RNI: DELENG/2005/15153
Publication: 15th of every month
Posting: 19th/20th of every month at NDPSO

No: DL(E)-01/5079/08-10
Licensed to post without pre-payment U(E) 28/2008-10
Rs.100

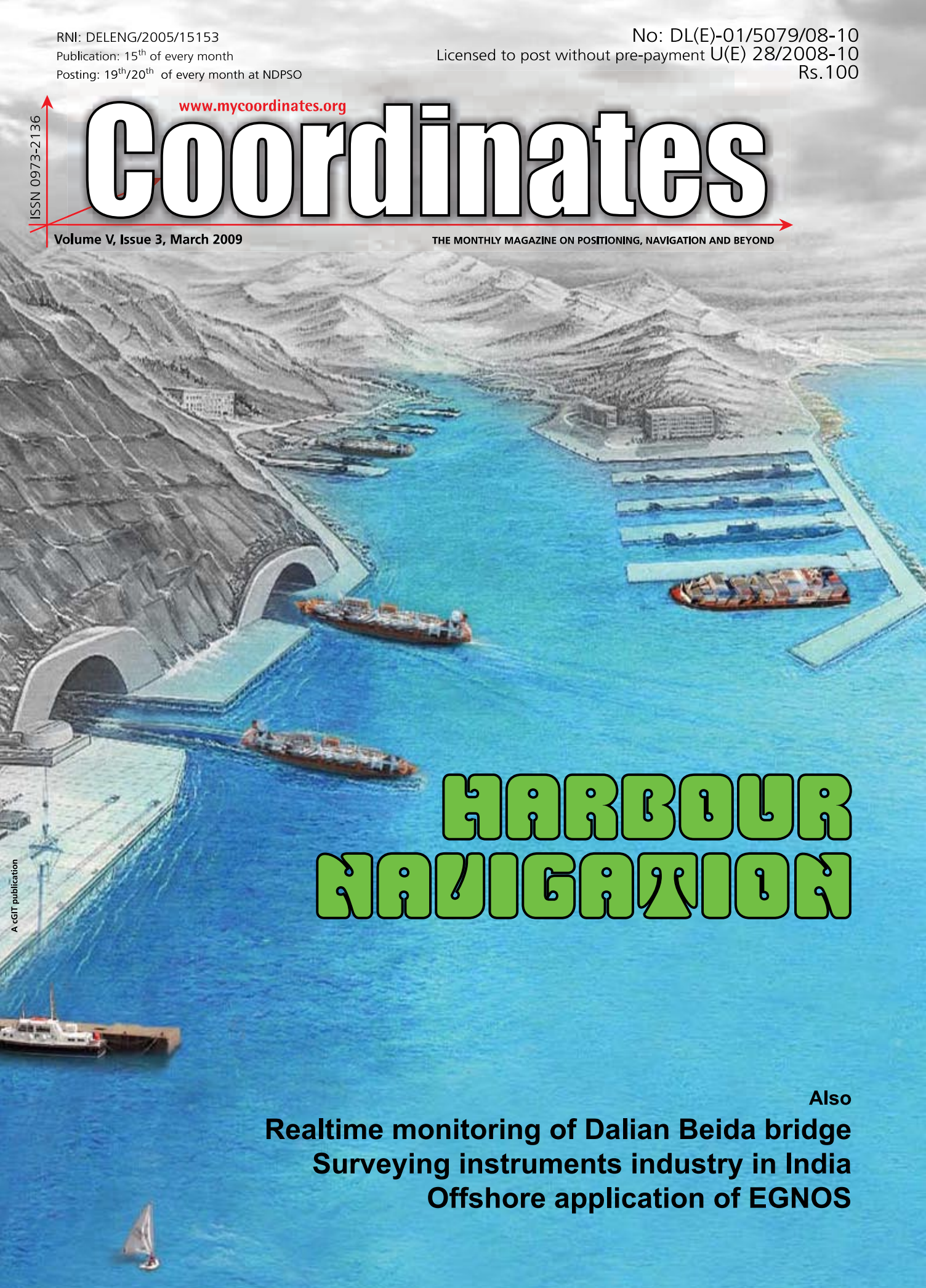
ISSN 0973-2136

www.mycoordinates.org

Coordinates

Volume V, Issue 3, March 2009

THE MONTHLY MAGAZINE ON POSITIONING, NAVIGATION AND BEYOND



HARBOUR NAVIGATION

A cGIT publication

Also

Realtime monitoring of Dalian Beida bridge
Surveying instruments industry in India
Offshore application of EGNOS

SANDING Optic-electric Instrument Co. Ltd. is one of the leading manufacturers for surveying equipment in China. Its products include total station, electronic theodolite, electronic distance meter, autolevel, self-leveling crossline laser, prism, surveying accessories, etc. With its outstanding manufacturing technology, Sanding now is sparing no efforts in establishing global sales network and maintenance centers.

Distributors wanted

If you have any interest, please don't hesitate to contact us. Our latest general catalogues and price lists are available for your kind reference.

PD-38,FREE!
ONCE A NEW CUSTOMER MAKES HIS FIRST ORDER, HE CAN GET ONE PD38 FOR FREE.
This activity will last until PD-38 is cleaned up!

SANDING

SANDING OPTIC-ELECTRIC INSTRUMENT CO., LTD.
(Indian Office)
Add: FA-229B, Mansarover Garden New Delhi, India
Tel: +91-11-64563666
Mob:9999999255 9818797768 Fax: +91-11-45530854
Email: 2008@sanding.com.cn
www.sandinginstrument.com

GO WHERE GPS HAS NEVER GONE BEFORE.

IMPROVEYOURGPS.COM

In this issue

Coordinates Volume 5, Issue 3, March 2009

Articles

Columns

This issue has been made possible by the support and good wishes of the following individuals and companies Charles S Dixon, Jason Hamilton, Steve Leighton, Wang Jun, Wei Erhu, Yi Xiaodong and Datem, Hemisphere GPS, Sanding, Magellan, NovAtel, NRSA, Spirent, Javad, Leica, South,; and many others

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

Email
[information]talktous@mycoordinates.org
[editorial]bal@mycoordinates.org
[advertising]sam@mycoordinates.org
[subscriptions]iwant@mycoordinates.org

Web www.mycoordinates.org

Annual subscription (12 issues) [India] Rs.1,200
[Overseas] US$80

Printed and published by Sanjay Malaviya on behalf of Centre for Geoinformation Technologies at A221 Mangal Apartments, Vasundhara Enclave, Delhi 110096, India.

Editor Bal Krishna

Owner Centre for Geoinformation Technologies

Designed at Thomson Press India Ltd.

Printer Thomson Press India Ltd., B 315, Okhla Phase I, New Delhi-110020, India

This issue of Coordinates is of 44 pages, including cover

Polluted space

On Feb 10, 2009 two communication satellites collided in space.

It happened over Northern Siberia, 490 miles above the earth surface.

The low-earth orbit (LEO) location of the collision contains many other active satellites.

They could be at risk from the resulting orbital debris.

With increasing number of satellites being launched into the space, such incidents may be unavoidable in future.

There are no doubts about the benefits of satellite technology for mankind.

Be it for communication, earth observation or even strategic.

Still, the disadvantages of such mishaps would be enormous.

When human intelligence is still fumbling in dealing with pollution on earth.

A space with satellite debris is, definitely, a scary proposition.

Bal Krishna, Editor
bal@mycoordinates.org

Harbour navigation

This paper focuses on the potential for a Harbour Navigation System to augment GPS for harbour operations

Charles S Dixon
Head of Future Programmes Navigation at EADS Astrium, Portsmouth, United Kingdom
chaz.dixon@astrium.eads.net

Certain emerging navigation performance requirements for maritime applications are challenging to satisfy using systems available today. Very stringent performance requirements have, in particular, been identified for port areas, and cover aspects including service robustness, accuracy, integrity and availability.

One promising answer may be to augment GPS coverage with a ground-based Harbour Navigation System. In the Spring of 2008 EADS Astrium demonstrated a prototype for such a System, using transmitters based on navigation Pseudolite technology.

This paper focuses on the potential for a Harbour Navigation System to augment GPS for harbour operations. The paper was derived from several recent publications [1-4] by the same author and colleagues from Astrium's Portsmouth offices.

Emerging maritime user requirements

Certain emerging navigation performance requirements are considered beyond the capabilities of GPS to support.

Identified applications in port areas (for example automated docking) have very stringent performance requirements as shown in Table 1. The figures are based on an analysis conducted in Project MARUSE [5] , and are compatible with figures from the International Maritime Organisation (IMO).

GPS performance today is suitable for the Oceanic Navigation Phase; for the other Phases, however, GPS cannot reliably meet requirements for accuracy or integrity. In addition, the demanded availability and continuity are impossible to meet using GPS alone in Port areas unless user vessels have a continuously clear sky view. In many Ports, various objects including high buildings, gantry and other cranes, and bridges, may obstruct the sky view for user vessels, potentially blocking GPS satellite signal reception and causing a navigation coverage outage.

Harbour Navigation System

HNS concept

The Harbour Navigation System (HNS)

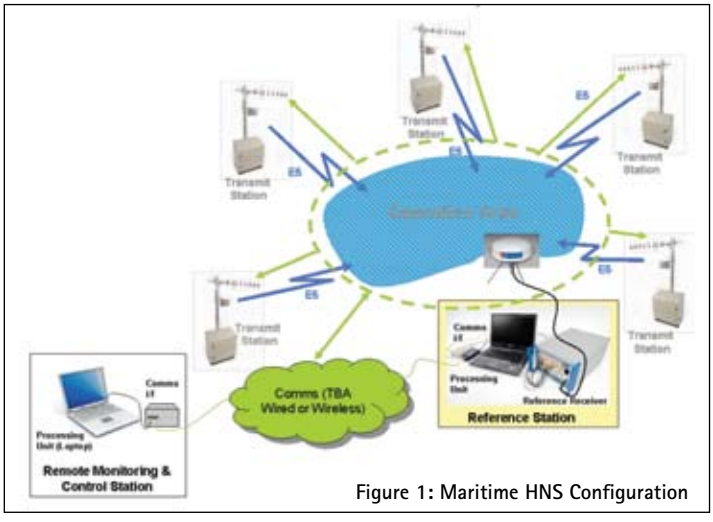


Figure 1: Maritime HNS Configuration

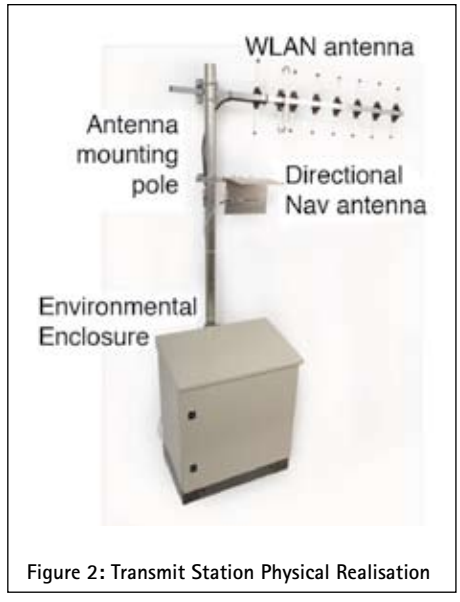


Figure 2: Transmit Station Physical Realisation

concept created by Astrium is for a Navigation System compatible with, but independent from, the GPS System. Users are able to navigation using HNS alone, GPS alone, or a combination of the two systems together.

EADS Astrium recently developed and demonstrated the use of an HNS. This included:

- A number of Transmit Stations mounted at accurately known locations overlooking the operation / demonstration zone. These transmit GNSS-like signals, typically pulsed to minimise any interference.
- A single Monitoring & Control Station with line of sight visibility of each Transmit Station.

In Figure 1 the configuration of the HNS is illustrated. This includes several synchronised Transmit Stations, a Reference Station, a Monitor and Control Station, and the wireless network interconnecting them (although wired interconnect may be equally valid for fixed installations).

A navigation solution can be obtained at a user receiver from a mixture of GPS and HNS signals. In addition to any on-vessel equipment, the HNS has its own GNSS receiver to provide references to the M&C facility. These receivers used conventional GPS L1 transmissions as well as the HNS transmissions to maximise system robustness.

	Navigation Phase		
	Ocean	**Coastal**	**Port**
Accuracy	H: 10 m V: N/A	H: 1 m V: 1 m	H: 0.1 m V: 0.1 m
Availability	99.8%	99.8%	99.8%
Continuity	99.97%	N/A	99.97%
Integrity	Yes	Yes	Yes

Table 1: Example Maritime Application Requirements (extract from [5])

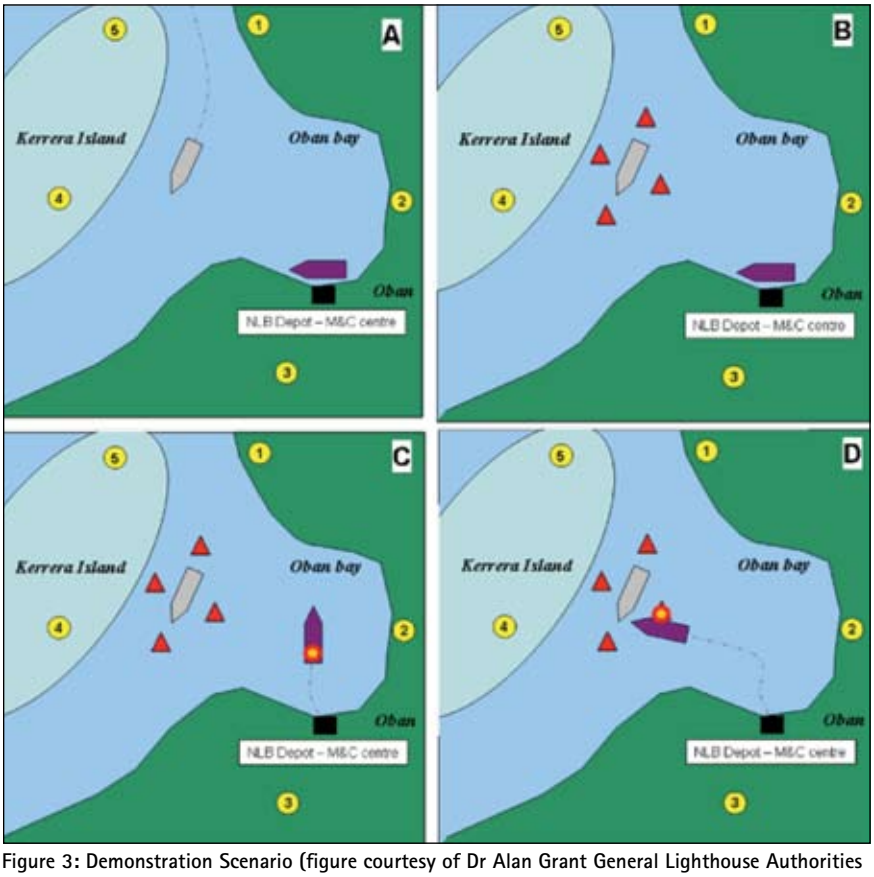


Figure 3: Demonstration Scenario (figure courtesy of Dr Alan Grant General Lighthouse Authorities of the United Kingdom and Ireland)

HNS benefits

The HNS can bring a number of benefits to Harbour Operations. These include the following:

- The HNS is a locally controlled and fully independent Navigation System.
- The HNS is scalable to larger or smaller coverage area. Transmitter powers can be increased or decreased to change the coverage provided. The HNS is also scalable to add more Transmitters if wanted, for example to provide a shaped coverage.
- The HNS is fully interoperable with GPS, but HNS operation permits local navigation if GPS were unavailable or suffered some problem.
- The primary usage model is based on a combined GPS / HNS Receiver on Ships or Pilot Portable Units. RF parts of the receiver are identical, as are signal processing parts, and items such as the display. New software is, however, needed to process the HNS measurements. Hence the cost impact on User Equipment is minimal. Operationally it is foreseen that users will use GPS anywhere, and will then switch to combined GPS & HNS in harbour areas.
- The HNS facilitates robustness to interference and to GPS "Black Holes". Power Control can increase signal levels; in addition, the HNS can operate on different frequencies if user equipment is configured to support this. In terms of GPS "Black Holes" (regions where local obstructions cause problems with GPS reception), the HNS mitigates the problem by placing Transmitters close to where there are GPS problems
- There is also potential to extend HNS capabilities by relaying GPS differential corrections and/or RTK and/or Integrity data over the HNS

transmissions using spare capacity in the transmission channel.

