi-spectral satellite is scheduled to launch on October 6th, 2009. It is expected to nearly double DigitalGlobe's collection capabilities to approximately 2million sqkms per day. *http://media.digitalglobe.com*

CRPF to expedite satellite project

The Central Reserve Police Force (CRPF) in India will soon approach the ISRO to expedite the ongoing project of high-resolution satellite imaging and video mapping of dense forest areas, used by Naxalites and Jihadis as hideouts. Since lack of knowledge of the topography has been the biggest hurdle for security personnel, CRPF had contacted ISRO to provide such maps which would help it carry out its operations with precision *www.timesofindia.indiatimes.com*

Spot 2 Comes Down

On 30th June, Spot Image in Toulouse began de-orbiting its venerable Spot 2 Earth observation satellite, which has been in operation 14 years longer than its design life of 5 years. Meanwhile, Spot 4 and Spot 5, continue to actively collect data. Spot 6 and Spot 7 are currently under development. *www.spot.com*

Topographic maps of Indian coalfields

The Central Mine Planning and Design Institute (CMPDI), an arm of the Coal India Limited, signed an MoU with the Survey of India (SOI) for preparation of the large scale updated topographical maps of 28 major coalfields of the country, based on remote sensing technique. The 5 years project has a budget of Rs 117 crore. *http://economictimes.indiatimes.com*

Vietnam to receive satellite images

The Ministry of Natural Resources and Environment (MNRE) recently opened Vietnam's first ground station to receive satellite pictures in Hanoi's Tu Liem District. It can receive five kinds of satellite images with high resolution, including those transmitted by Envisat. *www.thanhniennews.com*

RazakSAT launches successfully

RazakSAT, Malaysia's second remote sensing satellite was launched from Kwajalein Atoll in the Pacific Ocean's Marshall Islands. RazakSAT carries a high resolution camera that can take images from space for different applications to benefit not only Malaysia, but countries along the equatorial region. The orbital location will enable an increased frequency of image observation. The satellite will be operated through its ground segment in Malaysia, consisting of a Mission Control Station (MCS) and Image Receiving and Processing Station (IRPS). *www.mosti.gov.my*

Singapore's CRISP receives GeoEye

The Centre for Remote Imaging, Sensing and Processing (CRSIP) at the National University of Singapore has begun downloading images from the GeoEye satellite under the terms of an agreement signed last year. First reception occurred in May. *www.crisp.nus.edu.sg*

Ordnance Survey works with GRACE

GRACE – the GNSS Research and Applications Centre of Excellence – has recently worked with Great Britain's national mapping agency, Ordnance Survey. A team from GRACE carried out data collection at various sites to test potential new GNSS survey equipment. *www.grace.ac.uk*

Leica CloudWorx™ 1.0 for SmartPlant

Leica CloudWorx™ 1.0 for SmartPlant 3D was recently released by Leica. It is designed for Intergraph SmartPlant 3D users who want to take full advantage of accurate, laser scan as-built data directly in SmartPlant 3D.

Leica has also released the QuickSteer motor - a new retrofit option for farmers who want to add auto-steer functionality to their older tractors. It can be added to a wide range of agricultural vehicles that do not have factory-installed steering kits. *www.leica-geosystems.com*

Hemisphere & Juniper jointly offer DGPS Receiver

Juniper Systems and Hemisphere GPS offer the XF101 DGPS receivers for the Archer Field PC, designed to deliver sub-meter DGPS to location-based applications. The XF101 provides: Crescent GPS technology for sub-meter accuracy; COAST technology to maintain accuracy during temporary loss of differential signal; optional external antenna for centimetre-level accuracy; real-time or post-processed DGPS data collection, etc. It fully supports mobile GIS applications such as ESRI ArcPad and OnPoz GNSS Driver. *www.hemispheregps.com*

GPSDifferential for ArcPad 8

Magellan Professional introduced GPS Differential for ESRI ArcPad 8 which enables the MobileMapper 6 handheld receiver users to achieve sub-meter accuracy for GIS data collection and mapping at low cost. The software extension automatically logs the raw data even where real-time corrections are not available. *http://promagellangps.com*

Multi-GNSS test system by Spirent

Spirent Communications has launched the Spirent GSS6700 Multi-GNSS Constellation Simulator for GNSS testing. It offers not only GPS test capability but also support for GLONASS and Galileo systems. It is available with a range of software capabilities designed to suit differing test requirements. *www.spirent.com*

Sailing teams choose u-blox and Velocitek

u-blox LEA GPS receiver module now powers Velocitek's SC-1 speed compass, used onboard the boats in the Melges 24 and Viper 640 sport boat classes. It provides the critical heading, speed and position data, velocity made good (VMG), and tactical compass readouts in the SC-1. *www.u-blox.com*

