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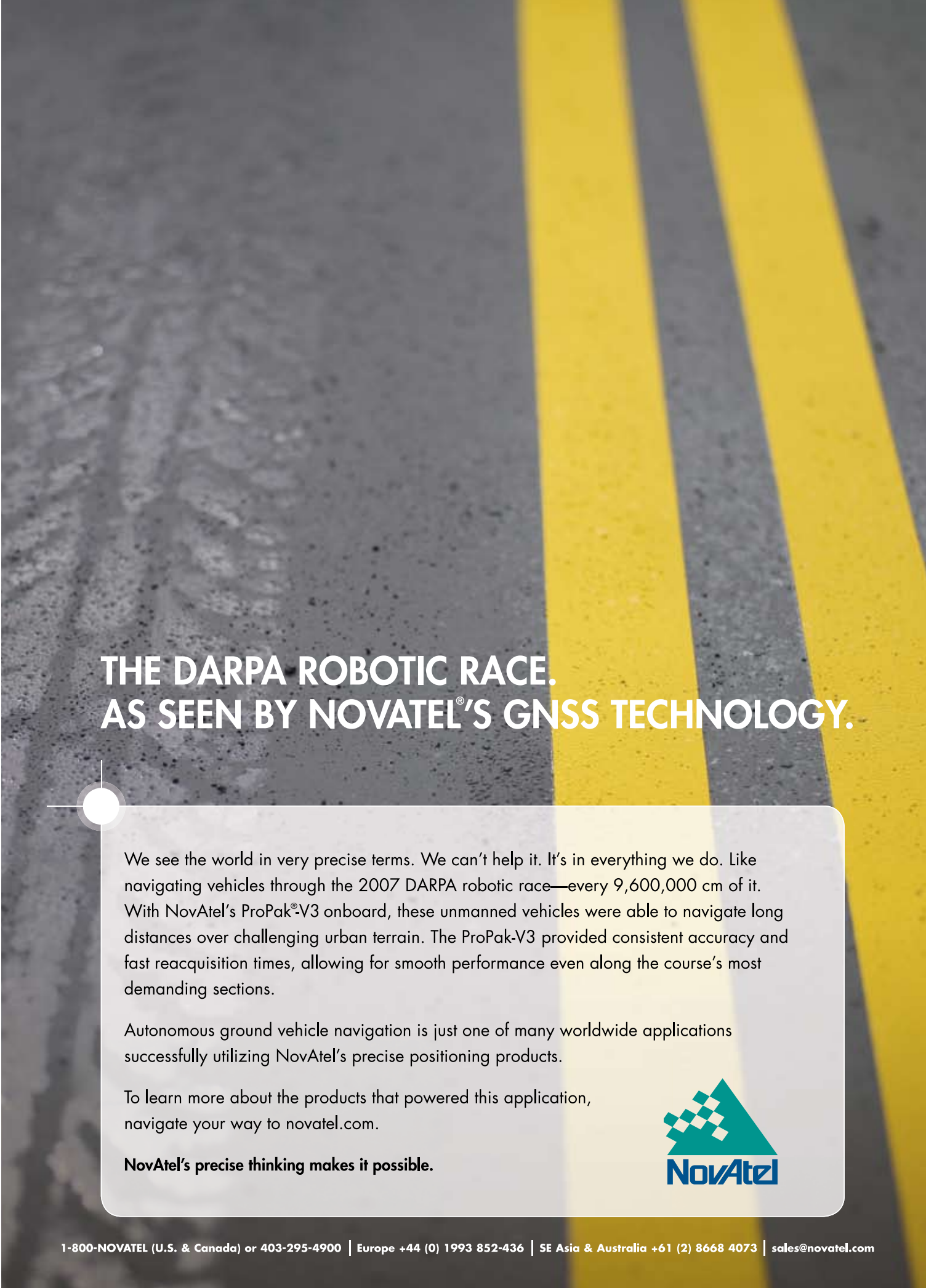

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Articles

Columns

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This issue of Coordinates is of 40 pages, including cover

Land matters

From the role of land administration in sustainable development…

To the promotion of effective land markets.

e-land administration, land registration, cadastral surveying and mapping.

Poverty reduction and protection of vulnerable groups.

A range of issues.

The 14th PCIGIAP meet at Kuala Lumpur discussed and deliberated all.

Another step in a long journey…

The journey which is difficult and tortuous.

Understandably, when one deals with issues pertaining to land.

An increasingly scarce resource.

Hence, conflict among 'haves' and 'have-nots'.

Spatial technology is a powerful tool in this context.

Especially to take care of interests of the marginalized and vulnerable.

Ironically, the technology itself becomes vulnerable.

At times, it sides those who own it.

Bal Krishna, Editor
bal@mycoordinates.org

"Our receivers maximize the use of SBAS"

Mr. René Parisé
Geneq Inc.

Geneq's Geomatics division came into being in 1993 to supply GIS grade GPS receivers to meet the growing needs of submeter mapping industry. With 2003 came the SXBlue GPS, the world's first GIS grade Bluetooth submeter GPS receiver. Later in 2007, a second generation, the SXBlue II GPS was born, adding an integrated battery pack and a USB port to the existing Bluetooth and serial ports.

Following are the excerpts of the interview with Mr. René Parisé, Vice-President of Marketing at Geneq Inc. highlighting various aspects of GPS business at Geneq.

1. "We offer the most technologically advanced products as well as the best quality/price ratio." Please elaborate

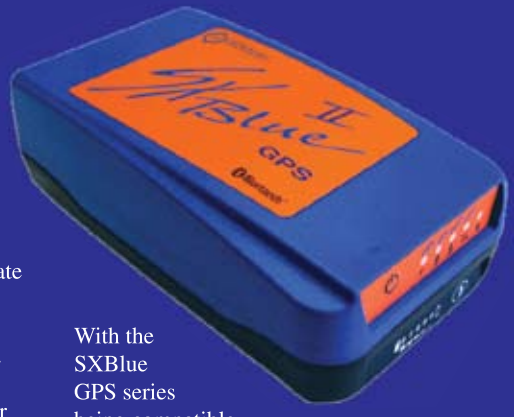
With our SXBlue GPS series, we pioneered the market for real-time, sub-meter mapping based on SBAS as the primary source of differential optimized for DGPS operations in difficult environments, like under forest canopy. Furthermore, the SXBlue GPS series require no post-processing when using SBAS signals reducing initial investment and thus keeping training for field and office personnel to a minimum.

2. What are the different products offered by Geneq Geomatics Division? What different applications do these products focus on?

Geneq focuses primarily on offering products and solutions around its SXBlue GPS series. The receivers are either sold alone for a customer to create his own mapping system based on his requirements and budget, or inside a package in our SXBlue Mapper series. We also offer companion products to complement our receivers such as laser rangefinders, rugged PDA's, radios and field data collection software. These companion products offer turnkey solutions to various types of applications such as water and electric utilities, bathymetric surveys, forestry and machine guidance, environment, land mapping and range of other applications.

3. What is unique about SXBlue GPS receivers? Are they meant for any specific kind of applications?

The SXBlue II GPS, being the world's first Bluetooth mapping grade GPS receiver redefined the structure of a typical data collection system. Using a modular system (separate computer, GPS receiver and software components) and ensuring a bulletproof wireless Bluetooth communication sets the users free not only to create the field data collection based on the needs but also to keep up with the technology.



With the SXBlue GPS series being compatible with any off-the-shelf NMEA compatible software, a big percentage of our customers have experienced the benefits of such a modular approach, either of PDA's, Tablet PC's or the new emerging UMPC's. The SXBlue GPS series is also field upgradeable through single frequency RTK to deliver a very affordable realtime centimeter level accuracy for various applications like environmental monitoring, mineral explorations, geophysics and also typical surveying.

4. How do you see the growth of GPS and GIS business in Asia-Pacific region? How does Geneq plan to tap the potential of this region?

We are very excited about the Asia-Pacific market for our products. Last September, MSAS was declared operational. Our tests confirm that the accuracy is better than we expected. We were also early testers of India's GAGAN system. In fact, we were the only mapping grade GPS system that I know of, that collected test data from GAGAN. The results were quite encouraging and we look forward to the broadcast from GSAT-4.We have distributors for India and Japan already in place and are also working on other partnerships in the region. Geneq will soon be releasing an L-Band version of the SXBlue II GPS. This would allow customers in countries like Australia not supported by SBAS signals to enjoy the same benefits of the technology. Furthermore, a single frequency (L1) RTK package will also be released to support a growing demand for high precision (cm-level) GIS applications in which surveying knowledge would not be necessary. With the Indian GAGAN signal coming back soon as the world's 4th SBAS system, the South Asia region should soon enjoy the same benefits with the SXBlue GPS as WAAS, EGNOS and MSAS users.