Transmit stations

The Transmit Stations are a variation of navigation pseudolite technology. They are compact and self-contained, and produce GNSS satellite-like transmissions at a source level that is preset and generally maintained constant. Transmitters are generally synchronised in groups to work together as a single, coherent system. The design places few restrictions on the location of their deployment, ensuring that planners have the freedom to create optimal signal environments for maritime or other sector applications.

Monitor and control station

The Monitoring & Control (M&C) Station coordinates the operation of Transmit Stations so that they form a coherent navigation system. At the heart of the M&C Station is a processing element with the ability to accept and process data from a GNSS Reference Receiver. The data received includes measurements of Pseudorange, Carrier Phase, Doppler, C/No and lock time; data such as raw Navigation symbols and tracking & receiver status.

The M&C also generates commands for dissemination to each Transmit Station, for passing of navigation parameters and miscellaneous data. Linked with this is the mechanism for accepting and processing acknowledgements and other health & status data from each of the transmit stations received via the communications link.

Reference station

Core to the Reference station was a Septentrio GeneRx Receiver, capable of tracking GPS satellites as well as transmissions from the pseudolites. Its main function are to measure Pseudoranges from the transmit stations, to collect the transmitted Navigation Data, to time-stamp this data and to relay it to the M&C Station.

Communications link

A Communications Link interconnects the M&C Station with each of the Transmit Stations at their remote locations. For the prototype equipment, X8200 Radio Modems were used. Serial data can be transmitted with baud rates from 1.2K to 115.2K over distances of 10km to 20km line of sight, and can operate in both license-exempt and licensed bands. Antennas used are 10dB Yagi at the Transmit Stations and 0dB omnidirectional antenna at the M&C Station. For an operational system this link type may be appropriate, or may be replaced by a domain-specific or fixed-line link.

HNS signals

The Signals transmitted for the Oban demonstrations were based on Galileo transmissions. In the HNS, there will of course be no ionosphere between the Transmit Stations and the Receivers; it is therefore of limited value to use multiple transmission frequencies.

The transmissions used were identical in terms of frequency and modulation to Galileo transmissions [6]. They comprise two pairs of I&Q components referred to as E5A and E5B, which are AltBOC modulated onto an RF carrier centred at 1191.795 MHz.. The navigation message content was adapted to cope with the Transmitters being stationary.

Oban demonstrations

Demonstration overview

Tests and live demonstrations took place in Oban on the West coast of Scotland, in March 2008. Observers from around Europe saw NLV Pharos undertake a variety of precision manoeuvres in the bay. These included placement of a wreck-marking buoy. Crucial to the success of the demonstration were a number of new systems developed under the MARUSE project, including innovative onboard dynamic positioning technologies and an array of EADS Astrium pseudolites which mimicked Galileo satellite signals. The pseudolites were placed in various locations around Oban Bay, enabling the vessel to use Galileo-like signals for the first time to navigate in British waters.

Participants watched the NLV Pharos in real time via closed-circuit television as it manoeuvred. The demonstration was hosted by the Research and Radionavigation Directorate of the General Lighthouse Authorities of the UK and Northern Ireland (GLAs), which include the Northern Lighthouse Board, the Commissioners' of Irish Lights and Trinity House.

Demonstration scenario

The public demonstration was based on the concept of action taken to deal with a vessel blocking a busy waterway. It

Figure 4: NLV Pharos deploying a wreck marker buoy during Oban Demonstration (photo: Dr CS Dixon, EADS Astrium)

SPIRENT

Spirent Communications
44 1803 546325
globalsales@spirent.com
www.spirent.com/positioning

Can anyone offer more choice?

Spirent offers, test solutions for GPS, GLONASS, Galileo, SBAS and now Quasi-Zenith capabilities—another world's first from Spirent.

For the first time, developers of QZSS receivers, systems and applications have a solution that provides accurate, repeatable testing.

Spirent simply offers more
If you are involved in GNSS applications, contact us today to learn how Spirent simulators can save you time and money.

Stay up-to-date with the latest GNSS news; sign up for our monthly newsletter at www.spirent.com/go/satellitenews

GSS8000 now supports QZSS signals

World leader in GNSS test and simulation systems

used a combination of HNS pseudolites, GPS and Virtual Aids to Navigation (making use of AIS and Electronic chart displays). The demonstration also used NLV Pharos vessel to undertake the physical demonstrations within Oban bay. The scenario for the demonstration is illustrated in Figure 3 and described below:

- A simulation of a vessel entering the Oban waterway (using AIS to show its position) is shown on an ECDIS electronic chart display.
- (Diagram A) The simulated vessel suffers a failure causing it to remain in the waterway as an obstruction.
- (Diagram B) The position of this vessel is marked by the GLAs using the virtual AtoN and its position is broadcast via AIS to all nearby vessels.
- (Diagrams C and D) The NLV Pharos is deployed to physically mark the vessel with a Buoy, over the same location as that provided by the Virtual AtoN, using the enhanced positioning from the EADS Astrium Pseudolites.

Results

For the Demonstrations, code-tracking accuracy was recorded as approximately 2 metres or better. There were measurement and other difficulties; however, subsequent analyses have shown that this accuracy can be reliably achieved. In an operational system, it would be possible to operate using this code-tracking method, or instead to track the carrier signal. Carrier tracking methods have been widely employed in high-precision GNSS applications for some time and yield higher accuracy but lower robustness than code-tracking methods. In separate experiments, EADS Astrium Transmit Station signals have been carrier-tracked with accuracies around 15cm. This was not done for the Oban Demonstrations, but is indicative of what could be achieved if wanted in an operational system.

Conclusions and future work

A Harbour Navigation System was created by EADS Astrium and was successfully demonstrated with several partner companies as part of GSA Project MARUSE. The demonstrations reported here were undertaken in Oban on the West Coast of Scotland in spring 2008 as part of Project MARUSE. This used Pseudolite Transmission Stations and M&C Station equipment developed by EADS Astrium and described in this article, Receivers from Septentrio, User Terminals from Kongsberg Seatex, and Vessels from the Northern Lighthouse Board.HNA equipment comprising Pseudolite-based Transmit Stations and M&C Station Equipment have been added to the EADS Astrium product range. Future work includes confirming market applicability for various domains and commercialisation of the equipment. Future adaptations of the Equipment for other domains are foreseen. This may include Emergency Management, Rail, Road, and Security-related domains.

References

[1] Dixon, C.S.: A Maritime Harbour Navigation System based on Pseudolite Transmitters. International Symposium Information on Ships ISIS 2008, September 2008, Hamburg, Germany

[2] Dixon, CS and RG Morrison; Demonstration of a Galileo-Based Maritime Navigation System: First Demonstration Results. ENC GNSS 2008 Toulouse, France, April 2008.

[3] Dixon, CS and RG Morrison; A Pseudolite-Based Maritime Navigation System: Concept through to Demonstration. Journal of Global Positioning Systems; Volume 7, No.1, 2008.

[4] Dixon, CS, M Bolt, A Helliwell, P Lau Semedo, RG Morrison, M Parks, A Whittaker, M Williams; Demonstration of a Galileo Based Maritime Navigation System RIN NAV 07 London, UK, October 2007

[5] Grant, AJ, N Ward, SE Christiansen, CS Dixon, A Suskind; MARUSE Demonstrating the use of Maritime Galileo Pseudolites. ION GNSS 2007 Conference, 25-28 September, 2007. Fort Worth, TX, USA

[6] Galileo Open Service Signal-In-Space Interface Control Document. GAL OS ICD/D.0 Issued 2006 Draft 0

Acknowledgements

Some of the work presented here was drawn from other publications, acknowledged above. The author thanks the European GNSS Supervisory Authority (GSA) for their financial support to project MARUSE; it is largely upon the developments from that project that this paper is based.

The views and opinions expressed throughout are those of the author, and as such do not necessarily represent those of GSA.

Particular thanks are due to Mr. Russell Morrison and the Team at EADS Astrium in Portsmouth who developed and demonstrated the HNS. Support and encouragement from Managements at EADS Astrium is acknowledged.

In addition, thanks are due to partners from MARUSE, including Stig Erik Christiansen of Kongsberg Seatex AS, Dr Alan Grant of Trinity House Lighthouse Service, Alain Suskind and Axel Van Den Burg of Septentrio.

The author acknowledges generous support of individuals and organisations that helped with, and hosted, pseudolite equipment around Oban. Particular thanks are due to many members of the NLB, to Mrs Aileen Miller, to the very Reverend Donald Mackay and to Argyll & Bute Council.

"We have the ability to tie the IMU and GNSS measurement data together"

An interview with Mr Jason Hamilton Product Manager, SPAN group and Waypoint Products Group, NovAtel on SPAN technology and its advantages

Jason Hamilton
NovAtel Inc.

"NovAtel's SPAN technology supplements GPS, opening doors for various applications requiring precise positioning". Please explain.

NovAtel has long been known for precision GPS and GLONASS technology. NovAtel's GNSS line-up stretches from single frequency GPS-only functionality all the way up to dual-frequency, GPS/GLONASS, RTK and L-band capable receivers.

All GNSS systems have the same limitation; to solve a solution they require reception of a very weak signal from a satellite orbiting 20,000km above us. In situations when the satellite signals are blocked by things like buildings or heavy foliage, the GNSS solution can become unreliable.

When precise positioning is required in GNSS-obstructed environments, GNSS needs to be augmented in some way. One option is to pair the GNSS with an inertial measurement unit (IMU) to form a GNSS-INS system. This is what NovAtel does in our Synchronized Position Attitude and Navigation (SPAN) product.

IMUs come in many shapes, sizes and grades. The base components of an IMU are gyroscopes that measure rotation and accelerometers that measure acceleration. Integrating rotation and acceleration over time gives a very stable relative position, velocity and attitude. In SPAN, NovAtel's OEMV receiver is paired with one of a range of IMUs from various suppliers and of differing grades to enable our customers to operate in nearly any environment.

The one thing that immediately stands out about SPAN technology is its capability even when GNSS reception is restricted. Please explain how?

When the two navigation technologies, GNSS and INS are brought together, they each bring their individual strengths into the product. GNSS provides accurate position and velocity when at least 4 satellites are in view. However, when not in view, the GNSS solution degrades almost immediately. The INS provides the attitude of the vehicle, roll, pitch and heading, and stable relative position over time without requiring external inputs. However, when the IMU navigates on its own, errors from the gyros and accelerometers accumulate over time and introduce errors in the solution.

When GNSS signals are present, SPAN uses the GNSS data to calibrate the error sources from the IMU. When the GNSS signals become unreliable or completely obstructed, SPAN uses the calibrated INS to bridge through the gap and maintain an accurate position, velocity and attitude solution.

How does this technology deliver 'faster' GNSS signal reacquisition?

Because NovAtel's core technology is precision GNSS, we have the ability to tie the IMU and GNSS measurement

data together at a very low level in SPAN. By doing this we can optimize the strengths of both the GNSS and the IMU. Two good examples of how SPAN takes advantage of this architecture are:

GNSS Carrier Phase Observations: SPAN utilizes the accurate carrier phase observations from our OEMV serial receivers directly in the GNSS/INS solution. The benefit of using the measurements instead of just the GNSS position solution is that the mm-accurate observations can be used even when there are not enough satellites in view to compute a full GNSS position solution. This result is an improvement in position solution accuracy of up to 50% in difficult GNSS conditions.

GNSS Tracking Loop Aiding: Because the GNSS/INS SPAN solution is generated right on the receiver, SPAN has direct access to the GNSS tracking loops. We can use the inertial data to help the tracking loops find the satellites faster when the vehicle moves out from under an obstruction. Satellite reacquisition time is reduced to under 2 seconds. This means that in very difficult satellites tracking situations, like urban canyons, the receiver can track all available GNSS signals which in turn provide the best calibration possible of IMU error sources.

What applications do you think can benefit most from the SPAN technology?

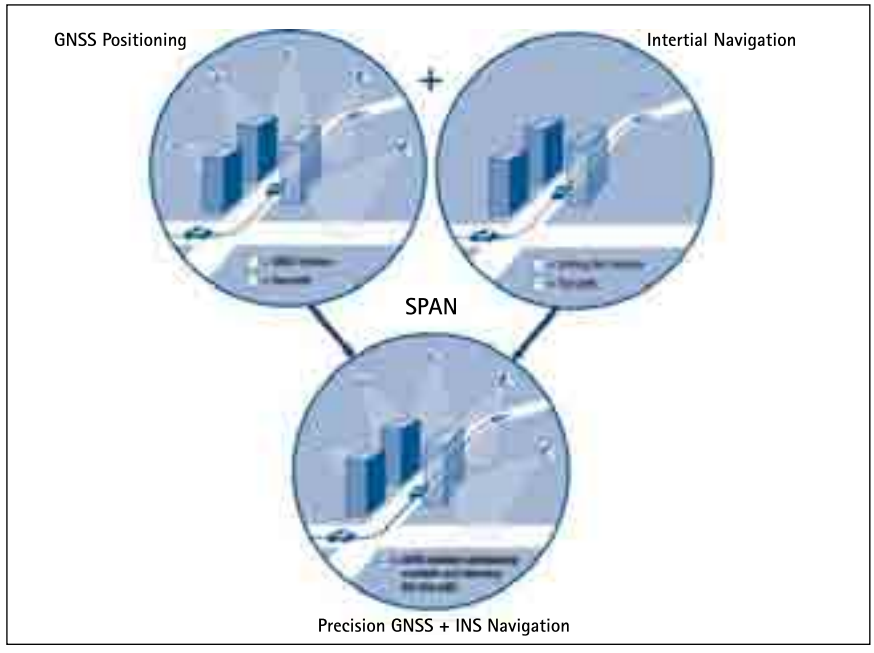
There are a wide range of applications for SPAN. The application areas break down into two groups: those that require the attitude of their vehicle and those that require robust positioning in difficult GNSS conditions.

An application that SPAN is particularly well adapted to is ground-based mapping and imagery collection. The deeply-coupled architecture of SPAN enables users to get a robust solution in even the most built-up of areas. The optimal use of all GNSS observation data and IMU measurements results in precise positioning and attitude determination in locations where GNSS typically gives erratic results.

Further to these traditional GPS/INS markets, SPAN has been used very successfully for television broadcast enhancements, for autonomous airborne refuelling, and in many other innovative, unique market applications.

What is the role of the 'Inertial Explorer' software?

NovAtel's post-processing software package is called Inertial Explorer.



Built upon the GNSS post-processing package, GrafNav/GrafNet, Inertial Explorer offers many features that are only possible in post-mission. Inertial Explorer takes in GNSS and IMU observation data collected by SPAN in real-time and uses may of the same techniques as SPAN to compute an optimal position, velocity and attitude solution.