Chronos CTL3500 GPS Interference Monitor

Chronos Technologys CTL3500 Interference Monitor is a low cost device designed to detect the presence of too much GPS power or non GPS signals and interference broadcasting on the L1 channel. It uses low noise signal amplification with precision SAW filters and logarithmic detection. These techniques check for unwanted signals within the centre of the GPS L1 band no matter what the waveform or modulation scheme may be. *www.chronos.co.uk*

Microsoft and ESRI launch Fusion Core Solution

Microsoft Corp. and ESRI launched Fusion Core Solution, a public safety and homeland security solution architecture. It was designed for more effectively prevent today's evolving physical and virtual security threats. It also strengthens the ability of government agencies to prepare, assess, and respond to natural disasters. *www.esri.com*

SuperGIS Mobile Engine 3 releases

SuperGeo released SuperGIS Mobile Engine 3, a Software Development Kit (SDK) based on .NET Compact Framework. It enables developers to effortlessly develop the lightweight mobile GIS programs with basic GIS functions or the powerful mobile GIS applications. *www.supergeotek.com*

Trimble creates Geospatial Division

Geo-3D, RolleiMetric, TopoSys, and INPHO have merged to create Trimble's GeoSpatial Division to provide sensors, systems, solutions, and professional services to the global geospatial industry. Trimble's GeoSpatial business delivers solutions in 3 key areas: Photogrammetry and LIDAR; Roads, Highways and Rail; Utilities and Energy for Transmission & Distribution. *www.trimble.com*

Topocad open source database connection released

Chaos systems AB released Topocad 11.3, a new and open source database connection. It uses the open source FDO from Open Source GEO, which has been adapted to Topocad. *www.chaos.se*

Telogis releases GeoBase 3.0

Telogis has released its mapping engine, GeoBase 3.0, which supports real-time navigation for commercial vehicles on both laptops and mobile operating systems and enables organisations to develop customised dispatching and navigation solutions. *www.telogis.com*

Accuracy Analyst™ Software

Accuracy Analyst™ by Information Solutions, Inc is a software solution to

determine locational accuracy of the image data used to produce maps. It saves 80% of the time needed for traditional accuracy assessment. *www.spatialis.com*

DeLorme enters digital map market

DeLorme entered into the worldwide digital map data market, making its US and World digital base maps available for use within third-party GIS and OEM applications. It offers two core digital topographic map data sets: DeLorme World Base Map at 1:250,000 scale, and DeLorme North America Data Sets. *www.delorme.com*

Safe Software raster ETL capabilities

Safe Software introduced support for Bathymetric Attributed Grid (BAG), enhancing their raster ETL offerings. FME enables translation and conversion of data between BAG and over 225 other formats supported by FME. www.safe.com

SWConnector version 2.0 released

Spatial Business Systems has released SWConnector v2.0, an application programming interface that supports interoperability between General Electric's Smallworld GIS and CAD, field mobility, enterprise resource planning applications as well as other GIS products. *www.spatialbiz.com*

ProximiTREE launched

Bluesky launched a new digital map layer accurately modelling the location and extent of trees and their proximity to buildings. It details the exact spatial location and height of individual trees together with the circumference of its canopy. It is derived from the most accurate and up to date aerial photography. *www.bluesky-world.com*

Gearworks launches etrace 7.1

Gearworks released the etrace 7.1, an enhanced version of its wireless and Web-based mobile workforce management solution that enables enterprises to supervise and optimize their personnel and activities in the field. etrace taps the GPS capabilities of wireless mobile devices for the same. *www.gearworks.com*

Geographic Imager 2.5 for Adobe Photoshop announced

Avenza Systems Inc. releases geographic Imager 2.5. It is the latest version of this software that adds geospatial functionality to Adobe Photoshop. *www.avenza.com*

AGI Releases 3D Software Component

Analytical Graphics, Inc. (AGI) has release Insight3D - a .NET control that lets developers add 3D visualization to their aerospace and GIS applications with ease. It supports terrain, imagery, 3D models, satellite orbits, aircraft routes and more. Objects can be animated and also interacted with through picking and flexible camera control. *www.agi.com*

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http://twitter.com/BaskaGNSS2009

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www.digitalearth-isde.org

INTERGEO 2009
22-24 September
Karlsruhe, Germany
www.intergeo.de

ION GNSS 2009
22-25 September
Savannah, Georgia, USA
www.ion.org

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6 October
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www.navigationevent.com

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www.loran.org

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http://www.aars-acrs.org/acrs

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19-22 October
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www.fig.net/vietnam/