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The drivers for a successful take off of LBS

The LBS market, after difficult period (2000-2005) is now taking off, and all indicators are "GREEN" for further growth

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Introduction

"Location Based Services in the coming years will represent the largest market of satellite positioning". In the beginning of the 2000's , many analysts stated such forecast. The [2000-2005] period has started by an impressive "Hype" phase: High expectations towards LBS, high revenue forecasts, and certainty to have found the Killer applications. But this hype phase rapidly blocked against concrete obstacle: Too large or not well defined value chain, too difficult and expensive integration, unavailability of performing location technologies. And this resiliation trend has been strengthened by the disappointment in the consumer segment: poor customer experience, and poor customer interest for the first deployed solutions. This LBS pioneer period [2000; 2005] definitively finished by a disappointment phase. By chance, the game was not over! In the following period, between 2006 and 2007, LBS business finally started taking off, with LBS first mass success stories, like for example the deployment from the following telco:

- US : Nextel (70M loc req/month), Sprint
- Asia : SK Telecom (68MUSD revenues in 2005), Vodafone KK

Figure 1: GNSS industry stock market until 2007

This trend is clearly confirmed at macroscopic level by Figure 1.

The Telco understood how consumer services can be enriched with the location, like PoI (Point of Interest) services. In parallele, "Navigation" was growing at worldwide level, meeting great success. And first generation of mature performing technology, like Assisted GPS, became available for devices in volume. But what will be the next challenges to maintain a sustainable growth? What will be the next trends? Who could be the new players? Where are the next hurdles? Those are the questions that we will try to answer in this article.

LBS MARKET

The LBS market has been segmented into 3 main categories:

- B2C: Business to Consumer
- B2B2C: Business to Business to Consumer
- B2B: Business to Business

Details of this segmentation are provided in Figure 2.

This segmentation highlights the diversity of services that can be offered by an operator. This diversity of services is also a diversity of business model.

The LBS market has been especially boosted in the past year by the parallel

take-off of PND (Pedestrian Navigation Device) market which has enabled the education of the mass market at a large scale. Thus, it is not surprising that, on representative sample of mobile users "early adopters", one over four find "navigation" on mobile phone, a compelling offer [2], though of course many barriers remain.

As another outcome of the survey regarding LBS interest from mobile users early adopters, one over three are very interested in "find the Nearest" services.

Thus it is not surprising that the Positionning market expectations for the following years are quite encouraging, as shown in Figure 4

End user spending forecasted for location are quite significant: $4 B in 2008 to over $8.5 B by 2010. And the addressable market for LBS suppliers is around $1.3 B over next 4 years, with highest potential for operators in Asia Pacific & European markets.

But these expected success are not granted, and will be driven by many factors:

- standard
- regulatory and socio-legal drivers
- business drivers
- technological drivers

Standard is a key drivers

A. Todays situation

Todays situation, regarding LBS standard, is already the results of years of work in standardization bodies like ETSI or OMA.

Control plane standard is available, and mainly used for emergency call

Supl V1 was the 1st attempt to standard . This was a good starting point, enabling open business model but limited for certain application like tracking.

Supl V2, with richer features (Galileo compatible, tracking services compatible) is nearly available (Q3 2008) and enables also open business model.

RRLP release 7 is also available, and is compatible with suplvV2, A-GPS, and Ephemeris extension.

And for the terminal, interfaces between GPS chipset and application are already standardized: NMEA JSR 179.

B. ... and future challenges

This situation has enabled the deployment of first generation of LBS. But today standards are however quite limited, for most of the situation that will be met in the future.

How to cover the diversity of :

- wireless network (GSM, GPRS, UMTS, TETRA, WiFi….),
- use cases (fleet management, navigation, geofencing….),
- architecture (network or handset centric),
- available positioning technologies (GPS, A-GPS, WiFi ToA, WiFi finger printing, UWB, …),
- protocol for the application and services (SuPL, Control Plane, MLP, …)

This is why future actions towards standardization bodies shall focus on:

- Handset:
  - o Needs of standard between sensors and/or chipset: (WiFi, Bluetooth, inertial MEMS, …) blocking advanced hybridisation
  - o Needs of more advanced interfaces between location sensors and application
- Availability of standard on professional wireless network (TETRA, WiMAx). Current standard shall be adapted to the specificity of each network (bandwidth, gateway, …).

Example: LIAISON project [1] has pioneered A-GPS over TETRA

- 3G Long Term Evolution, 4G, new social services

Regulatory & socio legal drivers

Regulation can play a strategic role for consolidating the development of LBS. For example , regarding emergency call, different approaches have been adopted all around the world, some of them (like the US E911) being at the origin of the LBS take-off in north America:

The US E911regulation is techno agnostic, with:

a time frame for the deployment, and performance requirements (accuracy, availability). This has strongly pushed the US LBS market, and the emergence of performing positioning technologies like Assisted GPS. The equivalent European initiative (E112 regulation) is quite late

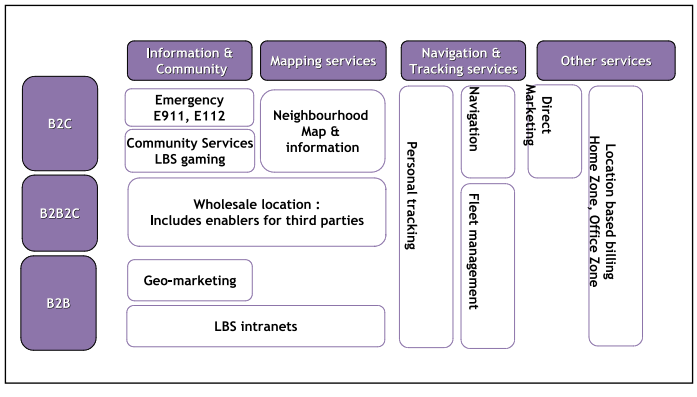

Figure 2: LBS market segmentation

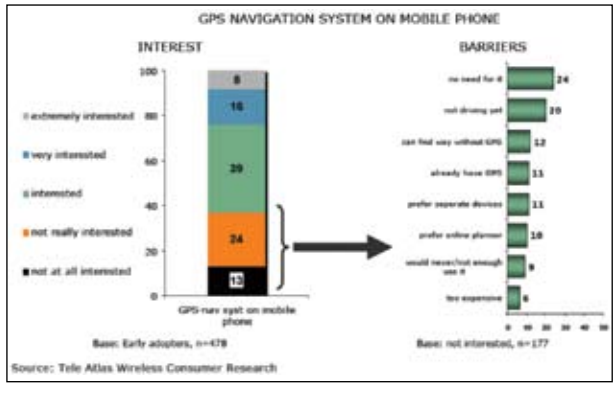

Figure 3: GPS Navigation system on mobile phones

w.r.t US, and faces many obstacles for a deployment in all European countries, on of the main obstacle being the unclear business model for such specific services. And Japan has put in place an technology driven alternative regulatory approach , that forces the integration of GPS on terminal after April 2007.

In the regulatory areas, the next challenges in the future, are:

- Transforming in Europe the chosen flexible approach of E112 into concrete deployment, through nNtional Policy
- Extending E112 regulation to professional wireless network (WiFi, TETRA, …).
- Favouring the deployment of new performing technologies (like WiMax or UWB indoor technologies) by relaxing some existing constraints: for example, why not authorizing, for emergency situation, on short period (emergency situation) higher power signals emissions in certain frequencies?
- Favouring emergence of specific market that could bring strong added value to the citizens, and will be pushed mainly by regulation: transportation of dangerous good, roach charging. Future regulation in those domain are now feasible, as adequate integrity system like EGNOS are now available all over Europe.

It shall be noticed that in most of the market, regulation is not sufficient: "Big Brother" fear remains, and in parallel of regulatory action, there is an obvious need of going on educating the market.

Blog dedicated to this goal already exists, as the one targeting LBS for professional market [3].

Business drivers

Business drivers remains also fundamental.

There is first the need of developing existing revenue streams:

- Enhancing existing service (yellow pages, advertising) through greater location accuracy;
- Provide greater customer satisfaction

New revenue streams should also be created, through offering of new services (personal tracking, social networking), dependant on high accuracy localization (availability today of more accurate GNSS system, like EGNOS).

And strong marketing effort shall be maintained, like

- Special Offers, Rebates, ..
- User education
- Sales force education
- Clear prices and business model

Technical drivers

The killer technology that really drove growth of the 1st LBS generation up to now was the development of assisted-GPS technology. But such technology, though offering positioning services in outdoor and light indoor situation, doesn't cover all the situation met tomorrow by the users.