In post-processing, the constraints of real-time operation are eliminated, so the software can process the data forwards and reverse in time and also combine and smooth forwards and reverse solutions to greatly reduce the errors associated with the IMU sensors and limited GNSS availability. Applications that do not require a real-time solution can improve their final solution greatly by using Inertial Explorer features like AdVance RTK GNSS carrier phase positioning and base-station free Precise Point Positioning using downloadable precision satellite clock and orbit information.

How cost effective is the technology to implement?

SPAN technology is available in a range of configurations. There are several IMU options to choose from depending on your accuracy requirements, budget and geographical location. The deeply coupled architecture of SPAN and Inertial Explorer provides performance levels that have typically required much more costly systems. The optimal combination of the GNSS and IMU data in SPAN enable lower grade IMU options to perform almost identically to higher-grade IMU systems.

The latest addition to the SPAN line-up is the SPAN-CPT, which combines NovAtel's OEMV technology with fiber-optic gyros and MEMS accelerometers in one housing. Export headaches sometimes experienced with inertial technology are alleviated with SPAN-CPT as the system is comprised entirely of commercial components.

iMagiNation

image to information for nation building

foot prints from Space

Payload: Cartosat-1 PAN
Resolution: 2.5 m
Swath: 27 km
Revisit: 5 days

for enquiries, please contact

NRSC Data Centre

National Remote Sensing Centre
Indian Space Research Organisation
Dept of Space, Govt. of India
Balanagar, Hyderabad - 500 625

इसरो isro

nrsc

Phone: +91(40)2388 4422, 4423, 4425
Fax: +91(40)2387 8158, 8664
Email: sales@nrsa.gov.in
Website: http://www.nrsa.gov.in

Real time monitoring of Dalian Beida Bridge

With the GPS receiver, it is easy to monitor the bridge of three dimensional dynamic deformation in real-time

Wang Jun
Associate professor, School of Civil Engineering, Qingdao Technical University, Qingdao, Shandong, China

YI Xiaodong
Associate professor, School of Civil and Hydraulic Engineering, Dalian University of Technology, Dalian, Liaoning, China

Wei Erhu
PhD,Professor, School of Geodesy and Geomatics,Wuhan University, Louyu Road, Wuhan, china

There are many traditional surveying methods used for the large-scale bridge structure deformation monitor such as the accelerometer measure, the total station surveying and the laser collimation, but these methods are limited by its function of which the continuity, timeliness and automaticity can not meet the need of the large-scale construction dynamic monitor. In recent years, with the GPS hardware and software technology developed, especially the GPS receiver with the high data-collection frequency (for example 10Hz even 20Hz[1][4]) appearanced as well as the GPS data processing was improvement, the GPS-RTK technology applied in large-scale bridge dynamic deformition monitor with real-time or quasi-realtime has become true[2][3]. Further, with the Fourier transformation tool the bridge base frequency could be obtained, the data of bridge vibrational state in spatial frame and frequency range distributed characteristic may provide the key to understand whether the bridge structure is health under the load drive environment. Structure health monitor flowchart [7] is shown in fig 1.

Testing plan and process

Installment of GPS sensor antana

In the bridge structure health examination, the sensor type, quantity and the structure testing position will guarantee the monitor effective implementation. Unsuitable sensor disposition would affect the precision of recognition parameter, one good sensor disposition plan aims to achieve: (1) If testing is in the noise environment, entirety and accuracy structure parameter should be acquired with as few sensors as possible; (2) Correlationship should be able to establish between the obtained testing modality and the model analysis result; (3) The interested modalities data could be gather through adding sensors with reasonable means; (4) The time interval testing record should be most sensitive to the modality parameter change.

Beida bridge is a suspension bridge with large-scale. Because the bridge is symmetrical, only half bridge were used to carry on the testing point arrangement.

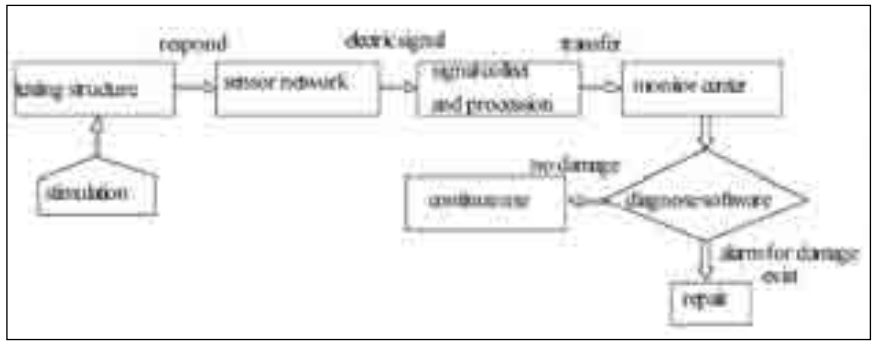


Fig 1 Health monitor flowchart

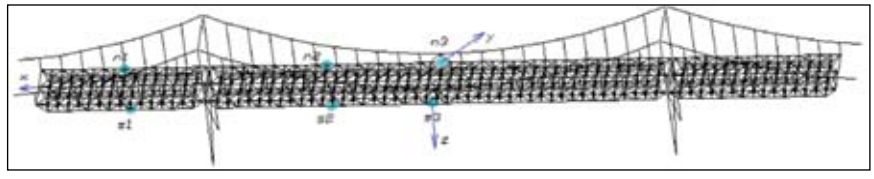


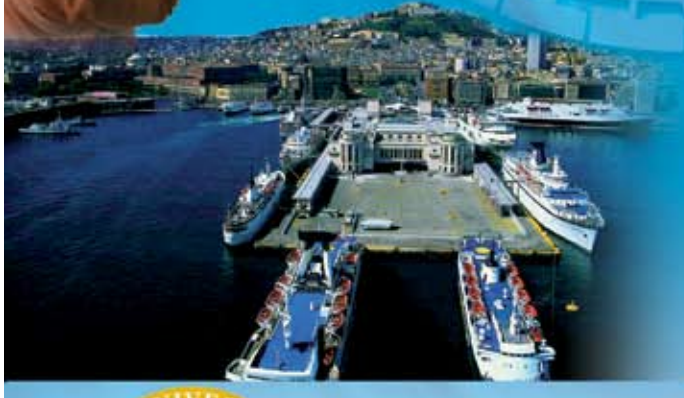
Fig 2 monitor points distribution

ENC-GNSS 2009

European Navigation Conference
Global Navigation Satellite Systems

May 3-6, 2009
Naples (Italy)

www.enc-gnss09.it



Istituto Italiano di Navigazione
Via Cremona, 15/B – 00161 Roma
Tel. +39064404202 – Fax +390644231351 – e-mail info@istnav.it
sito web http://www.istitutoitalianonavigazione.org

According to finite element modality analysis result, the measuring points had been arranged at six sites including the 1/2 scale, the mid-scale, the 1/4 scale along two sides of the bridge and with the names of s1, s2, s3, n1, n2, and n3, the measuring points distribution and the bridge testing coordinate frame are shown in Fig 2:

Testing process with GPS-RTK

The entire test had been implemented by TRIMBLE-5700 of the dual-frequency GPS receiver, S0, the GPS base station, located in spacious place nearby the bridge as seen in Fig 3 (a) where the error of multipath effect should be weaken, and rover station placed at s1, s2, s3, n1, n2, n3 separately, its main error source is the receiver system noise. The GPS receiver data sampling frequency was set 10HZ during testing process and data gathering time in each testing point will sustain more than 1h.

Spatial distribution of dynamic deformation for bridge structure

Generally, with the external force (such as typhoon, earthquake and heavey-load car), the large-scale bridge vibration takes on simple harmonics nature, and its amplitude and frequency are changed too when the external force are changed, therefore, two kind of situations exists in the bridge dynamic deformation characteristic distribution .

The vibration of large-scale bridge satisfies the simple harmonic motion equation, but its amplitude and frequency has a sudden change during bridge amplitudes (or vibrates).The simple harmonic motion equation is:

$$y = A \sin(2\pi ft + \varphi o) \quad (1)$$

Where, A is an amplitude; f is a frequency; y is the deformation quantity; φ0 is the beginning phase; t is the time.

2)The vibration frequency of large-scale bridge maintains invariable, but the amplitude becomes the exponential decay. The equation is:

$$y = A\, e^{-\alpha(t-\tau)} \sin(2\pi f(t-\tau)) \quad (2)$$

Where, α is the coefficient of attenuation; τ is the initial time; Other variables meaning is as same as Eq (1).

In order to obtain Beida bridge vibration characteristic, through the long time interval GPS dynamic monitored in each testing point, the massive monitor data have been acquired with their coordinates(N, E) in WGS-84 reference frame. For the convenience of data processing and comparison, using the coordinate transformation equation with three parameters(Eq 3.), changed these monitor data of (N, E) into testing coordinates system of (X, Y) .

$$\begin{cases} X = X_O + (N-N_0)\cos\theta + (E-E_0)\sin\theta \\ Y = Y_0 + (N-N_0)\sin\theta + (E-E_0)\cos\theta \end{cases} \quad (3)$$

Because along the direction of x and y axial, bridge vibration are smaller than that of z axial, therefore the structure vibration time interval curve obtained through computation is along the z axis. With abscissa axisis x of time (s) and axis Z of ordinatesis amplitude (m), Fig 4 shows the structure vibration time interval chart of the bridge at first 4 testing points.

Testing point spectral analysis based on FFT

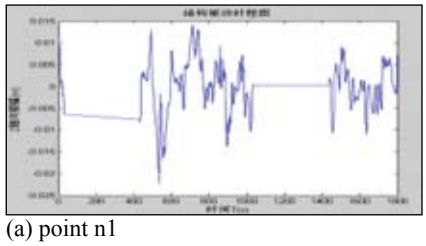
Bridge vibration frequency resolving in the condition of motivation context

Based on the motivation context, bridge vibration signal is not all the pure sine

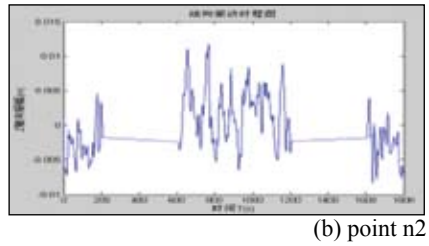
Fig 3 GPS device using in testing

form[5]. According to the Fourier analysis, vibrating signal could be decomposed into many harmonic components. Each harmonic component may be expressed by its amplitude and phase.

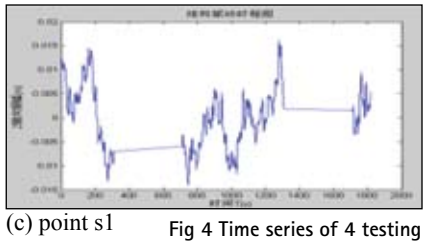
Supposed there is a dynamic deformation observation system, recording deformation value is x1 at t1 time, and x2 at t2 …, . xn at the tn time, these observed data constitute group of discrete time series which can be writed as {xt} (t=1, 2 …n).If the frequency fs (s=1, 2 .....k) of every harmonics in this group of time series is known, then they can be simulated with Fourier expansive formula (4):



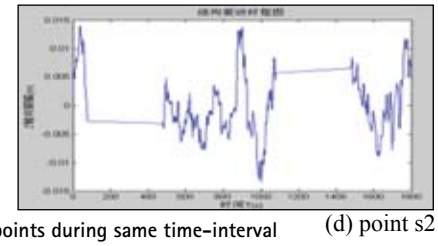
(a) point n1



(b) point n2



(c) point s1



(d) point s2

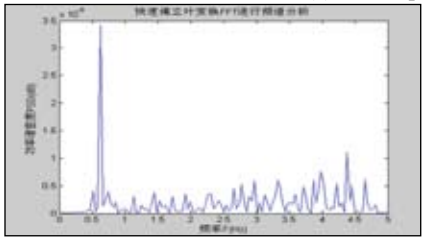
Fig 4 Time series of 4 testing points during same time-interval

$$x_i = a_o + \sum_{i=1}^{k} (a_s \cos 2\pi f_s t_i + b_s \cos 2\pi f_s t_i) \quad (4)$$

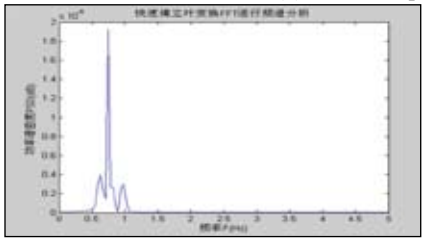
Actually, based on the time series, the bridge vibrates frequency of fs in various steps harmonics could be decides by spectral analysis which are supported by measured waveform or the data come from discrete processing. Formula (5) is the discrete form of Fourier transform.

$$X(k) = \sum_{n=0}^{n-1} x(n) W_N^{nk} \quad (5)$$

(a) first step



(b) second step



(c) third step

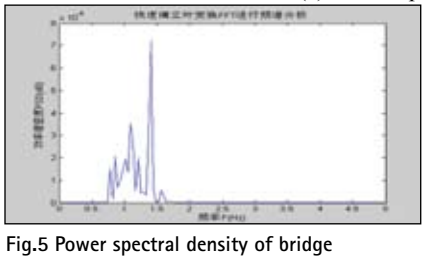
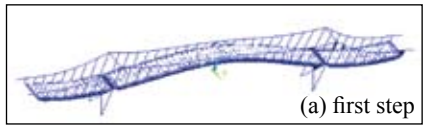


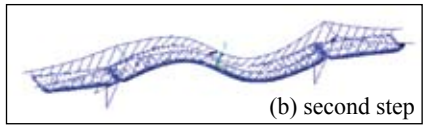
Fig.5 Power spectral density of bridge

Step	A GPS survey	B Ansys resolve	C Bias ratio ρ %	D Accelerometer Measurement	E Bias ratio ρ %
1	0.634	0.619	2.36	0.681	7.41
2	0.762	0.702	7.87	0.882	15.75*
3	1.402	1.418	1.14	1.480	5.56

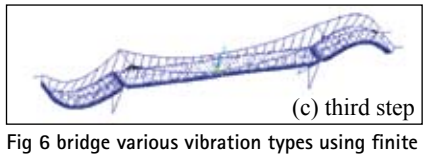
Tab.1 Comparison of vibration frequencies between GPS solution and other methods



(a) first step



(b) second step



(c) third step

Fig 6 bridge various vibration types using finite element method

In Eq (5) $W_N = e^{-j2\pi/N}$, x(n) and X(k) are the series of time order vibration and frequency response respectively at the testing point, k=0, 1, 2, …, n-1

In order to guarantee the operation speed, the fast discrete Fourier transform or FFT was introduced in computation, usually FFT algorithm has two method including the time extraction FFT and the frequency extraction FFT. The former makes the time domain signal into even-odd sequence, the latter makes the frequency range signal into even-odd

sequence. All of them take advantage of two characteristic of W_N^{nk}, one is the periodicity or $W_N^{kn} = W_N^{k(n+N)} = W_N^{(k+N)n}$, another is symmetry or $W_N^{k(N+n)} = (W_N^{kn})^*$,

Where signal * means W is conjugate.

This paper chose the former method.

Because the GPS signal noise source in testing point is multipath primarily, and the multipath signal frequency is lower than the bridge natural frequency. In order to compare the finite element modality analysis result, with the Matlab signal processing toolbox, a 9 steps Butterworth bandpass filter has been designed. Firstly, the filter for the structure vibration time interval curve has been carried out, then with the filtered signal the spectral analysis has been carried on by using the fast Fournier transformation (FFT), thus the structure frequency would be obtained. The result of the ANSYS finite element modality analysis and dynamic demonstration show that the bridge vibrates under the calm condition is primarily along the direction of vertical bridge floor, using fast Fournier transformation (FFT), the bridge self-oscillation along the vertical bridge floor direction has been obtained, because more number the vibration mode steps is, more difficult they can occur, the first three steps have been merely set in computation. Using Matlab signal processing, the first three steps power spectrogram.of the bridge are seen in fig 5.