18th UNRCC-AP
26-30 October
Bangkok, Thailand

13th IAIN World Congress
27-30 October
Stockholm, Sweden
www.congrex.com/nnf/iain2009/

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gnssws@gnss.or.kr
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NAV09
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Positioning & Location: 12 November, Nottingham
Land: 19 November, Teddington
Timing: 20 November, Teddington
Air: 25 November, London
www.rin.org.uk/news-events/events

WALIS International Forum 2009
11-13 November
Perth Convention Exhibition Centre, Australia
www.walis.wa.gov.au

24th International Cartographic Conference
15-21 November
Santiago, Chile
www.icc2009.cl

ISPRS (Geospatial Data Cyber Infrastructure)
25-27, November 2009
Hyderabad, India
www.incois.gov.in/isprs

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www.ignss.org

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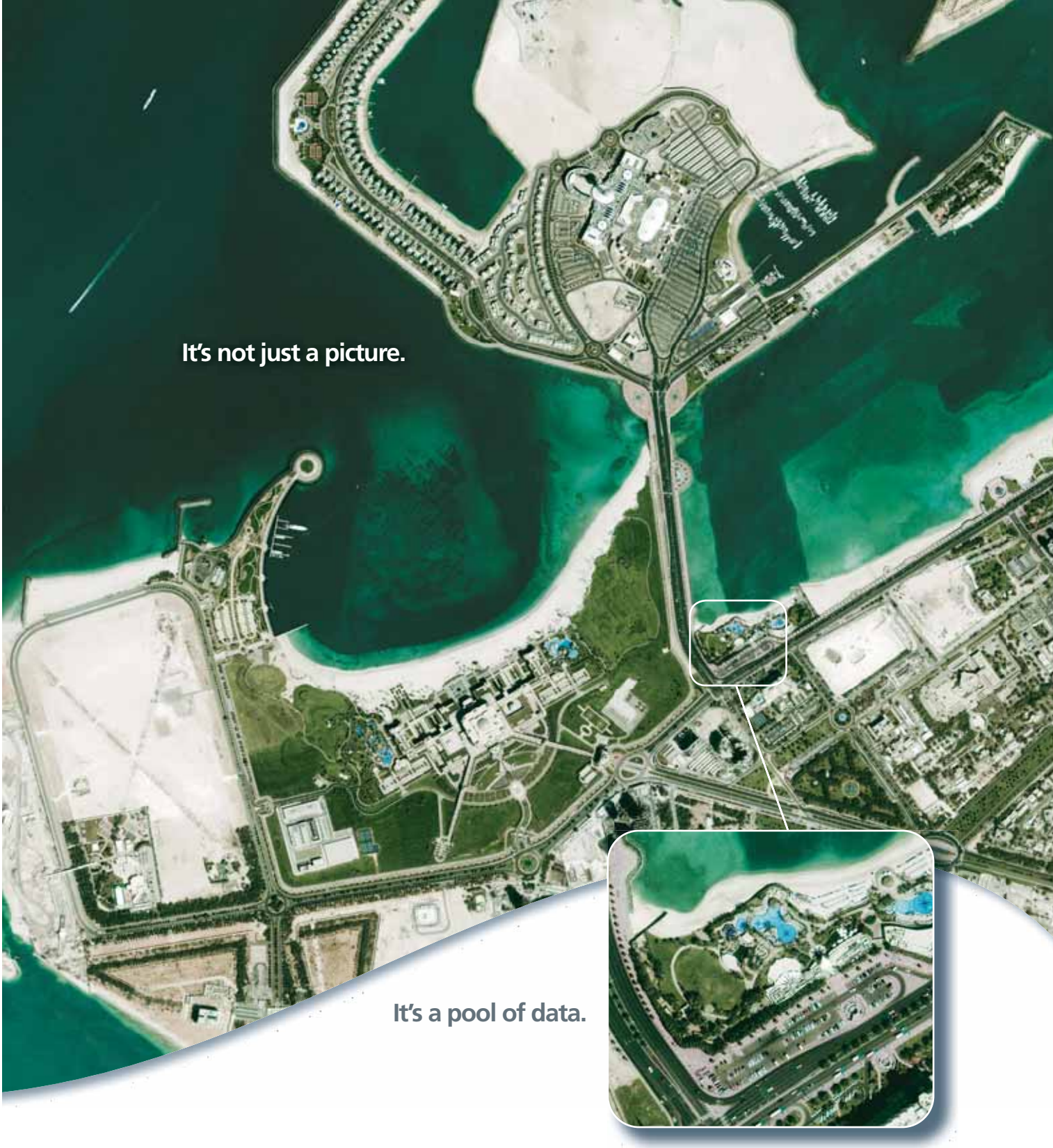

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