In the future, next challenges will be:

- To accelerate implementation of high QoS (accuracy, integrity) systems: augmentation system like EGNOS could definitively be better exploited
- To develop indoor technologies well adapted (technically, operationally, economically) to LBS
- To develop cheaper, more powerful and more friendly LBS handsets (200M GPS phones end 2008)
- To improve ease to use and integrated LBS applications
- To go on extending Digital map, especially for indoor environment

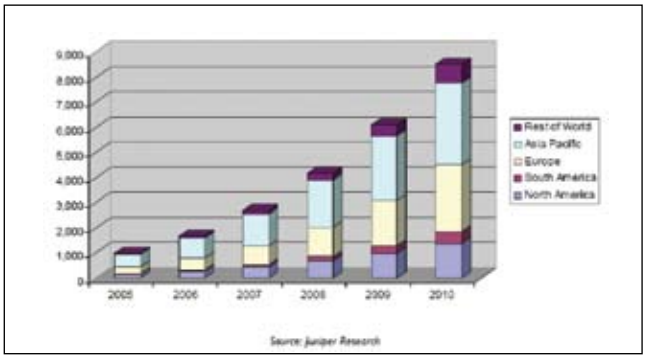

Figure 4: Worldwide LBS market forecast

Conclusion

The LBS market, after difficult period [2000; 2005] is now taking off, and all indicators are "GREEN" for further growth.

The killer technology that really drove growth of this 1st LBS generation, after 2005, was the development and availability of assisted-GPS technology.

The key drivers for next generation are: standard, techno, regulation, marketing & usability.

First generation of successful LBS is available, generates profit!… and laid the foundation for second-generation applications which will be more accurate, with better indoor penetration, and suitable for navigation purposes, as well as advertising and location-based social networking."

Acknowledgment

This paper was written in the context of the research activities of the European project LIAISON. LIAISON is a research project led by Thales Alenia Space and involving 34 other European partners, which aims at developing Location Based Services for professional markets. LIAISON has received research funding from the Community's Sixth Framework Program.

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References

[1] LIAISON *www.liaison-project.eu/*
[2] Teleatlas wireless consumer research
[3] *http://www.liaison-de.eu/.*

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INS/TACAN/ALT- an alternative solution for positioning

The system presented in the paper is designed according to the scheme of compensation and processes navigation data with use of a Complementary Extended Kalman Filter (CEKF)

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Contemporary positioning systems are usually composed of several navigation devices and an algorithm of joint data processing, which is often a Kalman filter [1, 8]. In aircraft positioning and navigation, INS/GNSS integrated systems are frequently applied [2, 3, 7]. Integration of INS and GNSS receiver via the Kalman filter presents one of the best achievements in positioning technology and one of the most successful applications of the Kalman filter. Although integration of INS and GNSS is very common, it is not the only possible option. Similar advantages can be gained in systems composed of INS and other than GNSS receiver radiotechnical devices. The presented in this paper INS/TACAN/ALT positioning system, composed of INS, Tactical Air Navigation System (TACAN) [7, 11, 12] and altimeter (ALT) [7], is an example of such an alternative solution.

Application of INS in almost all integrated positioning systems of aircraft results from the fact that it is the only navigational instrument providing for the complete set of information on position, velocity and angular orientation [2, 9, 10]. Its further advantages include good continuity, immunity to jamming and immediate response to rapid manoeuvres of the vehicle. The main drawback of INS, its unbound increase of errors along with time of operation and distance travelled by the vehicle, is the main reason for development of integrated systems, including devices which do not suffer from similar type of errors.

Errors of radiotechnical devices used in aircraft positioning, such as TACAN or radioaltimeter, are bound and can be modelled as time-uncorrelated Gaussian random sequences [1]. These devices do not suffer from typical for INS increasing positioning errors, and therefore they can be used for INS correction. As advantages and disadvantages of INS and TACAN/ALT subsystem [4] are to large extent complementary, their appropriate integration can eliminate drawbacks of both systems and make optimal use of their strengths.

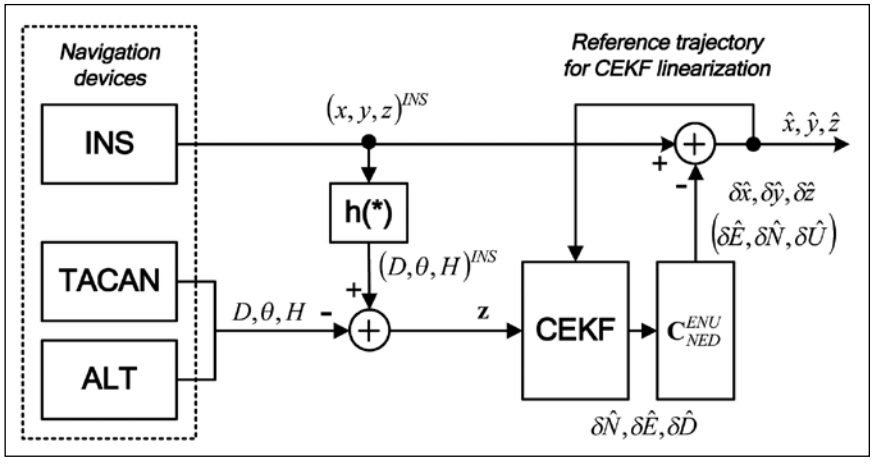

Fig. 1. Structure of INS/TACAN/ALT positioning system

Structure and operation of system

The system presented in the paper is designed according to the scheme of compensation and processes navigation data with use of a Complementary Extended Kalman Filter (CEKF). The INS/TACAN/ALT system works with a feed-forward correction, i.e. there is no feedback to INS and its errors are corrected externally. The structure of system is shown in the Fig. 1.

The INS contains accelerometers and gyros, enabling calculation of linear and angular displacement [2, 9, 10]. Velocity and position of the vehicle are obtained through initialized single and double integration of accelerations, previously

transformed from the body frame to the navigation frame of reference [9, 10]. It is assumed here, that INS position $(x, y, z)^{INS}$ will be expressed in an Earth-fixed reference frame OXYZ, with its origin at the location of TACAN ground station and with axes coinciding with the axes of the local horizontal frame of reference ENU (East-North-Up). The assumed frame is suitable for short-range systems, containing a navigation device, which measurements are to be referenced to a fixed point on the Earth's surface [10], as is the case in INS/TACAN/ALT system.

TACAN provides for measurements of distance D between the aircraft on-board equipment and the ground station

$$H = z \tag{1}$$

$$D = \sqrt{x^2 + y^2 + z^2} \tag{2}$$

$$\theta = arctg\left(\frac{x}{y}\right) \tag{3}$$

as well as the azimuth θ of aircraft with respect to the ground station. The altimeter (ALT) provides for the altitude H of aircraft above the horizontal plane OXY. The geometric relationship between the measurements and the position of aircraft is illustrated in Fig. 2.

As can be seen from Fig. 2, the relationship between the altitude H and the coordinate z is linear, whereas the distance D between the TACAN ground station and the on-board TACAN equipment, as well as the aircraft azimuth θ measured by TACAN are non-linearly related to the aircraft coordinates of position:

This non-linear relationship leads to a non-linear observation model of the system which breaches the linearity assumption of the Kalman filter [1, 2, 8]. Therefore, a Kalman filter with linearization of the observation model has been applied in the presented system. The filter is linearized around the reference trajectory (x^, y^, z^), which comes from the INS output $(x, y, z)^{INS}$, corrected with the most recent estimates of INS positioning errors (δx^,δy^,δz^). Hence, the filter belongs to a category of extended Kalman filters (EKF) [1, 8]. The name of the filter, i.e. Complementary Extended Kalman Filter (CEKF), reflects the above mentioned fact, as well as the fact that the filter exploits complementary statistical features of INS and TACAN/ALT errors to derive its estimates of INS errors.

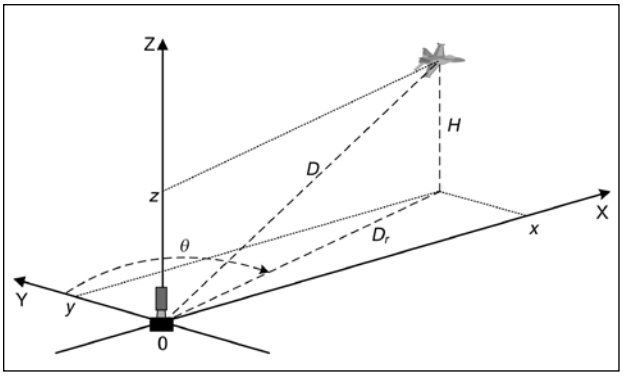

Fig. 2. Relationship of TACAN and ALT measurements to aircraft position

Two additional blocks in Fig. 1, $\mathbf{C}_{NED}^{ENU}$ and h(*), represent transformation of INS errors from NED to ENU frame of reference [2] and calculation of distance D, azimuth θ and altitude H on the basis of INS-derived user position.