Where cross direction express the frequency (Hz) vertical direction express the PSD (dB).

Validity checking of GPS dynamic surveying technique

Deterministic model method based on finite element

Because the testing bridge has complete structural design material, in order to understand the feasibility of using the GPS dynamic surveying technique to get the bridge multistage vibration frequency. A deterministic model has been established to resolve the bridge vibration frequency caused by load with the finite element method. The software of finite element computation is Ansys.

The first three step vibration mode graph of Beida bridge using the Ansys finite element resolving are shown in fig 6.

Accelerometer measurement method

In the same point and same time, Accelerometer with the type of 891, which was produced by State Bureau of Seismology Engineering mechanics Research institute, had been set to obtain bridge vibration frequency, and the data processing software adopted Donghua data collection and processing system.

Table 1 shows the comparing result of first three steps frequency in Beida bridge test among the Ansys finite element analysis method, the accelerometer method and GPS-RTK surveying method.

In table 1, the bias ratio refers to the deviation ratio between the GPS actual frequency compared to the frequency obtained from other two methods, and the computation follow equation (6).

$$\rho_{c(e)} = abs\ (B\ (orD) - A)/A \qquad (6).$$

It is shown from table 1 that the vibration mode deviation of bridge first three steps in same place is very small when comparing between the GPS surveying result and the accelerometer measurement as well as the result of using the Ansys finite element resolving. Every step data matchs well among them except the second step frequency value acquired by accelerometer is bigger. It is also known from the bridge testing that the accelerometer has been used in structure vibration test for its advantage of light weight, small volume and no affecting to testing system, but this method could make bigger measuring error than other's and the deformation result is not direct-viewing too, when the structure oscillation is slow, it could not measure the structure of whole vibration amplitude.

Conclusion

The vibration mode measured by GPS sensor receiver and accelerometer coincide with the result of using the finite element method, it indicates that the overall rigidity of the testing bridge structure conforms to the actual requirement

From the view of testing analysis flow, the GPS-RTK method has the characteristic of simple operation, nimble and convenient; with the GPS receiver, it is easy to monitor the bridge of three dimensional dynamic deformation in real-time as well as first step bridge vibration mode frequency or higher step one which can provide the datum data directly for the bridge use, maintenance and condition evaluation.

Reference:

[1] J.J.Guo, L.J.Dai, Y.C.Lu, Study of the Humen bridge GPS(RTK) real-time displacement monitors Bulletin of Surveying and Mapping, 2000.12:4-5.

[2] Leroy E. monitor on longest hanging bridge in the world with GPS real-time, Bulletin of Surveying and Mapping, 1996, 6:46-48.

[3]G.X.Zhu, X.D.Chen, Y.J.Wang. Application in Humen bridge operation safe monitor using GPS-RTK Technology, ROAD, 2002, 7:55-58.

[4] H.N.Li, T.H.Yi, X.D.Yi.Real-time monitor and data-analysisof long-span bridge base on total station and GPS technology, Disaster prevention disaster reduction project journal, 2005, 25(1):8-13.

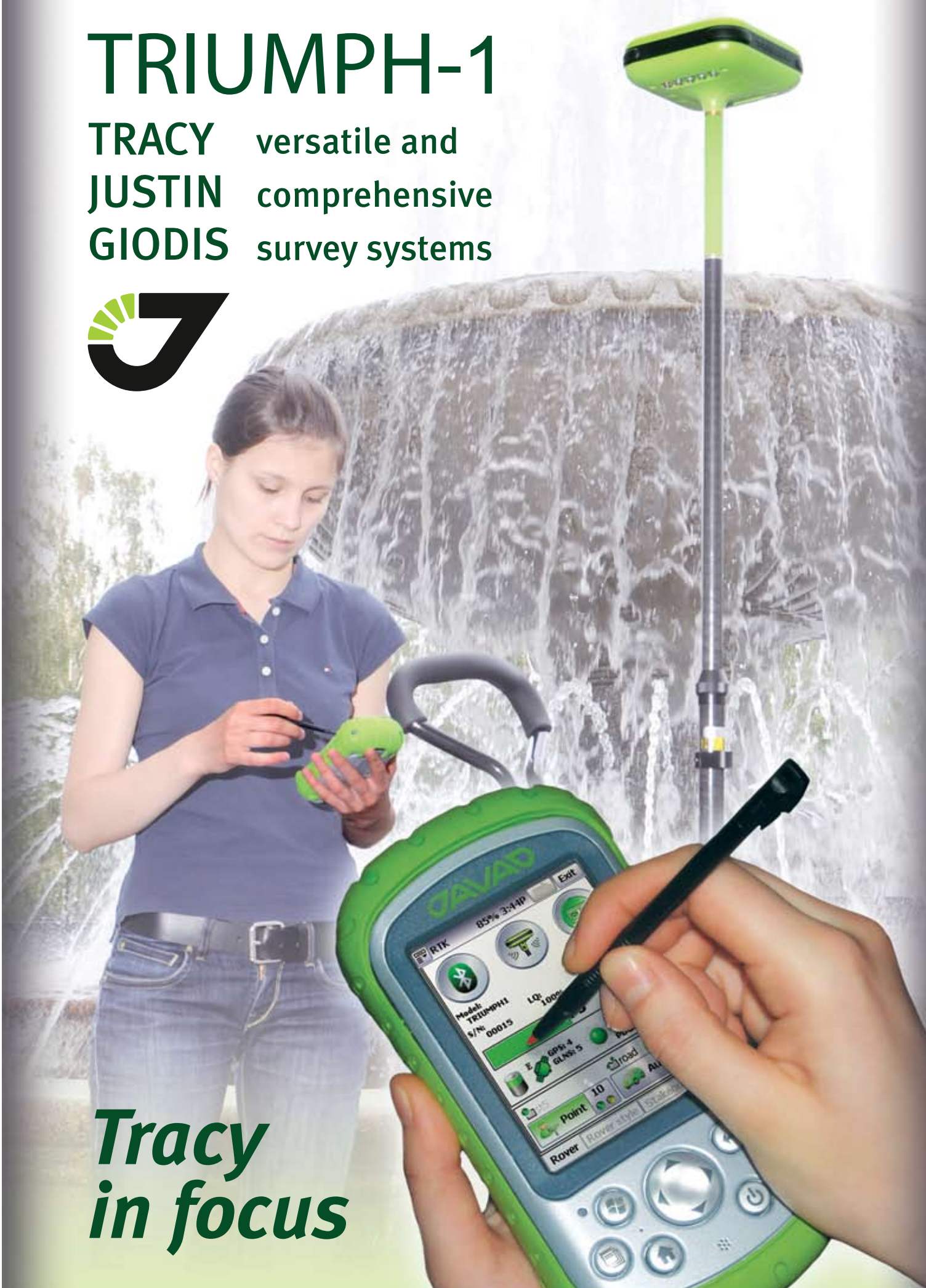
[5] H.N.Li, T.H.Yi, G.X.Wang. GPS used in structure health monitor research and application progress. Natural disaster journal, 2004, 13(6): 122-130.

[6] H.N.Li, T.H.Yi, X.D.Yi. On GPS Observation Errors with ANC Principles and Wavelet Denoise Method [J]. Wuhan University journal (information science version), 2006, 11, 995-998.

[7] H.Li, W.S.Zhou, J.P.Ou. Study of Large-scale bridge structure intelligence health monitor system integration. Civil engineering journal, 2006, 39(2), 46-52.

TRIUMPH-1

TRACY versatile and
JUSTIN comprehensive
GIODIS survey systems



Tracy in focus

Better than 30 cm GIS... instantly or 5 cm static

Actual size

GISmore stand-alone or inside the hat

Bluetooth wireless connection to GISmore

- GPS L1
- Galileo E1
- GLONASS L1
- 100 Hz update rate
- 100 Hz update rate
- RAIM
- WAAS/EGNOS
- Rechargeable Li-Ion Battery
- GNSS Antenna
- GSM Module
- Bluetooth® Interface
- Bluetooth/GSM Antenna

Many ways to use

Tracy – as easy as 1-2-3

1 CONNECT - 2 CONFIGURE - 3 SURVEY

- All complex GNSS survey with Tracy by just 3 buttons on one screen
- Constantly monitor all hard-ware status – green color means ok, red indicates on a problem

CONSTANT MONITORING
ALL SURVEY INFORMATION

1 Connection
2 Power
3 Radio
4 RTK Corrections
5 Position
6 Satellites
7 Memory

A comprehensive field software

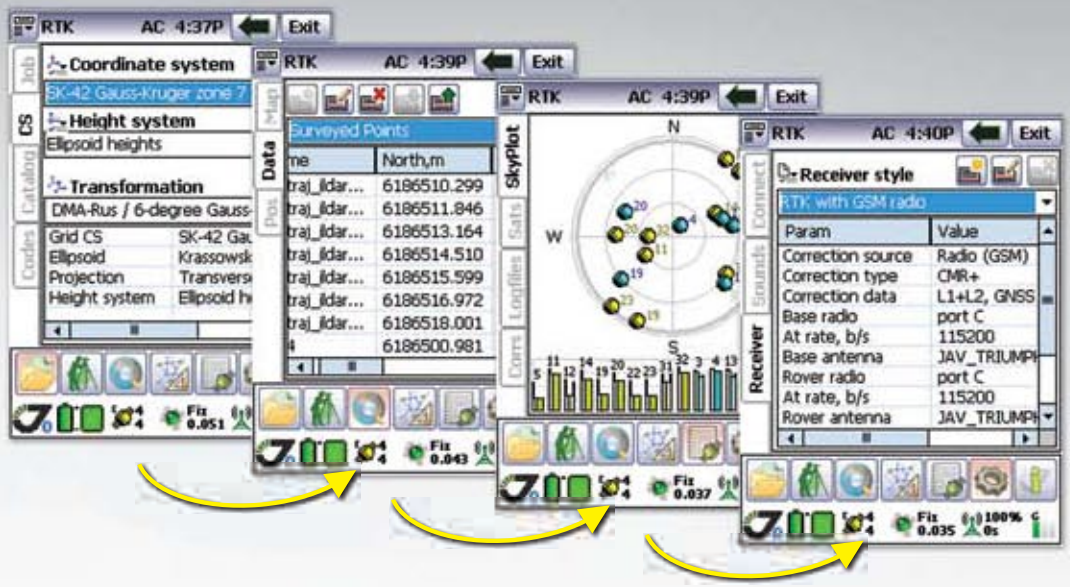
Two modes:

- **Lite**

  for novice user and main survey works

- **Extended**

  for complex tasks and configurations



Instantly switch from one window to any other by just one or two click due to tabs and pages window organization

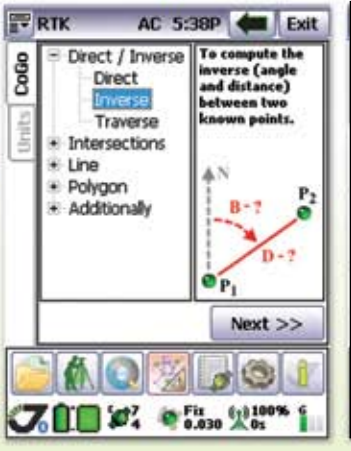
Suitable for all kinds of work

Feature codes and data acquisition with attributes

All main surveying task – point survey, trajectory survey, stakeout, data acquisition etc

- **Data acquisition with feature codes**
- **National and local coordinate system and geoid support**
  Horizontal and vertical localizations
- **Increased productivity and reliability**
- **Built in COGO routines**

Wide set of coordinate system including local and user defined. Ability to use global, regional and user defined (with Tracy Tools) geoids



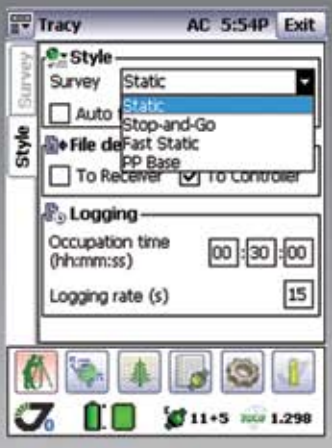
Set of CoGo (Coordinate Geometry) tasks

Full internationalization, including on-screen keyboard

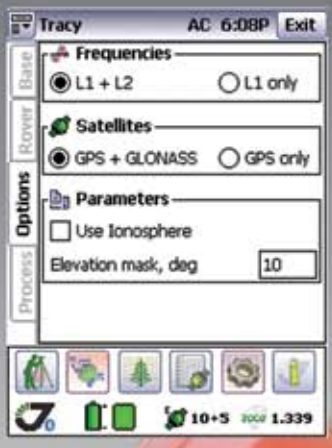
Special modules for special tasks

PPK module

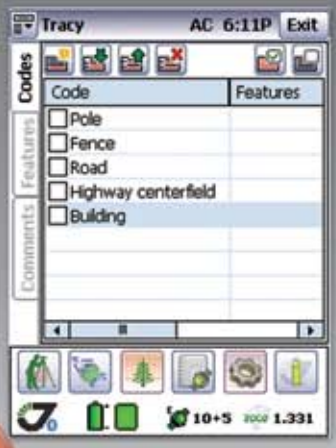
Data Collection for Post-Processing



Static, Fast Static and Stop&Go surveying



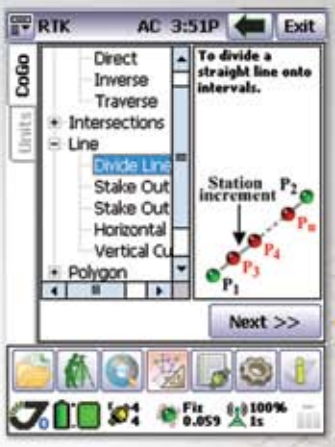
In-field data analysis



Data acquisition in post-processing survey with attributes

Tracy

RTK (Real Time Kinematics) survey and stakeout



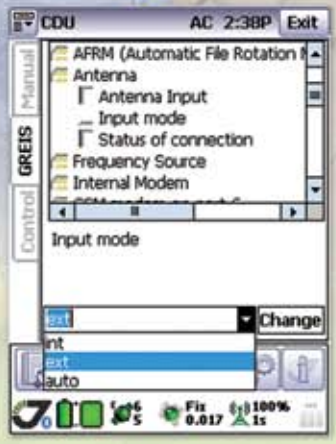
Support for survey and stakeout projects

CDU module

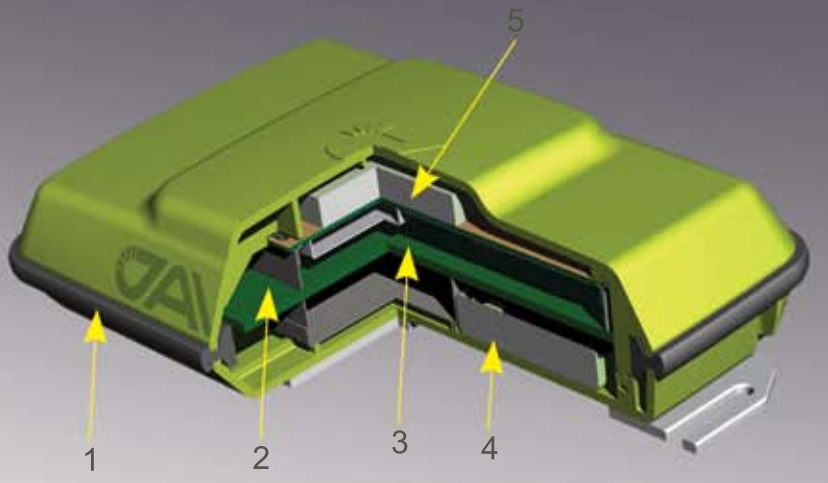
Control Device Unit

Advanced configuration and trouble-shooting directly in field

Configuration of all hardware, including internal UHF/ GSM/GPRS radios, Bluetooth module, WiFi module, etc



Full control of receiver with GREIS commands in terminal or by settings



1. Guard Bumper
2. Bluetooth/GSM Antenna
3. GNSS Receiver, Power Board, GSM/Bluetooth and Memory
4. Rechargeable li-Ion Battery
5. GNSS Antenna Connectors

GISmore receiver is based on our TRIUMPH Technology implemented in our TRIUMPH Chip. For the first time in the GNSS history we offer very powerful GIS field mapping receiver with up to 100 Hz RTK, 216 channels of single frequency GPS, Gallileo and GLONASS in a small attractive, sturdy, and watertight box.