Model of system

The dynamics model of the designed system describes time propagation of INS errors. Detailed INS errors models can be very complicated and may contain even several tens of states [9, 10]. However, some of the states are observable only conditionally, e.g. during manoeuvres of the aircraft, and only in high quality inertial systems [10]. Moreover, elimination of chosen states does not conspicuously affect the accuracy of integrated system, but it significantly reduces requirements with respect to the processing power of the navigation processor. Simple 9-state model of INS errors can be used in practice [1, 9], and in this design it has been further simplified to 8-state model [3]. In spite of significant simplifications, the assumed INS errors model is still applicable, especially for aircraft that do not perform rapid turns around its pitch and roll axis. The proposed dynamics model is linear, which well suits the requirements of conventional Kalman filters. The discrete dynamics model of INS/TACAN/ALT positioning system is as follows:

$$\underbrace{\begin{bmatrix} \delta N(k+1) \\ \delta v_N(k+1) \\ \phi_E(k+1) \\ \delta E(k+1) \\ \delta v_E(k+1) \\ \phi_N(k+1) \\ \delta D(k+1) \\ \delta v_D(k+1) \end{bmatrix}}_{\mathbf{x}(k+1)} = \underbrace{\begin{bmatrix} 1 & T & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & gT & 0 & 0 & 0 & 0 & 0 \\ 0 & -T/R & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & T & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & -gT & 0 & 0 \\ 0 & 0 & 0 & 0 & T/R & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & T \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}}_{\mathbf{\Phi}(k+1,k)} \cdot \underbrace{\begin{bmatrix} \delta N(k) \\ \delta v_N(k) \\ \phi_E(k) \\ \delta E(k) \\ \delta v_E(k) \\ \phi_N(k) \\ \delta D(k) \\ \delta v_D(k) \end{bmatrix}}_{\mathbf{x}(k)} + \underbrace{\begin{bmatrix} w_N(k) \\ w_{vN}(k) \\ w_{\phi E}(k) \\ w_E(k) \\ w_{vE}(k) \\ w_{\phi N}(k) \\ w_D(k) \\ w_{vD}(k) \end{bmatrix}}_{\mathbf{w}(k)} \tag{4}$$

where: x - state vector,
w - vector of random process disturbances,
Φ - state transition matrix,
δN,δE,δD - INS position errors,
δv_N ,δv_E ,δv_D - INS velocity errors,
ϕ_E , ϕ_N - INS attitude errors,
w_N, wv_N, $w\phi_E$, w_E, wv_E, $w\phi_N$, w_D,wv_D discrete random process disturbances,
g - gravity acceleration,
R - Earth's radius,
T - sampling interval of discrete model,
k - index of discrete time.

As has already been mentioned, the non-linear relationship between measurements and user position leads to a non-linear observation model of the system. It can be linearized around the corrected INS trajectory, and the following equation, representing linearized measurement model, can be formulated

$$\underbrace{\begin{bmatrix} D^{INS}(k)-D^{TACAN}(k) \\ \theta^{INS}(k)-\theta^{TACAN}(k) \\ H^{INS}(k)-H^{ALT}(k) \end{bmatrix}}_{\mathbf{z}(k)} = \underbrace{\begin{bmatrix} \frac{\hat{y}(k|k-1)}{\hat{D}(k|k-1)} & 0 & 0 & \frac{\hat{x}(k|k-1)}{\hat{D}(k|k-1)} & 0 & 0 & -\frac{\hat{z}(k|k-1)}{\hat{D}(k|k-1)} & 0 \\ -\frac{\hat{x}(k|k-1)}{\hat{D}_r(k|k-1)^2} & 0 & 0 & \frac{\hat{y}(k|k-1)}{\hat{D}_r(k|k-1)^2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 \end{bmatrix}}_{\mathbf{H}(k)} \cdot \underbrace{\begin{bmatrix} \delta N(k) \\ \delta v_N(k) \\ \phi_E(k) \\ \delta E(k) \\ \delta v_E(k) \\ \phi_N(k) \\ \delta D(k) \\ \delta v_D(k) \end{bmatrix}}_{\mathbf{x}(k)} + \underbrace{\begin{bmatrix} -v_D(k) \\ -v_\theta(k) \\ -v_H(k) \end{bmatrix}}_{\mathbf{v}(k)} \quad (5)$$

where: z -measurement vector,
v -vector of measurement noises,
H -observation (measurement) matrix,
D^{INS}, θ^{INS}, H^{INS} -distance, azimuth and altitude calculated from INS position,
D^{TACAN}, θ^{TACAN}, H^{ALT} -distance, azimuth and altitude from TACAN and ALT,
v_D, v_θ, v_H -errors of TACAN and ALT measurements, $x\hat{}(k|k-1)$, $y\hat{}(k|k-1)$, $z\hat{}(k|k-1)$ - estimated position, predicted for instance k, based on measurements up to k-1,

$\hat{D} = \sqrt{\hat{x}^2 + \hat{y}^2 + \hat{z}^2}$, $\hat{D}_r = \sqrt{\hat{x}^2 + \hat{y}^2}$

-distance and horizontal distance calculated from estimated position.

The above model has become the basis in designing CEKF for the INS/TACAN/ALT integrated positioning system. The detailed equations of the CEKF algorithm can be found in other papers of the author [5, 6].

Simulation results and conclusions

The designed positioning system has been tested via computer simulations. The simulations have included the following key steps: generation of aircraft trajectory, calculation of error-free values of distance and azimuth and altitude of flight, generation of measurement errors, addition of error-free observables and their errors, joint processing of erroneous INS, TACAN and ALT data via CEKF. The methodology of testing is presented in Fig. 3.

In the first scenario of simulations, lasting for 600 seconds, a horizontal path of flight, shown in Fig. 4, has been used. The altitude has been constant and equal 100 meters. Assumed standard deviations of TACAN distance and azimuth errors (σ_D = 90 m, σ_θ = 0.5°) are approximately equal the values of these parameters, as specified in 2001 Federal Radionavigation Plan and a companion document 2001 Federal Radionavigation Systems, both issued by the U.S. Department of Transportation and Department of Defense [11, 12]. A standard deviation of altitude errors from ALT has been set to σ_H = 10m. Chosen simulation results, comparing accuracy of INS, TACAN/ALT subsystem and integrated positioning system INS/TACAN/ALT are presented in Fig. 5-7.

From the above simulation results, one can see that INS/TACAN/ALT system is more accurate than any of its subsystems alone. The positioning errors of INS, increasing with the time of operation, have been eliminated and TACAN and ALT uncorrelated errors have been significantly reduced. One should be aware, however, that the system has an inherent drawback resulting from external INS correction. Along with time of operation, INS errors increase and so do the elements of measurement vector z. Then, the linearization of measurement model in CEKF introduces significant errors, which can even cause divergence of the filter.

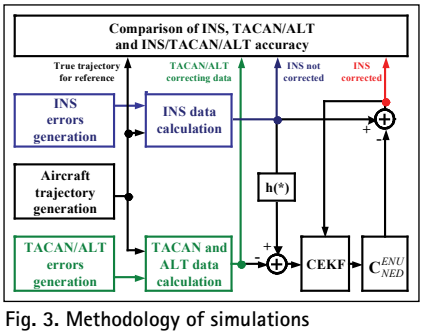

Fig. 3. Methodology of simulations

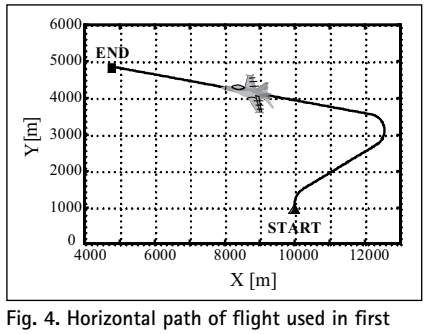

Fig. 4. Horizontal path of flight used in first scenario of simulations

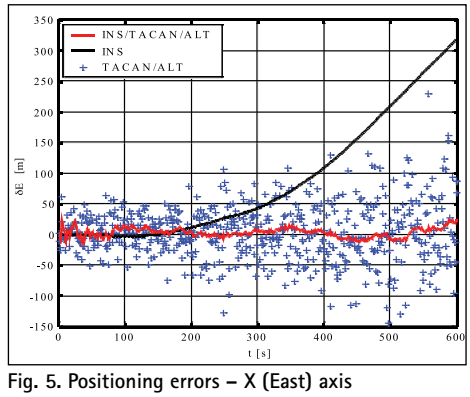

Fig. 5. Positioning errors – X (East) axis

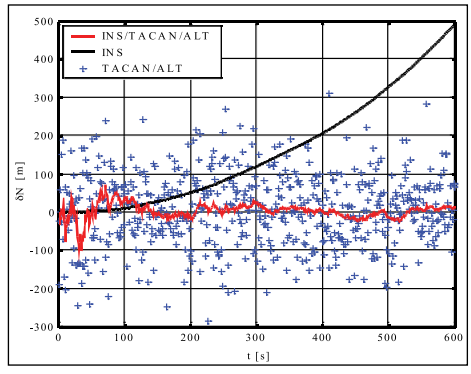

Fig. 6. Positioning errors – Y (North) axis

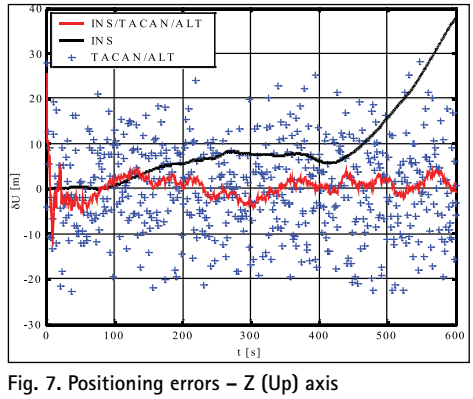

Fig. 7. Positioning errors – Z (Up) axis

This can be a serious problem especially in systems with low-grade inertial systems, especially if they are intended to operate uninterruptedly for long periods.

Divergence of the estimated aircraft trajectory from the true trajectory in an INS/TACAN/ALT system with a low-grade INS is demonstrated in Fig. 8. These results have been obtained for the second scenario of simulations, lasting for 3000 seconds. The assumed aircraft trajectory in this scenario represents an ascending spiral of radius 5000 m, starting at a point with coordinates: x = 10000 m, y = 15000 m, z = 100 m.

As can be seen, the INS trajectory quickly diverges from the true trajectory of aircraft. As long as the distance between these two trajectories is not very large, CEKF is able to properly estimate INS errors and the estimated trajectory almost agrees with the true one. After the first twist of the spiral, INS errors become too large for CEKF to properly estimate them, and the estimated trajectory goes away from the true one. This effect is further illustrated in Fig. 9-11, comparing positioning errors along individual axes of OXYZ frame of reference. One should note that the problem of divergence concerns only horizontal coordinates of position, as the vertical part of observation model is linear and does not require any linearization.

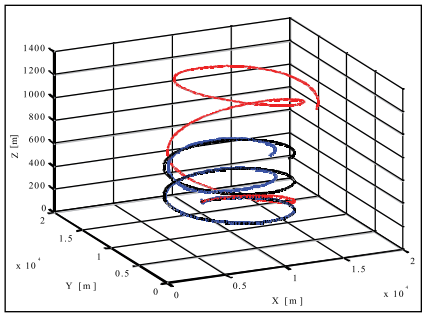

Fig. 8. Aircraft trajectories in 2nd scenario of simulations: true (black), from INS (red), estimated (blue)

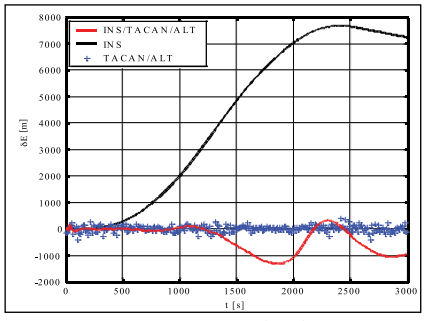

Fig. 9. Positioning errors – X (East) axis

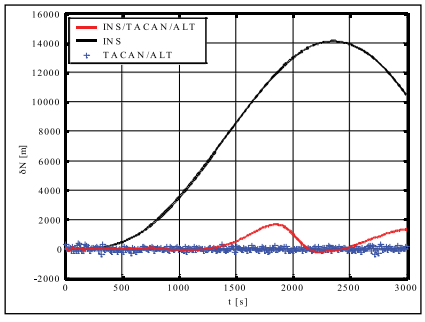

Fig. 10. Positioning errors – Y (North) axis

The above demonstrated problem of divergence in INS/TACAN/ALT positioning system does not make the open-loop configuration useless, but imposes limitations on times of operation and requirements with respect to INS accuracy. The time of uninterrupted operation of the system without divergence is dependent on the quality of INS used in the system. As times of flight of aircraft are usually relatively short, the presented system can find its applications in aviation. Nonetheless, the author has recently designed a modified, closed-loop version of INS/TACAN/ALT system, which is able to operate long without divergence even with a low-grade INS. The new system will be shortly presented in another paper.

As TACAN is a military system, the presented design is naturally dedicated for military aircraft. However, a slightly modified version of the presented system, with a pair of radiotechnical systems VOR/DME [7, 11, 12] instead of TACAN, can also be applied in civilian aircraft. VOR and DME systems are commonly used in civilian aviation and together they have functionality similar to TACAN. Maritime applications of the presented system are also possible.

Acknowledgements

This work was supported by the Polish Ministry of Science and Higher Education from sources for science in the years 2007-2010 under Commissioned Research Project PBZ-MNiSW-DBO-04/I/2007.

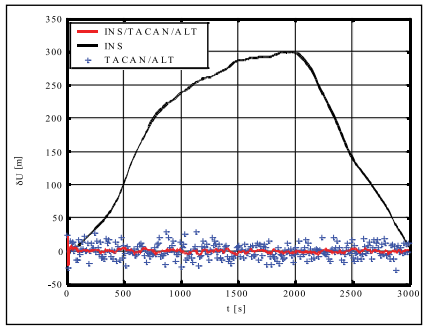

Fig. 11. Positioning errors – Z (Up) axis

References

1. R.G. Brown, P.Y.C. Hwang, Introduction to random signals and applied Kalman filtering, John Wiley & Sons, Inc., USA, 1997.

2. M.S. Grewal, L.R. Weill, A.P. Andrews, Global Positioning Systems, Inertial Navigation and Integration, John Wiley & Sons, Inc., USA, 2001.

3. P. Kaniewski, Aircraft Positioning with INS/GNSS Integrated System, Molecular and Quantum Acoustics Vol. 27, 2006, pp. 149-168.

4. P. Kaniewski, Application of Unscented Kalman Filter in TACAN/ALT Integrated Navigation System, ENC-GNSS 2007, Geneva, Switzerland, 2007, CD.

5. P. Kaniewski: Integration of INS with TACAN and ALTIMETER, Molecular and Quantum Acoustics Vol. 28, Gliwice, 2007, s. 165-177.

6. P. Kaniewski: Aircraft Positioning with INS/TACAN/ALT Integrated System, ENC-GNSS 2008 – The European Navigation Conference, Francja, Tuluza, 23-25.04.2008, DVD.

7. M. Kayton, W.R. Fried, Avionics Navigation Systems, John Wiley & Sons, USA, 1997.

8. G. Minkler, J. Minkler, Theory and Application of Kalman Filtering, Magellan Book Company, USA, 1993.

9. O. Salychev, Inertial Systems in Navigation and Geophysics, Bauman MSTU Press, Russia, 1998.

10. D.H. Titterton, J.L. Weston, Strapdown Inertial Navigation Technology - 2nd Edition, American Institute of Aeronautics and Astronautics, 2004.

11. U.S. Department of Transportation, U.S. Department of Defense, 2001 Federal Radionavigation Plan, DOT-VNTSC-RSPA-01-3/DoD-4650.5, USA, 2001.

12. U.S. Department of Transportation, U.S. Department of Defense, 2001 Federal Radionavigation Systems, DOT-VNTSC-RSPA-01-3.1/DOD-4650.5, USA, 2001.

We need more than one "GIS"

For reasons unknown, the "GIS/Geographic" has quietly crossed its rightful "domain

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It was up to 1985 that everything used to be "packed" into Land Information System (LIS). Then, more "comprehensive" Geographic Information System (GIS). Recently, another "GIS" (Geospatial Information System) is being introduced by some universities.

For reasons unknown, the "GIS/Geographic" has quietly crossed its rightful "domain". It is now more than "geographic". However, if we review closely, the "GEO" in geography seems to "engulf" all other "GEO" information systems, e.g., GUS/Geodetic, GIS/Geologic. Even "MIS" (Marine Information System" is hardly considered.

To rectify the overlap(s) and mix up of different types of information under "Geo", the following "naming " system is proposed:

- Geodetic Information System (GdIS)
- Geographic Information System (GgIS)
- Geologic Information System (GlIS)
- Geophysical Information System (GpIS).

All the above systems will become "layers" of the "Earth Information System (EIS). Under this "Umbrella", more "specific" systems, e.g., Ocean Information System (OIS), Mineral Information System (MIS) would enter.

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Land administration Trends and issues in the Asia and Pacific

19-20 August 2008 - Kuala Lumpur, Malaysia

The UN sponsored Permanent Committee on GIS Infrastructure (PCGIAP) together with the Food and Agriculture Organization of the United Nations (FAO), the Malaysian Government, the International Federation of Surveyors (FIG), the Global Spatial Data Infrastructure Association (GSDI) and the Centre for SDIs and Land Administration, University of Melbourne, were organized a two day seminar from 19-20 August 2008 as part of 14th annual meeting of PCGIAP in Kula Lumpur to discuss land administration issues and possibility of establishing an annual forum under the UN in the Asia and Pacific region. The Seminar was Chaired by Prof Ian Williamson and co-chaired by Associate Professor Abbas Rajabifard.

Over 150 people from 30 countries and 5 international organisations attended the seminar. The objectives of the seminar were:

- To share land administration experiences in the Asia and Pacific region with a focus on access to land and security of tenure, the role of land administration in supporting sustainable development, the promotion of effective land markets, poverty reduction, protection of vulnerable groups, e-land administration, land registration, cadastral surveying and mapping.

- To discuss the objectives and focus proposed by the Mongolian Round Table with a view to preparing a firm proposal to go to the appropriate UN agencies as well as the PCGIAP. It is planned to have a firm proposal and resolution to be put before the UN Cartographic Conference for Asia and the Pacific in Bangkok in 2009.