Using its internal Bluetooth® and GSM/GPRS connection the receiver can access local GNSS Reference Station Network. As standard future the GISmore receiver provides access to the SBAS correction services. In addition to post-processed DGPS capabilities, the GISmore utilizes external correction services for real-time DGPS mapping and navigation applications.

Victor

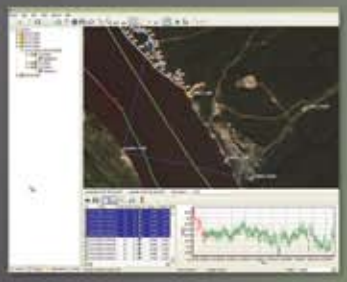
Victor is pre-loaded with our Tracy field software. When turned on, Victor automatically connects to GISmore, TRIUMPH-1 or TRIUMPH-4X via its internal Bluetooth and guides you through field operations. It manages the GNSS receiver and modem operations automatically.

- **Lightweight (17 ounces; 482 grams)**
  magnesium case with easy-to-grip over-molding
- **Operating temperature**
  -22°F to 122°F (-30°C to 50°C)
- **Connectivity via built in Bluetooth, USB Host and Client, plus 9-pin RS-232 and optional WiFi and Modems**
- **Rechargeable, field replaceable, Li-Ion battery**
  It operates for more than 20 hours on one charge (3 to 5 hours of charging time)

Software

• Justin

A comprehensive Survey and GIS software



• Tracy

A versatile and powerful field software

• Giodis

Full-featured office post-processing software

JAVAD

WWW.JAVAD.COM

In the line of sight

A perspective of surveying equipment industry in India

Shubhra Kingdang
shubhra@mycoordinates.org

Contrary to the gloomy economic picture painted by the financial pundits at the end of 2008, the reactions to the global economic slowdown are mixed in the survey equipment industry in India. The growth in the survey industry has been fuelled by the spate of infrastructure projects in the country and may well ride out the economic slowdown wave without feeling the pinch much feel the players in the industry.

What will really happen in the coming months remains to be seen, but we do have a picture of the current scenario of the digital survey equipment industry in India. One could have as many views as the number of people one speaks to and we did indeed speak to a wide section of players in the industry to get the entire spectrum of views. The discussions and interactions with the dealers and users focussed on getting a deeper perspective about mindsets rather than just gather data.

The growing industry

Across the board everybody agreed that the digital equipment business has been growing, especially in the last few years. Dealers said they have been selling more instruments, and business has been good. Many have moved completely from dealing in conventional instruments to now dealing only in digital equipments. Several new players have entered the market and competition is also growing.

Users said they have been buying more instruments to meet the demand of increased projects. Most projects now are time bound and have delay clauses, and with the use of these equipments users have been able to adequately address the survey needs of their projects. Also, acceptance and use of this technology is seen not only in large projects but also small ones.

The government and private sector both seem to be contributing to this growth. Dealers said they sell equally to both sectors and users said they undertake projects for both. But, considering that a large number of government projects are further sub-contracted to private organisations, it could just be that the government sector is ultimately driving the growth in the industry.

When users were asked about the application areas where they work, 'infrastructure' was the most ubiquitous area including projects related to road construction and railway alignments. Another offshoot of the infrastructure projects was the heavy machinery alignment using digital survey equipment.

Additional application areas included projects in irrigation and command area development; forestry; environment, urban development; land records and cadastral mapping; mining; police; hydrography; various topographic surveys; education and others.

Country wide spread

It thus emerged that there are now a growing number of application areas where digital survey equipments like Total stations, GPS, levels and Distometers are being used. The presence of dealers and users of the equipment even in small obscure towns of the country indicate the percolation to the technology to the ground level so to say.

The distributors and big dealers are no doubt based in the metros, but many now have regional offices and or representation in terms of sub-dealers at the regional level. This spreading network speaks volumes for the support structure that is being slowly created and will ultimately benefit the industry as a whole.

As of today, the smaller town dealers do face issues about access to service centres, product information flow from distributors, and availability of spare parts; but hopefully as the networks improve these issues will also be addressed.

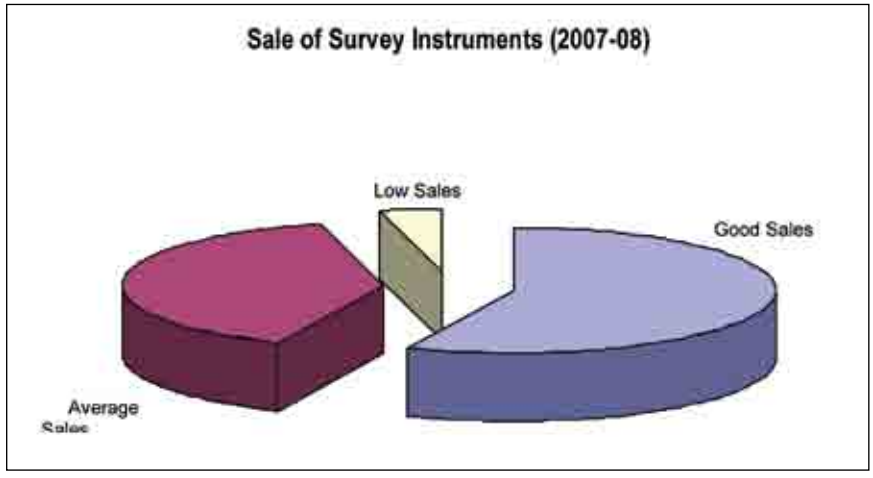
Therefore an interesting factor that emerged during the discussions is that though they are based in a particular city, the region of operation of both dealers and users seems to be spread well beyond that city. Many users also said they have teams who can undertake projects across the country.

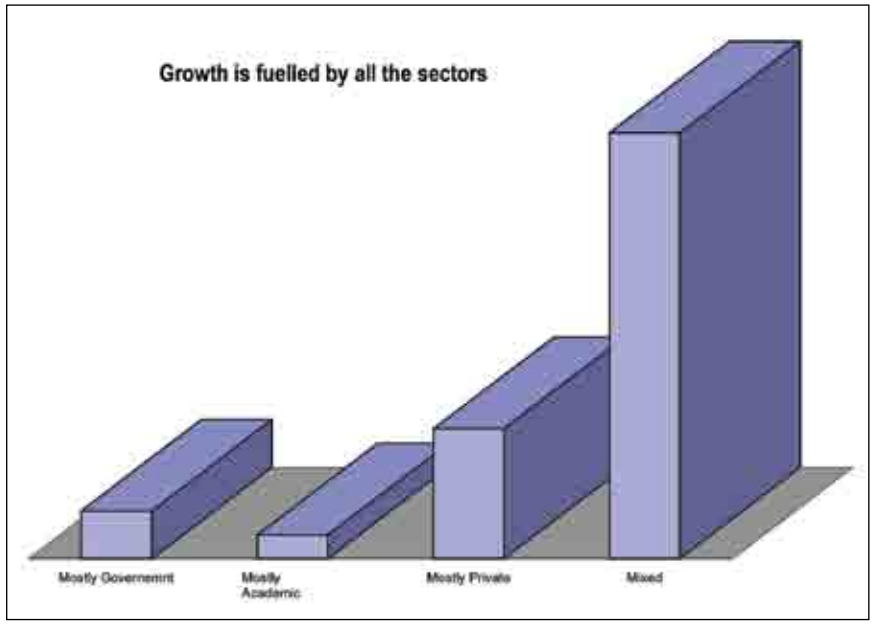
The growing awareness

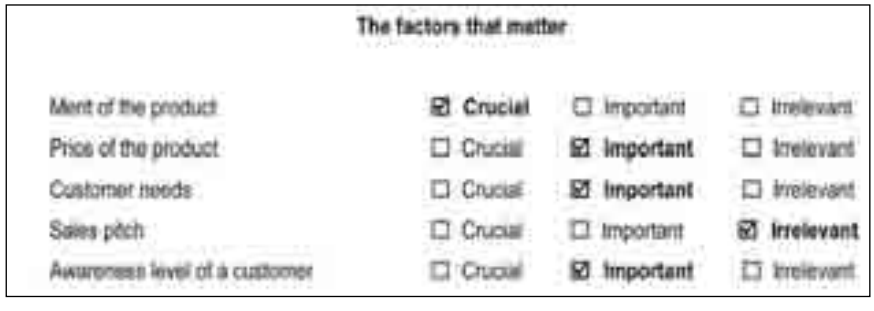
According to the dealers most of the customers are quality conscious. This point tallies with another dealer observation that most of the customers today have good awareness, since one could infer that an aware customer would care about quality. Though, a distinction was drawn between being 'aware' about products, especially because of the internet; and being 'educated' about the potential of the products.

Since the technology is evolving continuously, it was felt that constant efforts have to be made to educate the customer. This brought into focus the need for capacity building among potential users. Training of people who buy equipment is being addressed by the dealers, but there definitely seems to be a gap in trained manpower being available to the survey industry in general.

A focussed government-industry-academia effort seems to be needed to address this lacuna. The industry could initiate steps like introduction of 'trial versions' of equipment in academic institutions so that up-to-date equipment is available for training courses. New specialised courses need to be introduced as well. For the industry to truly grow, it will have to be driven by the users, with maybe just the right push from the government and the dealers.







The price debate

When dealers say that the price of a product is important to some of the customers, and the users also say price is an important factor guiding the purchase of a product, then the emphasis on quality seems to take a beating. If we go with the perception that a good quality product will cost more than other inferior quality products – then the assumption that if quality matters then price should not matter and vice versa should hold good. Following this logic both quality and price cannot be important. But if we question this perception itself – that a high price does not necessarily mean good quality and a lower price does not necessarily mean inferior quality then the whole 'price-quality' debate falls flat.

Another way to look at this debate is from the small and large projects point of view. A view emerged that on smaller projects the funds are limited and therefore the investment made on equipment is limited and 'price' automatically becomes a focus. While on larger projects 'quality and 'durability' become the focus and price is not an issue.

The user speaks

The users unanimously wanted to be properly informed about a product. Demonstrations and case studies were appreciated, sales pitch was not. So, it seems the industry is evolving with the user becoming more demanding about his needs.

The evolving mindset of the user is reflected in the emphasis that was laid by the users on the appropriateness of a product for the application at hand. This is significant also because today there are a variety of brands and products available to choose from. Understanding which product is suitable for his needs is a big step towards the user driving the market.

Most users agreed that though digital equipment was highly technical, its ease of use had definitely helped them to improve their work processes.

Brand loyalty by itself may not be a concept well embraced by the Indian user, but a very practical aspect of retaining a brand emerged during the discussions. As the users pointed out, when they continue with the same brand, training, software and servicing aspects are streamlined.

After sales service

When dealers said that after sales service is important to most customers and therefore they take special care to provide that service, it seemed like shop talk. Users also said after sales support was an important factor for them, but when a majority said they were satisfied with the service they got it shattered a major myth. The myth that the customer is always unhappy with the after sales service!

Conventional instruments market

Among all the positive talk about digital instruments it emerged that the conventional survey instruments manufacturing in the country has been hit hard by the influx of digital instruments. Though conventional instruments are still being used in the country, especially in the academic institutions, there are few takers for these instruments in the industry.

The emerging picture

As the survey technology develops the Indian survey industry is accepting this technology with open arms. This acceptance comes from a growing understanding about the technology and its benefits. As mindsets change, identifying problems and working towards solving them becomes easier. Though the dealers and users seem to be in tandem, the technology seems to be vendor driven as of now. But, once a technology is introduced and takes root eventually it is the users who will have to push it.

Offshore application of EGNOS

The GIANT project has been pushing ahead with the necessary activities to make EGNOS a viable navigation system in the hazardous North Sea environment

Steve Leighton
Principal GNSS engineering consultant with Helios
Steve.Leighton@askhelios.com

Oil was first commercially exploited in the North Sea in the 1960's. Production is underpinned by regular and reliable helicopter operations enabling the movement of staff and equipment to and from the shore. However, the North Sea environment is challenging for rotorcraft operations from many perspectives, not least its remoteness from the shore, the exacting weather conditions and the changeable nature of rigs. There have been six fatal accidents since 1976, with the loss of 79 lives.

Today there are more than 300 helidecks in the UK sector alone being serviced by regular flights. Approach options in Instrument Meteorological Conditions (IMC) are limited to using the aircrafts' weather radar to identify the rig. This is neither designed nor certified for the task and following a UK Civil Aviation Authority (CAA) review the need for an accurate and reliable instrument approach aid for conducting offshore approaches has been highlighted.

With support from the UK CAA, the GNSS Supervisory Authority's (GSA) GIANT project has sought to develop a new approach procedure based upon SBAS guidance, in this case EGNOS.

PRN	Satellite	Elevation	Azimuth
120	Inmarsat AOR-E	23.9º	200.1º
124	ARTEMIS	21.7º	156.9º
126	Inmarsat IOR-W	20.7º	152.9º

Table 1

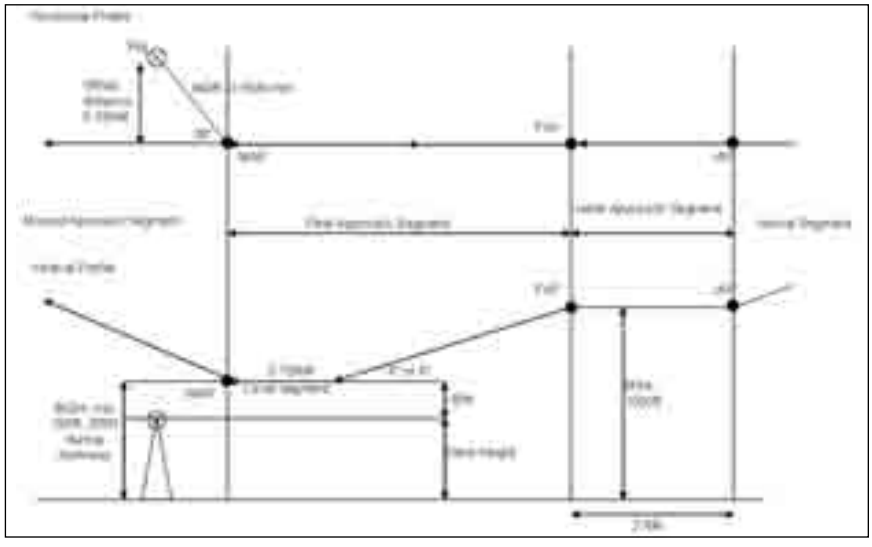


Figure 1

North sea operations

The North Sea – particularly at the latitudes of the oil fields – can be an inhospitable environment. A helicopter operating to the rigs is exposed to the full wrath of the weather. During winter lightning strikes to helicopters are common. There is hail and sleet to contend with along with icing conditions at typical operating flight levels. Furthermore the helipads can be located hundreds of feet from sea level. This means that a cloud base of down to 200' may obscure the pad.

Even without the weather there are still many factors for the flight crew to contend with that are of particular significance once operating in IMC on an instrument approach. Whilst many oil platforms are fixed in their location a number of rigs are moveable and can be relocated at short notice. Some platforms are semi-submersible – tethered to the sea bed, but still free to heave on a heavy swell. Rigs often have moving cranes, gantries and chimneys that are used in 'flaring' – burning natural gas. Perhaps most hazardous for a crew on an instrument approach is the potential for moving obstacles. It is not unknown for supply vessels to arrive at the rig whilst the aircraft is on approach. As many of these ships are relatively large their superstructure can easily impinge on the planned flight path.

Despite all of these factors the vast majority of approaches are conducted successfully – even those in IMC at night. This is testimony to the skill and training of the current flight crews.

The current instrument approach procedures to North Sea oil rigs utilise the aircrafts' weather radar. They are known as Airborne Radar Approaches (ARA). The helicopter initially navigates to the proximity of the rig, it then identifies

the rig using the weather radar display and flies toward it descending on the altimeter at the same time. When closing on the rig the crew will level off and adopt an offset heading to guide them abeam the rig whilst still maintaining radar contact. If by the closest point on this approach (typically 0.75NM) the crew have not achieved visual contact with the rig they will instigate a banking, climbing missed approach. In addition to being used for navigation the weather radar is used continually to look for other mobile obstacles in the final approach such as supply ships.

EGNOS in the North Sea environment

EGNOS provides accuracy and integrity sufficient to enable guided vertical descent procedures and its ability to contain the gross navigation system errors could also permit closer approaches to the rigs to remove the necessity for a climbing, turning missed approach procedure. EGNOS could also maintain cost effectiveness as it requires no ground infrastructure on rigs.

Removal of the traditional procedures using radar equipment not intended for the task, together with the ability to auto-pilot couple the EGNOS guidance to aid workload could all help to improve achieved safety levels and perhaps even operating minima in the future.

However, the majority of platforms are located in the latitude range of 58°N to 63°N. At these latitudes the EGNOS geostationary satellites are at a low elevation angle (approx 20-25°) and appear clustered in the sky to the south. This factor coupled with the often sub-optimal GPS antenna installations common on rotorcraft result in a major challenge to the successful application of EGNOS in this environment. [Table 1]

A new approach

An ideal offshore approach procedure would have a number of new features.

Ideally the approach would be straight in but offset from the rig. This would allow for an optimal straight ahead climb for the missed approach. The approach should bring the helicopter close enough to enable visual identification whilst also far enough away to allow for final speed and height adjustments.

One positive element of the current ARA approach procedure is that it provides the crew with the ability to choose their approach heading. This flexibility should not be lost as it allows the crew to optimise their approach taking into account wind direction whilst maintaining clearance from moving obstacles or superstructure. This would however, require the SBAS avionics to generate the approach procedure on-the-fly. This is a challenging requirement for current avionics as SBAS approaches usually consist of a set of waypoints that are typically hard coded in a database.

New approach procedures should be able to provide guidance to the aircraft autopilot. This will help to reduce overall cockpit workload during the critical approach phase of flight and allow the crew to focus on just monitoring the guidance whilst undertaking other tasks. Ideally the procedure should also provide guidance for the descent too that will encompass a stable descent (typically 4° to 6°).

The potential for mobile obstacles will remain a reality of North Sea operations. Therefore a new procedure will still need to provide the crew with the ability to ensure that the path ahead of them remains clear of obstacles. It is likely therefore that the need will remain for the use of the weather radar even on an SBAS approach.

SOAP trial procedure

Within the GIANT project a new offshore oilrig approach procedure was designed that used EGNOS to address the recognised shortcomings of the ARA. The result of this work is the SBAS Offshore Approach Procedure (SOAP).

The approach is divided into four segments [Figure 1]. The arrival segment is used for the helicopter to descend to the minimum safe altitude of 1500ft. Once the helicopter reaches the Initial Approach Fix (IAF) it enters the initial approach segment, in which it aligns itself on the final approach heading and decelerates to the final approach speed between 60kts and 80kts - depending on the environment and the capabilities of the helicopter. During this time the crew use the weather radar to check the system-generated final approach and missed approach areas and verify that they are clear of radar returns.

On reaching the Final Approach Fix (FAF), the helicopter enters the final approach segment and begins its descent to the Minimum Descent Height (MDH, defined as the height of the rig's helideck plus 50ft, with a minimum value of 200ft in daylight and 300ft at night).

The descent angle can vary depending on the elected final approach speed. Once the helicopter reaches the MDH, it flies a level segment during which the pilot and co-pilot attempt to acquire visual contact with the rig. If visual contact is not made, the helicopter will reach the Missed Approach Point (MAP) and perform a missed approach procedure simply by climbing straight ahead at the steepest safe angle.

The various lengths and angles of the approach procedure can be seen in the figure [Figure 2]. Certain points, such as the FAF, are positioned depending on distances that will vary, such as the distance covered whilst the helicopter is descending (which depends on the descent angle and the MDH value).

The procedure also dictates the sensitivity of the guidance to be used, which can be seen in the two figures (3 & 4), the first showing lateral sensitivity and the second showing vertical sensitivity.

Throughout the procedure, lateral guidance is provided by EGNOS. Vertical guidance during the arrival and initial approach segments is provided by the helicopter's baro-altimeter, and by EGNOS backed up by the radar altimeter during the final approach segment.

Flight simulations

As part of the design process for the SOAP approach, a set of simulation trials were carried out in order to determine the optimum values of certain parameters in the procedure description and evaluate its overall flyability. These trials were carried out in the Eurocopter SPHERE facility, in Marignane, France. The pilots involved included representatives from various different offshore operators.

The SOAP procedure was flown in the simulator using different values for the Minimum Decision Range (MDR), descent slope, maximum offset angle between the final approach track and the track from MAP to rig, and final horizontal and vertical airspeeds. These were tested against different wind directions and speeds, and a visual range slightly above the MDR value.

The primary results from the simulation trials were that the final visual approach and deceleration towards the rig is the most critical of the procedure, and must be at least 0.75NM for a final groundspeed of 80kts, but could be reduced to 0.5NM for a groundspeed of 60kts. It was agreed that a glideslope of 6° was too steep at a groundspeed of 80kts, and that at this speed 4° should be the maximum.

A maximum offset angle of 30° was agreed, with 45° making it hard to establish visual contact in the difficult visual conditions.

Also tested was the presentation of the vertical guidance provided to the pilot. Some pilots preferred the 'Procedural guidance' [Figure 3] in which an ILS-like glideslope beam was provided during the descent but not during the level segment, whereas others preferred the 'Full ILS-like guidance' [Figure 4] in which a linear vertical deviation scale was provided on the level segment in addition to the ILS-glideslope.

Overall the trials were deemed to be successful and of sufficient quality that the results were used to finalise the approach procedure as described above.

Flight trials

The Geostationary satellites broadcasting the SBAS correction message appear at a low elevation angle at the Northerly latitudes of many of the oil platforms

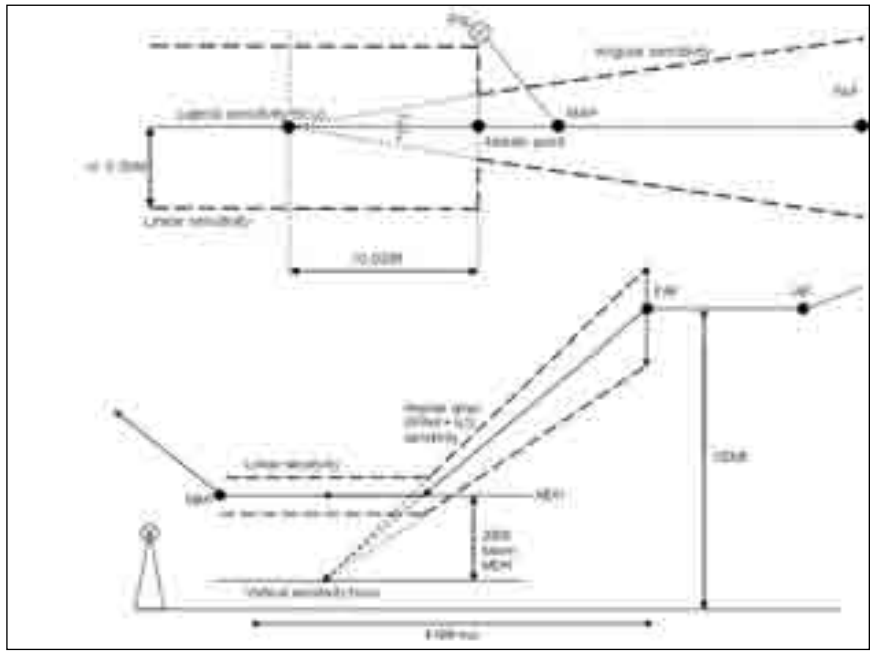


Figure 2

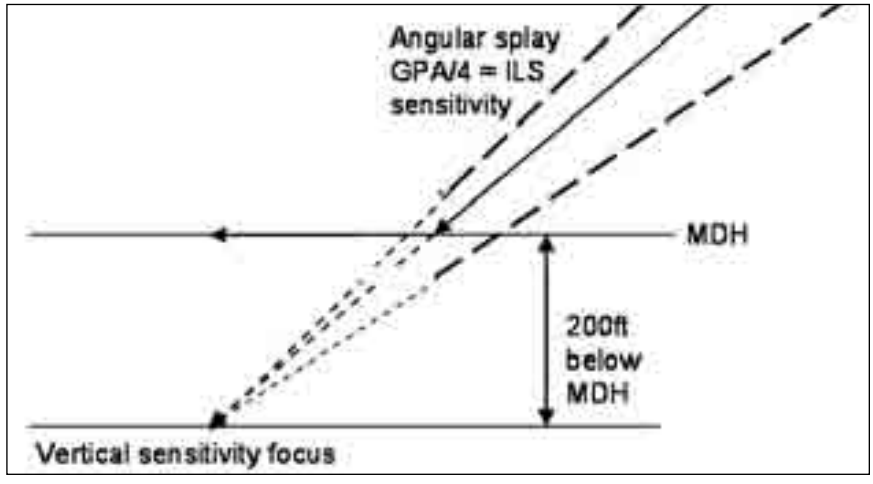


Figure 3

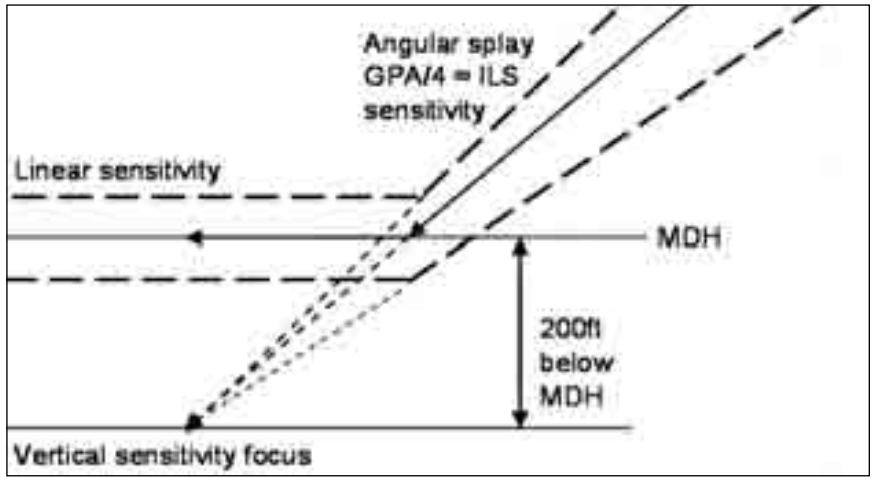


Figure 4

Figure 5

where the helicopters will be operating. When coupled with the potential occurrence of signal masking by the airframe of the helicopter itself, and sub-optimal antenna location, visibility constraints could be significant barriers for EGNOS usage. To assess the practical impact of these parameters the GIANT project undertook a helicopter flight trial to investigate the signal availability of EGNOS under representative conditions.

The trial platform was a Eurocopter AS.332L Super Puma operated by CHC Scotia helicopters out of Aberdeen [Figure 5] and is a typical aircraft that works in the North Sea environment. The trial took place near Aberdeen airport in Northern Scotland. At this latitude the three EGNOS geostationary satellites are at a very low elevation angle to the South.

The helicopter had a typical GNSS antenna installation that is currently used as an input to a Canadian Marconi CMA3012 GPS receiver that in turn provides position input to the aircraft Flight Management System (FMS).

For the purposes of the trial the aircraft's own antenna was used. The location [Figure 6] is on the tail boom, just above the rear of the passenger cabin. There was expected to be clear airframe masking from the main cabin and engine assembly ahead, as well as possibly from the tail itself to the rear. This was expected to fully obscure reception of SBAS Geo signals in a 70° arc ahead of the antenna.

The objectives of the trial were to examine the extent to which airframe masking impacts SBAS satellite reception as well as the practical implications of real world antenna installations on EGNOS performance. To this end a Septentrio PolaRx2 SBAS capable data logging receiver was installed on board the helicopter connected to the main antenna. This was configured to receive all SBAS satellites in view. Data was also logged through the helicopter's own flight data recording system so that aircraft attitude parameters were available.

During the trial the aircraft undertook a series of orbits at constant bank angles and altitude. The objective being to record data on the practical masking effect on the visible SBAS geostationary satellites. It was found that engine masking caused the receiver to sequentially lose lock on the three satellites during periods where the helicopter's heading moved through due South. Whilst the period of total SBAS-signal loss was only about 20 seconds in each case, the individual satellites were each obscured for up to 100 seconds. In the operational EGNOS space segment of only two satellites this could present a risk.

The horizontal and vertical protection levels calculated by the receiver were well within the requirements for APV approach procedures whilst SBAS satellites were in view. However there were notable spikes in the protection levels during periods where no SBAS satellites were being tracked. These spikes would have exceeded alarm limits for APV-II, LPV200 and APV-I approaches.

Finally a number of representative SOAP-like approaches were undertaken to the four compass headings to allow the collection of data on the practical performance of EGNOS under representative flight dynamics. The constant heading meant that there were no periods in which SBAS-tracking was completely lost, and as such the protection limits were always within APV-II alert limits. As expected flying the approach in a southerly direction caused significant constraints to the visibility of the GEOs, whilst the north-facing approach saw all three satellites being consistently tracked. Surprisingly, it was found that when flying the approach East or West only the AOR-E satellite was consistently in view. It is possible that this was due to the low antenna gain characteristics at low elevation angles resulting in successful tracking of the highest elevation satellite only.

The flight trials clearly show that in certain situations the orientation of the helicopter can cause the receiver to lose track of all SBAS satellites, denying it the guidance required to perform APV approaches. Whilst the current antenna position is well suited to providing an input for the GPS navigator, to support SOAP operations it would ideally be relocated or else augmented with a second antenna to reduce the effect of airframe masking.

Figure 6

Conclusions

The GIANT project has been pushing ahead with the necessary activities to make EGNOS a viable navigation system in the hazardous North Sea environment. Procedure development, flight simulations and flight trials have all contributed to the development of SOAP helicopter approaches and will feed into a potential future implementation process.