The seminar was the result of a desire by many countries in the Asia and the Pacific region to have a forum to discuss and share land administration issues, best practice and experiences in a similar manner to the Working Party on Land Administration (WPLA) for European countries organized by the UN Economic Commission for Europe (UNECE).

The focus of the seminar was developed both by the PCGIAP and a successful international workshop organized by the Mongolian Government titled “Good land administration – its role in economic development” (www.la-east.west.mn) , that was also supported by UNDP, UNECE (WPLA), GSDI Association, the International Federation of Surveyors, the Asian Development Bank, German Technical Assistance (GTZ), Eurogeographics and the National Land Survey of Sweden. A Round Table meeting was also held in Mongolia with the above agencies and a number of countries in the region to develop a draft proposal for a regular meeting on Land Administration in the Asia and Pacific region.

As part of the seminar program, there were more than 20 presentations including invited presentations from FAO - Land Tenure Service and UNECE – WPLA and also selected countries from Asia-Pacific that presented. The seminar was conducted in six sessions including an opening session, three invited speaker sessions and a special session on data integration. Each session and presentation followed with a panel discussion. The countries presented were Australia, Cambodia, Fiji, Iran, Laos, Malaysia, Mongolia, New Zealand, Philippines, South Korea, Thailand and Vietnam.

Seminar Outcomes

The final session of the seminar and a follow-up meeting were used to discuss and finalise seminar outcomes, resolutions and the report to the PCGIAP. In summary, the following items are feedback from the Seminar:

- Mongolia, Iran, Cambodia, Fiji (on behalf of Pacific Island nations), Australia, Philippines and India

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expressed strong support from senior land administration officials for the concept of an annual land administration forum

- Iran has offered to host the next land administration forum in 2009 in May (prior to 18th UNRCC- AP Conference in Bangkok in October 2009.
- Australia speaking for FIG 2010 has offered to host a Pacific forum and an Asia and Pacific land administration forum.
- Australia through Western Australia offered to co-host a WALIS Forum with PCGIAP or host a land administration forum.
- Land Administration meetings or forums must be demand driven (provides value and helps solve problems), must pursue cost sharing, focus on specific problems or be thematic.
- Be committed to long term. Building a community takes time. Must be sustainable.
- Be opportunistic and look for individual funding opportunities
- Collaboration not competition.
- A forum must be linked to the UN in some way.

From the issues and challenges presented by speakers and feedback from the Seminar to support the establishment of an annual forum in Asia-Pacific region, the seminar discussed and agreed on the following three resolutions and further agreed to forward this to the PCGIAP meeting for consideration. Following are the resolutions as modified and agreed during the PCGIAP plenary on the 22nd August, 2008.

Resolutions

1. Rename WG3 "Land Administration" with a mandate to consider land administration (land policy, land registration, cadastre, land markets) issues, spatially enabling government and their joint role in supporting sustainable development in the context of SDI.

2. PCGIAP supports an annual land administration forum and related activities focusing on land administration issues, challenges and implementation in the Asia and Pacific region.

3. WG3 will facilitate the annual land administration forum and any other related activities and will liaise with the respective agencies in the Asia and Pacific region through WG3 in the pursuit of this objective

Further information about the Seminar (background document, aims and objectives, seminar outcomes, etc.) and other related materials can be found at the dedicated seminar website *http://www.geom.unimelb.edu.au/research/SDI_research/Integrated/* or through the PCGIAP-WG3 web page (*www.pcgiap.org*).

–Associate Professor Abbas Rajabifard Seminar Co-Chair and PCGIAP-WG3 Vice-Chair (abbas.r@unimelb.edu.au

Future Cities India 2020 Competition Finals

The Ministry of Science & Technology, Government of India and Bentley Systems, Incorporated has launched the 2008-2009 Future Cities India 2020 competition finals. Currently in its third year, the competition encourages students to help prepare India's cities for the year 2020 by providing design solutions to real-world infrastructure challenges. This year's competition challenge focuses on Indian Railways' recently announced plans to redevelop 22 of its centuries-old railway stations into world-class facilities. Students must create a conceptual design plan to upgrade the New Delhi Railway station, the first facility on Indian Railways' redevelopment schedule. The program, which is open to all students attending schools in New Delhi and the National Capital Region (NCR), is sponsored by the Department of Science and Technology (DST) and Bentley Systems. Additional co-sponsors this year include McGraw-Hill Education and The American Center. Scott Lofgren, global director of Bentley's BE Careers Network, said, "Infrastructure sustains our world and serves as the interface between people and our planet. It provides the critically important facilities, services, and installations needed for the functioning of our society and the well-being of its people. Each team in the 2008-2009 Future Cities India 2020 competition must address three requirements for designing the conceptual solution:

- Use the existing land and infrastructure to best advantage,
- Accommodate internal access zones, with separate parking zones at Paharganj and Ajmeri Gate terminals,
- Use environmentally responsible materials.

During a preliminary competition held last week, a panel of distinguished judges that included Dr. Purnima Parida of the Central Road Research Institute, Ms. Meenakshi Singh of the National Capital Region Planning Board, Mr. Anuj Maitrey of Infrastructure Leasing & Financial Services Limited, and Mr. Kapil Mangla of Nirman Architects & Interior Designers, selected the following 15 student teams to participate in the Future Cities India 2020 competition finals: Team 1 KV Tagore Garden, Team 1 Manav Bharti International School, Team 1 Modern School Vasant Vishar, Team 1 APJ School Sheikh Sarai, Team 2 APJ School Sheikh Sarai, Team 1 APJ School SAKET, Team 1 Oxford School, Team 1 Convent of Jesus & Mary School, Team 1 APJ School Noida, Team 1 APJ School Pitampura, Team 1 Vasant Valley School, Team 1 Father Agnel School, Team 1 APJ School Faridabad, Team 1 AIS SEC 43 Gurgaon, and Team1 AIS Saket.Winners of the finals competition will be awarded scholarships and trophies, and the teachers and technical professionals who serve as counselors and mentors will receive awards and recognition.

For more information about the Future Cities India 2020 competition, visit www.futurecitiesindia2020.co.in.

Watch your steps!

A variety of commercial and military applications exist for the TIDGET/ZigBee, GNSS wristwatch

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The TIDGET/ZigBee wristwatch device was designed specifically to provide an ultra low-power, miniaturized wireless GPS tracking device. It includes a low-power GPS sensor, a flash memory, and a ZigBee wireless data link. The design of the device was selected to minimize the power drain to allow operation for extended periods of time. The power savings is accomplished by remoting the GPS signal processing from the sensor to the LocatorNet server. This has the advantage of minimizing the power drain within the TIDGET/ZigBee device while allowing sophisticated signal processing to be performed at the server to maximize the sensitivity of the GPS signal processing solution.

The networked system architecture for relaying data between the tracking devices and the LocatorNet Server is illustrated in Figure 1. The ZigBee devices are programmed to search for a ZigBee Gateway that provides a connection to the Internet. Once a Gateway is found, the devices upload their GPS sensor data through the Gateway to the LocatorNet Portal for processing. This paper describes the LocatorNet system architecture and the design of the ZigBee Gateways. The ZigBee Gateways have been developed to be an add-on to a standard PC providing a low-cost, secure method of connecting ZigBee to the Portal through a variety of physical network connections including wired Ethernet for fixed connections or WLAN, cellular, or SATCOM services for mobile units.

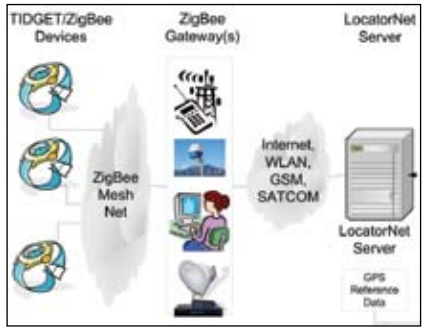

Figure 1 LocatorNet System Architecture

The LocatorNet Server provides the data processing to convert the GPS sensor data into locations. The LocatorNet Server is integrated with a Web Portal that allows users to access the sensor location data for analysis and display. This web-based architecture allows the common infrastructure to be leveraged by a variety of different users.

TIDGET/ZigBee GPS sensor

The patented TIDGET® ("tracking widget") sensor operates by taking brief snapshots of GPS data when activated [1]. These snapshots are stored in the flash memory and forwarded to the LocatorNet Server through the data link for processing [2]. The TIDGET is built using the RF front-end of a commercial GPS chip (see Figure 2). The device is designed to operate with a variety of different types of data links providing a low-power location solution. Instead of performing the GPS signal processing using an internal baseband processor, the TIDGET device only samples and records the GPS snapshots periodically. While this requires more data to be transmitted across the wireless data link, it significantly reduces the overall power drain of the device making this an ideal solution for low-power tracking applications.