Intelligent map system tender by SLA

The Singapore Land Authority (SLA) has awarded the tender for the design, development and maintenance of a government-wide intelligent map system to NIIT Technologies Pvt. Ltd. The proposed solution shall be based on ESRI ArcGIS Server 9.3 and Microsoft Dot Net Technology. *www.sla.gov.sg*

EC awards INSPIRE@EC contract

The Statistical Office of the European Communities (Eurostat) has awarded the INSPIRE@EC contract based on ESRI technology. It covers the development of the technical components of a European Commission (EC) spatial data infrastructure compliant with the provisions of the Infrastructure for Spatial Information in Europe (INSPIRE). *www.esri.com*

Microsoft and TomTom go to court

Microsoft has filed a lawsuit against TomTom NV and Tom Tom, Inc., for patents infringement. The suit was filed in the U.S. District Court for the Western District of Washington and in the International Trade Commission. *www.microsoft.com*

$73 billion in potential geospatial spending- MAPPS

According to an analysis by MAPPS, the association of geospatial firms, the economic stimulus bill passed by Congress and signed into law by President Obama includes more than $73 billion in programs that will require geospatial data, technology, services and applications in at least 24 Federal agencies. *www.mapps.org*

EVC provides key map and GIS data for UN FAO project

UN Food and Agriculture Organization (FAO) have chosen East View Cartographic as the map provider for its Desert Locust early warning system. The system, with its geographic focus on northern Africa, the Near East and Asia, tracks environmental conditions and locust infestations so that early actions can be taken to prevent plagues from developing. *www.cartographic.com*

PolicyMap launches affordable GIS e-resource for students

TRF's PolicyMap.com is opening up its online market and demographic data to university students at a deeply discounted rate. They can utilize the website for quick access to more than 4,000 data indicators related to demographics, real estate markets, education, employment, money and income, crime, energy, and public investments. *www.trfund.com*

California lawmaker targets Internet mapping sites

A California lawmaker is targeting Internet mapping sites, fearing their detailed images of public buildings provide a blueprint for terrorists. Assemblyman Joel Anderson, from San Diego, USA introduced a bill after reading that terrorists who attacked in Israel and India used Google Earth and Microsoft's Virtual Earth. Clear, detailed images of schools, hospitals, churches and all government buildings would not be allowed. His bill would make it illegal in California to post close-up images of such buildings. *www.mercurynews.com*

Osama hunt: can UCLA trump CIA?

According to a team of UCLA geographers, they have a good idea of where the world's no.1 terrorist leader was at the end of 2001 - and perhaps where he has been in the years since. In a new published study, the geographers report that simple facts, publicly available satellite imagery and fundamental principles of geography place Bin Laden in one of the three large compounds in Parachinar town in Pakistan's Kurram area. The team relied on two principles used in geography - the distance-decay theory, and the island biogeographic theory, to pin Bin Laden's location to one of these buildings. *http://timesofindia.indiatimes.com*

TCS completes ERP project for Cochin port

Tata Consultancy Services (TCS) has completed an ERP implementation at the Cochin Port Trust (CPT). CPT would now be enabled and empowered to closely monitor performance, improve operational efficiency and provide higher standards of service. The GIS-based estate management system will enable CPT to monitor as well maximize returns on their reality holdings. *www.business-standard.com*

Australian bushfires spark Open Data debate

Australia's southeast suffered its worst ever outbreak of bushfires last month which killed many people, left thousands homeless and devastated huge swaths of the state of Victoria. The disaster has also sparked renewed debate about the need for open data and the role of private industry in assisting with information flows to the public in disaster situations. *www.dse.vic.gov.au*

Map mistake: three officials suspended in India

In major gaffe Himachal Pradesh's official roadmap of India conceded inalienable parts of the country - Pakistan Occupied Kashmir and Aksai Chin to its neighbours Pakistan and China, the state government suspended three officers for the blooper. *www.timesofindia.com*

CartoPac offers new method of moving pipeline GIS data

CartoPac Field Solutions, powered by Spatial Data Technologies, Inc. and New Century Software, Inc., shall offer a joint solution to the oil and gas pipeline industry that creates a round-trip workflow between the field and the office by integrating a number of their applications and processes. *www.cartopac.com*

Satellite built by Indian university to be launched in ISRO's next flight

For the first time in the history of Indian space research, a satellite developed by a university in India will be launched by Indian Space Research Institute (ISRO) during the next flight of the polar satellite launch vehicle (PSLV) in March-April this year. It will carry a small remote sensing satellite – Anusat, developed and fabricated by Chennai-based Anna University. *www.business-standard.com*

GeoEye starts commercial ops for GeoEye-1 Earth-Imaging Satellite

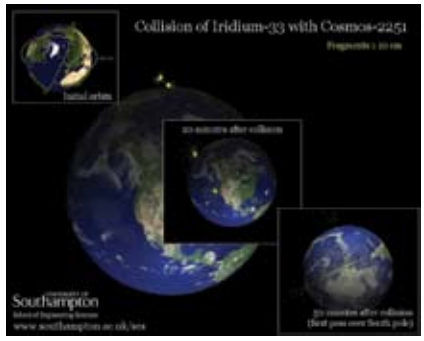
GeoEye has started commercial operations for its new GeoEye-1 Earth-imaging satellite. The Company is also submitting imagery to the National Geospatial-Intelligence Agency for their certification under the terms of the NextView contract. *www.geoeye.com*

Iran launches 1st satellite with own rocket

Iran has recently launched its first satellite, Omid into orbit using a modified homemade long-range missile. It is a small communications satellite designed to circle the Earth 15 times every 24 hours and carries experimental control systems, communications equipment, and a small remote sensing payload. It has two frequency bands and eight antennas for transmitting data.

Iridium 33 and Cosmos 2251 Satellite Collision

On February 10 at approximately 1656 GMT, the Iridium 33 and Cosmos 2251 communications satellites collided over northern Siberia. The impact between the Iridium Satellite LLC-owned satellite and the 16-year-old satellite launched by the Russian government occurred at a closing speed of well over 15,000 mph at approximately 490 miles above the face of the Earth. The low-earth orbit (LEO) location of the collision contains many other active satellites that could be at risk from the resulting orbital debris. *www.agi.com*



Mumbai civic body in India to take up aerial mapping

The BMC has obtained permission from Ministry of Defence to carry out low-lying aerial photography required for contour mapping. Claimed to be a first of its kind initiative (first municipal corporation in Asia), civic officials will travel on a private helicopter to capture vital locations and flood-prone areas on a camera. MWH from Mumbai and ORG from Gurgaon has been appointed to carry out the exercise *http://timesofindia.indiatimes.com*

New flood alert system in India's North East region

A new flood monitoring system will come up along the Brahmaputra basin in the North-Eastern part of India. The project shall be executed by the Pune-based CDAC, aims at a new object-oriented strategy to attempt "near-real time" flood monitoring in the Brahmaputra basin with the help of microwave remote sensing system that can penetrate clouds. *http://www.thehindubusinessline.com*

StereoMirror(TM) 3D/Stereoscopic Display by Planar

Planar Systems has announced new entry-level version of its StereoMirror(TM) 3D/stereoscopic display. The SD1710 makes it possible for larger audiences to deploy 3D monitors and for less frequent users of stereoscopic applications to benefit from the capabilities of this technology. *www.planar.com*

NRL's Rampant Lion II survey builds on success of Rampant Lion I

After the success of Rampant Lion I, scientists from the Naval Research Laboratory and the USGS have completed Rampant Lion II, a geophysical and remote sensing survey of Afghanistan. *www.nrl.navy.mil*

China plans to launch 3rd ocean survey satellite in 2010

China plans to launch Haiyang-2A, 3rd ocean survey satellite in 2010. It will be used to monitor ocean wind fields, sea levels and temperatures. *www.chinaview.cn*

China's remote sensing map on wetland distribution completed

The first nationwide remote sensing mapping of wetland distribution of China was completed recently. The news came on Feb. 19 as research from the Institute of Remote Sensing Applications under the Chinese Academy of Sciences (CAS) and the State Key Laboratory of Remote Sensing Science attached to Beijing Normal University showed there were 308,000 square kilometers of wetlands in China in 2000, 50,800 square kilometers less than that in 1990. Wetlands, known as the "kidneys of the earth," are the ecosystem with the richest natural biodiversity on Earth. *http://english.people.com.cn*

JU Starts Masters in Remote Sensing

The University of Jammu in India has commenced a new Masters degree course in Remote Sensing and GIS from the current academic session 2008-10, according to a varsity spokesman. ''Remote Sensing and GIS programme will help to master advanced techniques in remote sensing and GIS, strengthen problem solving skills in Remote Sensing and GIS,'' the spokesman said, adding the University of Jammu is the only varsity in northern India to have this course at Master's level. *www.kashmirobserver.net*

Delhi Police to use GPS & GIS

HCL Infosystems revamped the infrastructure of Delhi Police with ICT-driven tools. The GPS-based solution will facilitate routing of emergency calls directly to PCR vehicle network operators for the scenarios that include traffic congestion, medical assistance and fire, as well as crime-in-progress situations. *www.hclinfosystems.com*

Key patent obtained for GPS-Driven Utility Asset Management System

Christie, Parker and Hale has prosecuted a major patent application through issuance for its client Guardian ProStar of Grand Junction, Colorado, USA. The patent, U.S. Pat. No. 7,482,973, pertains to GPS technology for managing and avoiding damage to buried utility assets under the ground, retrieval, and display processes that are required to make numerous business decisions including how, when and where excavators should or should not be digging the ground. *www.cph.com*

600 more MTC buses to get GPS

The Metropolitan Transport Corporation (MTC), Chennai, India has decided to install GPS in 600 buses on various routes. *http://timesofindia.indiatimes.com*

Third Satellite of GLONASS is active

The third GLONASS satellite is now transmitting L-band signals on its assigned frequency channel (6) and is being tracked by a number of International GNSS Service (IGS) stations. *http://sidt.gpsworld.com*

Doosan Infracore America selects ORBCOMM Telematics App

Doosan Infracore America has selected MobileNet's TrakPak application as the GPS system to be included as standard equipment on new qualifying Doosan DX Series Excavators and DL Series Wheel Loaders. *www.doosanlift.com*

Galileo update

GRACE hosts UK 'Growing Galileo' event

The GNSS Research and Applications Centre of Excellence (GRACE) based at the University of Nottingham hosted the UK 'Growing Galileo' event. The event focused on access to new funding from the European GNSS (Global Navigation Satellite Systems) Supervisory Authority (GSA) for collaborative R&D projects under the European Framework 7 Programme (FP7). *www.grace.ac.uk*

Galileo gets military clearance

The European Parliament has opened the way for the civilian Galileo satellite system to be used for military and security purposes as part of a plan to improve the efficiency of defence communications It also called for more standardisation in communications and surveillance technology to get more from total defence spending of over€200bn a year, and "strongly requested" member states to focus their efforts on "common capabilities which can be used for both defence and security purposes". This applied to satellite-based intelligence, surveillance and warning equipment, unmanned air vehicles, helicopters and telecommunication equipment and air and sea transport. In a statement the European Parliament said it considered it necessary to allow the use of the Galileo and GMES (Global Monitoring for Environment and Security) systems for security and defence purposes.

Originally built to compete with the US's Global Positioning System (GPS), Galileo has struggled to find commercial users.

Parliamentarians also demanded a common technical standard for protected telecommunications and ways of protecting critical infrastructure. They were "deeply concerned about the lack of efficiency and co-ordination" in defence spending. They urged greater efforts to reduce unnecessary duplication between member states through specialisation, pooling and sharing of existing capabilities, and joint development of new ones. They said capability needs are often technologically very similar or identical for armed forces operations, border surveillance, protection of critical infrastructure and disaster management. This created opportunities to rationalised and enhance interoperability between armed forces and security forces, they said. *http://www.computerweekly.com/Articles/2009/02/20/234941/galileo-gets-military-clearance.htm*

Galileo Commercial Authorization

Receiver technology having Galileo capability to operate in the Galileo frequency bands and using information from the Galileo system for future operational satellites is restricted in the publicly available Galileo Open Service Signal-In-Space Interface Control Document (GAL OS SIS ICD) and is not currently authorized for commercial use. Receiver technology that tracks the GIOVE-A and GIOVE-B test satellites uses information that is unrestricted in the public domain in the GIOVE A + B Navigation Signals-In-Space Interface Control Document. Receiver technology having developmental GIOVE-A and B capability is intended for signal evaluation and test purposes *www.trimble.com/srv_new_era.shtml*

DigitalGlobe announces agreement with Nokia for use of imagery

DigitalGlobe and Nokia have agreed to bring high-resolution satellite and aerial imagery to Nokia Maps, both on mobile devices and on Ovi, improving the global driving, hiking and walking navigation capabilities for consumers who use these applications. *www.digitalglobe.com*

SatGuide launches voice based navigation service

SatNav Technologies, is set to launch India's 1st Voice based Navigation Directions service LCU (Lost? Need Directions? Call Us!). It has filed a patent for LCU which is an integrated solution to the yellow pages and directory services. *www.satguide.in*

BMW developing navigation system that predicts destination

BMW is working on the ILENA system (Intelligent Learning Navigation). It is able to provide a logical list of places where it thinks you are going by monitoring and recording your driving habits and destinations that you frequently visit. After compiling the data, the system can guess where you are heading every time you start your vehicle. *www.bmw.com*

u-blox releases GSM/GPRS module and cards for mobile computers

u-blox releases the GSM transceiver module "LEON", which will benefit applications such as fleet management, asset and personnel tracking, vehicle recovery, point-of-sales terminals and metering. It has also released GPS "PCI Express Mini", which enables next-generation laptop, netbook, mobile internet device and "Ultra Mobile" PC OEMs to provide GPS and location-based services.

TeleNav debuts All-in-One Fleet Management Service

TeleNav, Inc. has launched TeleNav Vehicle Manager. It is powered by Turnpike®, which combines vehicle diagnostics and IFTA Fuel Tax filing with GPS-enabled navigation, tracking, wireless forms and wireless timecards. *www.telenav.com*

Rediff.com adds maps feature to LocalAds

Rediff.com, India has announced the addition of maps feature, now in beta, to LocalAds. Advertisers can use the visually intuitive maps to pinpoint their exact location within a locality, so that users can easily locate the advertisers. It currently covers 64 cities and towns in India. The feature is powered by Rediff's own maps service. *www.Rediff.com*

NAVTEQ selected by ESRI for ArcLogistics Navigator solution

ESRI has selected NAVTEQ map data for its in-vehicle navigation solution, ArcLogistics Navigator. The product, designed for the trucking, fleet, and logistics industries, creates optimized routes and schedules that can be transferred from the desktop to the field. *www.esri.com*

Getac introduces rugged GPS unit

Getac announced Getac PS535F, a GPS unit with a built-in 3-megapixel camera, E-compass, Windows Mobile 6.1and altimeter. It also uses proprietary software that makes interacting with the GPS unit easier. *www.getac.com*

Indians can now plan multi-city road trips with landmarks along the way

Microsoft India has delivered the next release of Live Search Maps which offers multi point routing ability to enable Indians to plan multi-city road trips in a single search query. Live Search Maps is available through the computer or mobile and can be accessed at maps.live.co.in/ and m.live.co.in. *www.microsoft.com*

deCarta announces real-time, two-way connected navigation service

deCarta, announced its real-time, two-way European connected navigation solution for PND's and smartphones. It will be available to consumer brands, automotive OEMs, in-vehicle service providers, mobile network providers and handset manufacturers from the end of March 2009. *www.decarta.com*

Intelligent GPS devices by NAVIGON

NAVIGON released the NAVIGON 4300T max and 3300 max - the first intelligent GPS devices on the market to deliver personalised route recommendations based on individual driving habits. *http://navigonusa.com*

Tele Atlas expands African map coverage to 14 countries

Tele Atlas, released its first navigable databases for Angola, Kenya, Malawi, Mauritius, Nigeria, Tanzania, Uganda and Zambia in Africa. It also includes Guadeloupe, Martinique, Mayotte, Réunion, Saint Barthélemy and Saint Martin in France. www.teleatlas.com

MapmyIndia raises venture funds from Qualcomm

Qualcomm Ventures is making strategic investment in MapmyIndia with participation from existing investors Kleiner Perkins Caufield Byers, Sherpalo Ventures and Nexus India Capital. *www.qualcomm.com*

At a Glance

- GOGOindia has announced a partnership with SatNav Technologies under which GOGOindia will buy all India map dataset for all its navigation devices.
- Broadcom Corporation has released BCM2075, a new, integrated GPS, Bluetooth, and FM radio in a single-chip design, targeting LBS applications.
- Garmin and ASUSTeK have joined to design, manufacture, and distribute co-branded location-centric mobile phones.
- Seiko Epson and Infineon Technologies have developed a GPS single-chip design, the XPOSYS, which is optimized for mobile devices for the consumer market.
- STMicroelectronics and Ericsson have agreed on merging Ericsson Mobile Platforms and ST-NXP Wireless into a 50/50 joint venture.
- Skyhook Wireless has closed a new deal with Texas Instruments through which the chip maker will include the Skyhook software on its NaviLink and WiLink products.
- Location Based Technologies has launched Smartphone application for the BlackBerry's Curve model of Smartphone. PocketFinder service directly downloadable to handsets.
- GeoSentric has launched GyPSii OpenExperience API (OEx), the all-inclusive platform for incorporating location-based social networking functionality into embedded mobile clients and applications.
- Networks In Motion (NIM) has partnered with Ericsson to offer NIM's LBS for GPS-enabled mobile phones to Ericsson customers worldwide.