The TIDGET can be programmed to take different sizes of GPS snapshots depending on the application. The larger the snapshot, the greater the ability of the LocatorNet processing to track low-power GPS satellite signals [3]. For the TIDGET/ZigBee device, a 36.4 kbyte snapshot size was selected. This allows GPS signals to be detected to a C/N0 of 26 dB-Hz (-148 dBm) with an SNR detection threshold of 10 dB. When multiple satellites are in view, enhanced signal processing can be used to detect weak signals as low as

20 dB below the strongest GPS satellite signal, down to a threshold of -156 dBm.

The TIDGET/ZigBee wristwatch device includes a ZigBee data link that can be used to connect to a ZigBee Gateway when within range. ZigBee[3] is a low-power wireless mesh networking protocol that has been designed for maximum power life. A networking protocol has been developed that allows the ZigBee wireless data link to transport the data to the Gateway where it is forwarded to the TIDGET/ZigBee Server for processing.

The normal range of operation of the ZigBee data link, using onboard or PCB antennas, is within 100 feet of a Gateway. A Gateway can be a conventional PC equipped with a ZigBee USB device and installed with the LocatorNet network upload software. While straight ZigBee dongles exist, the system design uses a TIDGET/ZigBee unit configured in a "gateway mode" connected by USB to the PC. The LocatorNet network upload software converts the TIDGET/ZigBee data into a sequence of database update commands and sends those over a TCP/IP connection to the Portal. The range between the TIDGET/ZigBee device and the ZigBee Gateway can be extended by adding an improved antenna to the ZigBee Gateway. Static directional antennas on both the node and the coordinator can improve the operational distance by a factor of 4-10, but are unacceptable for the watch unit. Larger amplified directional antennas, such as that shown in Figure 4, have allowed us to extend the high-bandwidth single-hop transmissions up to 765m, while only using the onboard PCB antenna for the TIDGET/ZigBee node The Phased Array antenna shown in Figure 4 also provides a Linux-based network router making it ideal for a Gateway unit.

As depicted in Figure 4, the TIDGET/ZigBee wristwatch unit comprises a ZigBee chip with an embedded microcontroller, a "glue-logic" CPLD programmable logic device, GPS cache SRAM, bulk-storage Flash memory, a GPS front-end RF chip, antenna and TCXO, a USB interface chip and power management circuitry. Each captured GPS snapshot requires 15mJ to acquire

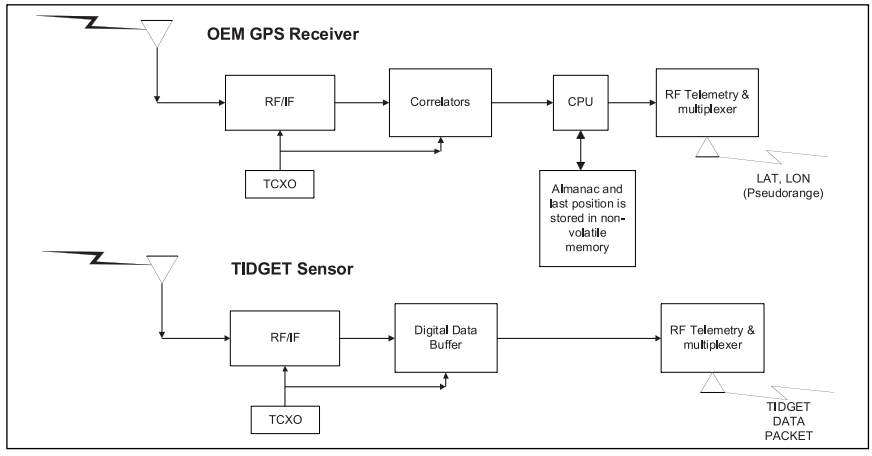

Figure 2 TIDGET Sensor

under all circumstances. To transmit the data to the Gateway, the circuit will consume between 70mJ and 231mJ per snapshot depending on range and signal environment. Total battery energy available to the device is 2000 Joule.

Locatornet portal

The LocatorNet Portal is based on an Oracle Application Server. The ZigBee Gateway software is designed to "publish" data into the LocatorNet Portal which initiates a data processing sequence using the LocatorNet Server signal processing software. The LocatorNet Server GPS processing is implemented

Figure 3 Extended Range ZigBee Connection

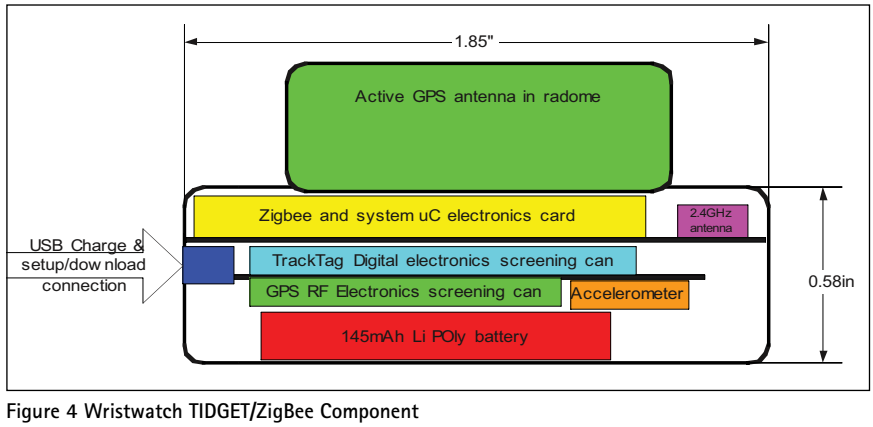

Figure 4 Wristwatch TIDGET/ZigBee Component

using an SDR architecture where the GPS signal generation and code correlation functions are performed in software. The GPS Navigation data is loaded into the LocatorNet Portal from reference station sites across the Internet allowing world-wide tracking of GPS data. The LocatorNet Portal also can access digital terrain data allowing altitude-aided solutions to be

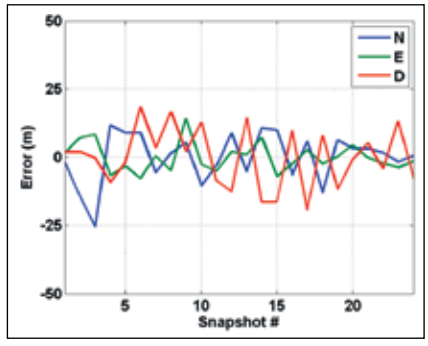

Figure 5 Snapshot NED Comparison to Reference

calculated in the event that only three GPS satellites are tracked. Figure 5 and Figure 6 illustrate the navigation accuracy provided a CEP of 5.14 m. As shown in Figure 7, the LocatorNet Portal also supports Location Based Services (LBS) based on the TIDGET solution data using an Oracle Mapping Server with an open architecture Open Geospatial Consortium (OGC)[5] compliant web service based design approach. OGC have developed a family of web services that can be used for sharing and distributing mapping and feature data between web servers. This includes Web Mapping Service (WMS), Web Feature Service (WFS) and OpenGIS® Location Service (OpenLS).

A variety of different WMS data feeds are already available on the web from public sources and more are being added. Examples of some of the data that has been linked into the LocatorNet Portal are shown in Figure 8 through Figure 12. Figure 8 shows current TIDGET data for a user's area of interest that has been extracted from the local LocatorNet database. In Figure 9 the user adds in vector street data to provide location context. This street data is stored on the server database, and thus is available even when the server is not able to access the Internet – useful for some mobile and military applications. In Figure 10 the user has requested a USGS supplied topographic map overlay in lieu of the vector streets. This data was requested on-the-fly from the USGS through the Internet [6]. Figure 11 shows a high-resolution aerial image obtained from another USGS Web Map Service as the background [7]. Lastly, Figure 12 shows how remote data services can also provide time-sensitive information – in this case Doppler radar data [8].

Example locatornet application

Figure 13 illustrates a basic LocatorNet personnel tracking LBS application. This application was developed based on an Oracle Application Server and iSMART5 mapping server, together with some custom web pages. The Oracle Application Server and database maintains data integrity and security, allowing users access to only the data they need. Oracle Spatial database extensions were used to quickly provide spatial querying capabilities; users can ask questions such as "Who is near the intersection of Powers Blvd and 30th Street," or "Where was User X at 2pm yesterday?" By making use of live WMS feeds such as Doppler radar users can even make queries such as "Was User X being rained on a 2 pm yesterday?"

The flexible LocatorNet LBS architecture allows additional mapping and feature content to be easily added for customized applications. Maps, images, and features from WMS, WFS, and WCS sources can easily be added into location based services. The open architecture also allows content to be shared through OpenLS standards.