Hemisphere partners sponsorship of The Green Miles project

From December 2008 through October 2010, Arjen van Eijk and Florian Dirkse of the Netherlands will set sail on an adventure and produce a documentary targeted at raising awareness about the critical role oceans play in our world's climate. To accomplish the "Care for the Ocean" mission, Hemisphere GPS and its partners Saderet and Nautikaris have donated navigation equipment. *www.thegreenmiles.nl*

Topcon adds GIS data collection to GPS Handheld

Topcon Positioning Systems has announced a GIS data collection kit for the new Topcon GMS-2 Pro, a GIS-GPS handheld receiver that features an integrated laser rangefinder, 50-channel dual-constellation tracking, an integrated digital camera, and an electronic compass. *www.topconpositioning.com*

Leica Geosystems

...partners with Maptek

Leica Geosystems' Spatial Solutions Division has selected Maptek, a mining technology developer, to supply a long range laser scanner and associated mine scanning software to be sold under the Leica brand.

...introduces the CrossCheck service

which is a web based service for GPS/GNSS reference network coordinate calculation, integrity monitoring and deformation monitoring.

...announces Ultra High-Speed, Phase Scanner

Leica HDS6100, an ultra-high speed laser scanner for many as-built survey applications.

...releases Leica GNSS Spider V3.2

offers a versatile solution for GNSS Infrastructure and Network RTK. It will allow any manufacturers rover systems that follow the RTCM standards to seamlessly use both networked and single base GPS & GLONASS correction data.

...MobileMatriX supports 4 GNSS constellation

Version 3.1 of Leica MobileMatriX supports the new Leica Geosystems instrument series FlexLine and GPS1200+, as well as ESRI ArcGIS 9.3, and Microsoft Vista. *www.leica-geosystems.com*

GPS-Photo Link Express series introduced

GeoSpatial Experts has introduced GPS-Photo Link Express Series, a consumer edition of its photo-mapping software. It runs on both desktop and laptop computers and is compatible with any handheld GPS receiver and digital camera, including iPhone 3G. *www.geospatialexperts.com*

Flight schedule information available via new GPS service

OAG has partnered with NAVITIME Japan Co., Ltd., for GPS navigation service easy access to flight schedules and the latest updates on flight arrivals and departures. It is available for both mobile and web interfaces within each of NAVITIME's U.S. and European service areas. *www.oag.com*

Sidwell and Pictometry partnership

The Sidwell Company and Pictometry International have signed an agreement allowing Sidwell offerings to include Pictometry Intelligent Images. These images are captured using a proprietary process, and are utilized in a digital format by assessment and public safety professionals. *www.sidwellco.com*

Bentley's "Be Employable" initiative provides free software, training

Bentley Systems has launched an initiative to help outplaced AEC and geospatial professionals update and upgrade their technology skill sets. Be Employable is an addition to Bentley's Be Careers Network that provides free access to Bentley's software portfolio and training, as well as the ability to earn learning units from the Bentley Institute, its training organization. A learning unit is earned for each hour of self-paced or instructor-led learning content completed. The participants

SOUTH

www.southinstrument.com
http://us.southinstrument.com

Dual Axis Compensation
High automation in eliminating errors and compensation.

300m Reflectorless Range

Colourful Touch Screen
Easy to use, operate by direct touch or press the key board according to your habit.

Win-CE System
Windows® CE.Net™ is installed.

Convenient Data Communication
The SD huge extended memory is incredibly flexibility and reliable safety, while USB interface help you build a close communication between TS and PC.

Dual sides with graph

Built-in Software
With various outstanding surveying programs, Mapping Genius and Engineering Genius evolved your TS into a more powerful product.

NTS-960R SERIES TOTAL STATION
Win-CE System
Touch Screen
Water & Dust Proof
Stability Greatly Improve

2" or 5"
Measuring range without prism :300m
Accuracy: 5+3ppm
Measuring range with single prism: 5Km
Accuracy:2+2ppm

are expected be better positioned as candidates for employment opportunities and able to deliver greater value to their new employers. *www.bentley.com*

Infotech and VolkerWessels Telecom agreement

Infotech Enterprises, India has signed a three year agreement, through Infotech Enterprises Benelux BV with Volker Wessels Telecom. It will enable Infotech to provide service in Telecommunications Engineering to telecommunications industry worldwide. *www.infotech-enterprises.com*

Garmin to offer optional pedestrian content in new nüvi line-up

Garmin introduced the nüvi 1200 and 1300 Series with pedestrian navigation capability enabled through optional "CityXplorer" maps. These maps, based on the NAVTEQ Discover City data, are available for select tourist destinations in both North America and Europe. *www.garmin.com*

Infrastructure Modeling Software by Autodesk

It helps users in utilities, telecommunications organizations and government agencies improve the design and management of their infrastructure. www.autodesk.com

Raytheon Anti-Jamming Antenna System

A subsidiary of Raytheon Company has received a U.S. Air Force contract for initial production of the GPS Advanced Digital Antenna Production system. The system protects GPS-based navigation and precise timing systems from deliberate jamming and accidental interference.*www.raytheon.com*

Outback Sts™ and Outback S3 software by Hemisphere GPS

Outback Sts, the latest addition to the situational awareness and data management tools from Outback Guidance® introduced. Now, Outback S3 software release version 2.11, the new supplemental software release for the Outback S3™ is available.

Magellan and Carlson Software partnership. Magellan ProFlex 500

Magellan Professional and Carlson Software have teamed to pursue Machine Guidance and Control opportunities using Magellan GNSS receivers and Carlson software.

It has also launched new dual-frequency GNSS Receiver – the ProFlex™ 500. *www.pro.magellangps.com*

Macao Electrical Utility selects Intergraph

Companhia de Electricidade de Macau-CEM, S.A. (CEM), has selected the Intergraph® InService outage management system (OMS) to speed response and service restoration from power outages by up to 33% .*http://www.cem-macau.com*

EUROCONTROL contract with GMV

The European Organization for the Safety of Air Navigation - EUROCONTROL CNS Research Area has renewed the GNSS support contract with GMV. *www.ariadne.es*

Data Off The Shelf

AAMHatch's new data mart, Data Off The Shelf, provides information about datasets, including terrain and contours, ortho photos, oblique imagery and 3D city models. *www.aamhatch.com/data*

Trimble

...R8 GNSS System

comes with innovations in Trimble R-Track™ technology including RTK Signal Prediction™ technology, RTK correction compression and GNSS architecture.

It also features capabilities to customize, remotely configure, and connect to base and rover receivers from the office. www.trimble.com

...adds new Rugged Tablet PC

as part of its surveying product portfolio offering flexibility to surveyors by providing a large screen display PC designed for rugged field work.

...VRS Network Solution

VRS™ network solution - Trimble VRS3NET™ software, which provides users with a suite of tools for creating and managing a VRS network that is designed to support current and future GNSS constellations.

...Data Capture and Analyst Software

Trident-3D™ data capture software and analyst software 4.4 for mobile mapping applications that will integrate with the Trimble G360 camera.

Groupe Alta and IMT partnership

Groupe Alta and Integrated Mapping Technologies, Inc. (IMT) announced their alliance to integrate Web diffusion solutions and recurrent aerial acquisition programs to streamline distribution of high-precision geospatial data in BC, Canada. *www.groupealta.com*

SuperGIS Server Beta releasing in March (chek if this news is twice)

SuperGeo Technologies will release the Beta version of its first enterprise application server software, SuperGIS Server, by the end of March. *www.supergeotek.com*

Blue Marble releases GeoCalc 6.4

Blue Marble Geographics has released an update to its coordinate conversion engine - GeoCalc. *www.bluemarblegeo.com*

Geographic Imager 2.1 for Adobe Photoshop

Avenza Systems Inc., announced the release of Geographic Imager 2.1 for Adobe Photoshop CS3 and CS4. *www.avenza.com*

TerraGo agreement with Trimble

TerraGo® Technologies, has signed a Mapping and GIS business partner agreement with Trimble. *www.terragotech.com*

ERDAS new suite of ArcGIS extensions

ERDAS announced a new suite of extensions that operate with Stereo Analyst® for ArcGIS, available for ArcGIS 9.3. These extensions form a production set of tools aimed at assisted feature collection and terrain editing. *www.erdas.com*

Digital pen and paper technology

Thiess Constructions digital pen and paper technology – Capturx, has sped up GIS-based work plans. It can speed up a range of paper-based workflows, including inspections, service requests, change order and more. *www.thiess.com.au*

Memex integration with Oracle

Memex, Inc., announced the integration of its search and analysis solutions with Oracle GIS modelling and mapping technology. *www.memex.com.*

Latest Geo-Imaging software by PCI

Geomatica 10.2 is the latest version of PCI's image-centric desktop software, emphasizing automation and productivity for turning spatial data into information. *www.pcigeomatics.com.*

SUBSCRIPTION FORM

YES! I want my Coordinates

I would like to subscribe for (tick one)

☐ 1 year	☐ 2 years	☐ 3 years
12 issues	24 issues	36 issues
Rs.1200/US$80	Rs.2100/US$145	Rs.2700/US$180

SUPER saver

First name .....

Last name .....

Designation .....

Organization .....

Address .....

.....

City ..... Pincode .....

State ..... Country .....

Phone .....

Fax .....

Email .....

I enclose cheque no .....

drawn on .....

dated ..... towards subscription

charges for Coordinates magazine

in favour of Coordinates.

Sign ..... Date .....

Mail this form with payment to:

Coordinates – cGIT
11C Pocket A, SFS
Mayur Vihar Phase III
Delhi 110 096, India

If you'd like an invoice before sending your payment, you may either send us this completed subscription form and we'll bill you, or send us a request for an invoice at iwant@mycoordinates.org

MARK YOUR CALENDAR

April 2009

GEO Siberia 2009
21-23 April
Novosibirsk, Russia
nenash@sibfair.ru
www.geosiberia.sibfair.ru

Defence Geospatial Intelligence Middle East
26 – 29 April
Dubai
enquiry@iqpc.ae
www.geospatialdefence.com

May 2009

ENC-GNSS 2009
3-6 May
Naples, Italy
www.enc.gnss09.it

International Conference on Integrated Navigation Systems
25-27 May
Saint Petersburg, Russia
www.elektropribor.spb.ru

EOGC2009
25-29 May 2009
Chengdu, China
http://www.eogc2009.com.cn

June 2009

GSDI 11 World Conference
15-19 June
Rotterdam, The Netherlands
http://gsdi.org/gsdi11/

TRANS-NAV 2009
8th International Navigational Symposium
June 17-19
Gdynia, Poland
http://transnav.am.gdynia.pl

July 2009

ESRI International User Conference
13–17 July
San Diego, USA
www.esri.com

August 2009

SEASC 2009,
4-7 August
Bali, Indonesia
www.bakosurtanal.go.id/seasc2009/04/

2009 IMTA Asia Pacific Conference & Trade Show
7-8, August
Darwin, Australia
imtaaspac@chariot.net.au
http://www.maptrade.org/events/upcoming.php

September 2009

ISDE 2009
9-12 September
Beijing, China
www.digitalearth-isde.org

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

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

October 2009

ACRS 2009
19-23 October
Beijing, China
http://www.aars-acrs.org/acrs

November 2009

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

December 2009

IGNSS Society 2009
1- 3 December
Holiday Inn Gold Coast, Queensland, Australia
www.ignss.org

ProMark 500 + ProFlex 500

MAXIMUM FLEXIBILITY

Multi-constellation RTK Surveying by Magellan

Designed by our GNSS experts, ProMark 500 survey solution delivers state-of-the art RTK features in a light, rugged cable-free rover that gives you maximum mobility and flexibility in the field. Its unique GNSS engine insures fast initialization, long-range accuracy, robust signal tracking, and secures future constellation evolutions.

ProMark 500 and now the new ProFlex 500 for backpack and remote antenna applications bring the best Magellan technologies for the survey market. These receivers include all the features that users expect for productive and reliable RTK GNSS positioning.

Embedded BLADE technology provides the best possible measurements from three constellations GPS+GLONASS+SBAS and full interoperability with any vendor's reference station transmitting GPS+GLONASS L1/L2.

Competitive Advantage:

- **BLADE™ GNSS technology**
- **Enhanced RTK accuracy**
- **Wide range of communications**
- **Rugged base & rover solution**
- **Multi-application field terminal**

To learn more about the unique BLADE technology, and take full benefit of any available GLONASS corrections, visit www.pro.magellanGPS.com today.

For more information:
France(HQ) +33 2 28 09 38 00
China +86 10 65 66 98 66
APAC +65 983 842 29

professionalsales@magellanGPS.com

MAGELLAN® PROFESSIONAL

Leica FlexLine
As flexible as you are

The new generation of Total Stations:
Leica TS02/06/09 for basic to advanced users with the need for flexibility and performance.

Based on latest high-end technology and Leica quality, the FlexLine family of Total Stations provide you with complete flexibility and performance. For the first time, hardware and software options can be simply selected so that the FlexLine Total Station exactly meets your requirements.

The choice is yours, and performance is guaranteed.

Features and Benefits

- Complete flexibility in selecting features
- Removable USB memory stick
- *Bluetooth*® wireless technology
- ±1 mm accuracy in Prism mode
- >1000 m range in Non-Prism mode
- New 30 m Non-prism mode using laser pointer
- Quadruple axis compensation for best accuracy
- Integrated FlexField and FlexOffice software solution
- Lithium-Ion batteries for 20 hours operation time

With a FlexLine Total Station you can be sure of complete flexibility for Today and Tomorrow.

Leica Geosystems
Woodlands East Industrial Estate
Singapore 738068
Telephone: +65 6511 6581
Email: ise.support@leica-geosystems.com
www.leica-geosystems.com

Telephone: 0124- 4122291
Email: sales1@elcometech.com

- when it has to be **right**

Leica Geosystems