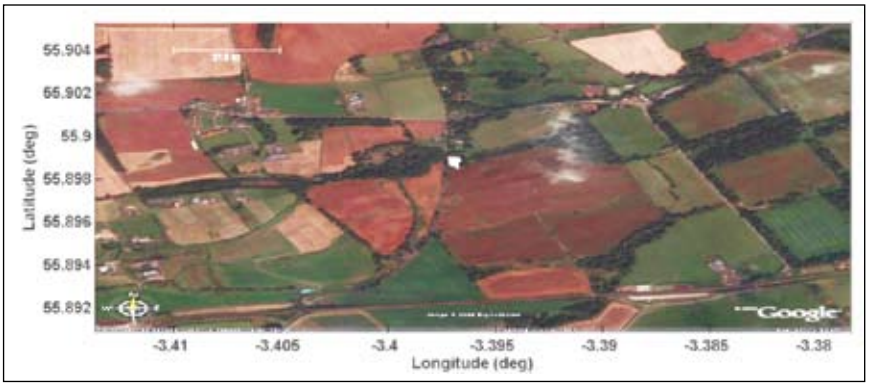

Figure 6 Snapshot Position Solution

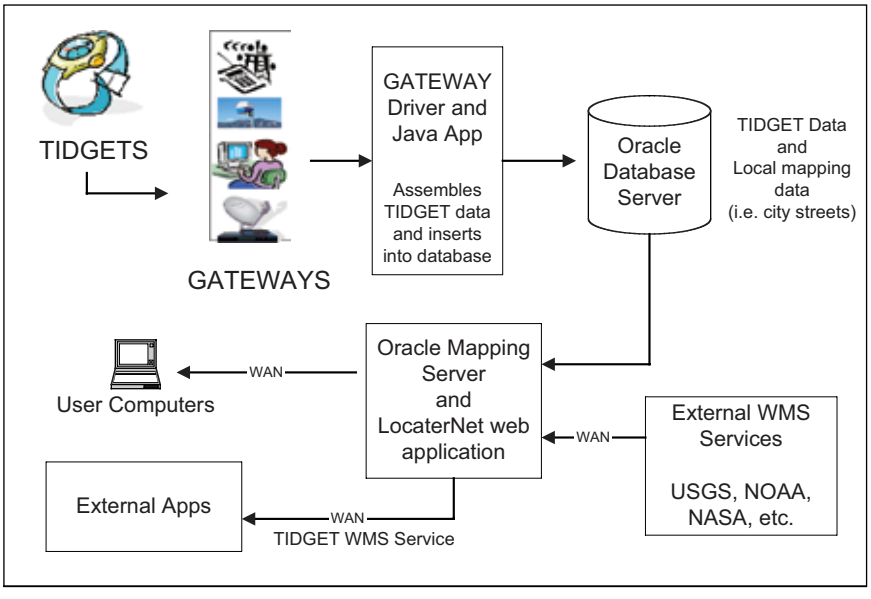

Figure 7 LocatorNet LBS Architecture

Conclusion

The TIDGET/ZigBee tracking sensors have the following advantages over previous GPS tracking solutions.

- Ultra low-power design enabling operation for 30 days using a wristwatch size device and battery
- Wireless networked connectivity using low-cost COTS ZigBee devices
- Improved ZigBee data transfer reliability using an enhanced ZigBee transmission protocol

The open architecture, standard-based design approach for the LocatorNet server has the following advantages for offering Location-based services

- Web-based access and display of the TIDGET/ZigBee tracking results using only a thin client
- Powerful search and query engines using Oracle's geospatial application server
- Rich feature content through integration with OpenGIS web services
- Flexible web based user interface

Figure 8 TIDGET/ZigBee Data

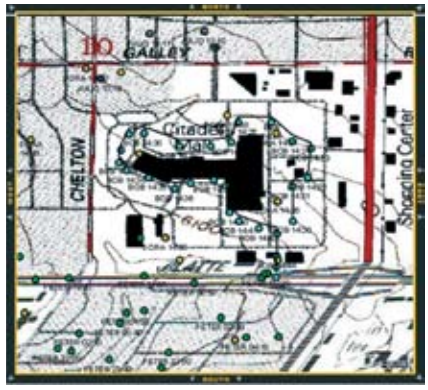

Figure 11 High-resolution Aerial Imagery pulled over the internet from another USGS Web Map Service

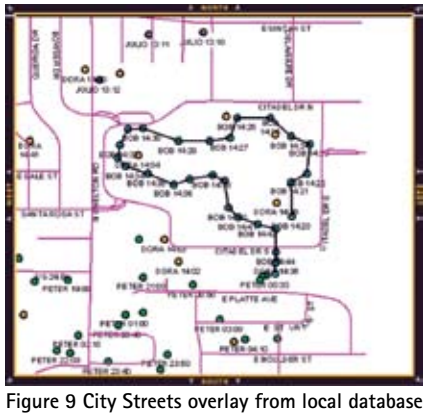

Figure 9 City Streets overlay from local database

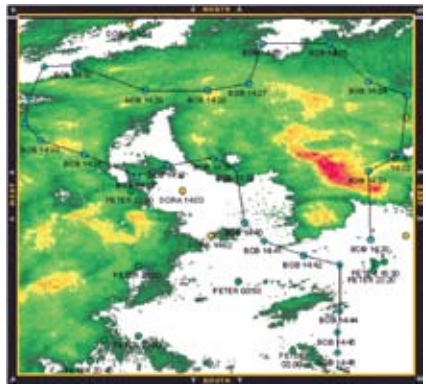

Figure 12 Live Doppler radar pulled over the internet from a NOAA Web Map Service

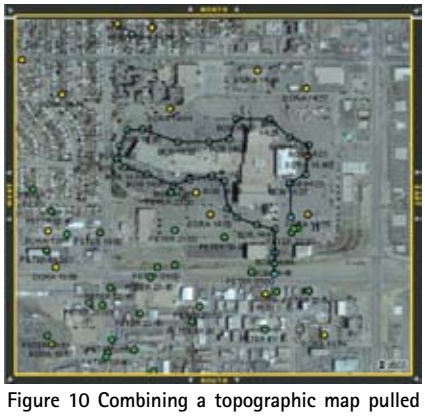

Figure 10 Combining a topographic map pulled over the internet from a USGS Web Map Service

design for rapid implementation and deployment of web based services

- Secure data management for maintaining privacy and managing access to TIDGET/ZigBee tracking data

A variety of commercial and military applications exist for the TIDGET/ZigBee tracking unit and the LocatorNet Location-based services. The first TIDGET/ZigBee system is being developed for the U.S. Army TATRC for use in clinical trials. Its initial use is envisioned as a hospital type bracelet that will be used to collect the location and time of treatment applied to trauma patients in support of clinical trials. Other applications for the TIDGET include embedding in other wireless devices which require low power operation and location operation, such as 3G cell phones, or for geotagging sensor data or images, for example in digital cameras. NAVSYS is currently working with industry partners who are interested in producing and distributing the TIDGET devices for a variety of commercial applications.

Figure 13 LocatorNet Application

Acknowledgments

The authors would like to acknowledge the support of Dr. Gary Gilbert and TATRC who have provided funding to support the development of this technology.

References

[1] A. Brown, "The TIDGET – A Low Cost GPS Sensor for Tracking Applications," ION 5th International Technical Meeting, Albuquerque, September 1992

[2] GPS tracking system, United States Patent 5,379,224

[3] A. Brown, M. May, B. Tanju, "Benefits of Software GPS Receivers for Enhanced Signal Processing," GPS Solutions 4(1), Summer, 2000 pp 56-66

[4] ZigBee Specification v1.0, ZigBee Document 053473r00, Version 1.00, ZigBee Alliance dated December 14, 2004.

[5] Open Geospatial Consortium, http://www.opengeospatial.org/

[6] Via http://terraserver-usa.com/

[7] Via http://terraserver-usa.com

[8] http://maps.customweather.com/image?VERSION=1.1.1&REQUEST=GetCapabilities&Service=WMS

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MX	5.8 m	23 km	5 days
Cartosat-1			
PAN	2.5 m	27 km	5 days

Tiannmen Square (Cartosat PAN - 2.5 m)

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Oil spills pollution

The purpose of this study was to locate most oil-threatened areas and to document occurrences of oil spills through the production of space oil spills Atlas in the Arabian Gulf, offshore UAE

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The influx of oil from tankers and offshore oil operations are amongst the major causes of pollution in the marine environment (U. S. Coast Guard, 1990). Ballast water and other oily water discharged into the Arabian Gulf ranged between 400,000 and 750,000 tones in 1986. There have already been several remarkable accidents in the Gulf region involving the loss of large quantities of crude oil from disabled tankers (Table 1, Figure 1). Even a small spill can cause havoc to the ecologically sensitive environment.Intentional or accidental oil spills, ballast water discharge, dredging and infilling for coastal development, and uncontrolled sewage and industrial wastewater discharges present real threats to the marine environment in the Arabian Gulf region. Oil discharged from ships imposes a much greater long-term threat to the marine environment than one big accident. Monitoring illegal oil discharges is thus an important component in ensuring compliance with marine protection legislations and general protection of the coastal environments.

This contribution documents the detection by means of satellite imagery, direct hydrocarbon pollution (such as big spills by tanker accidents), discharged oil caused by routine maintenance, and leaking oil from offshore exploration and development operations. Satellite-borne sensors have varying electromagnetic sensitivities characteristics with different limitations for detecting marine surface features. Therefore a combination of sensors is required to monitor marine oil pollution effectively. This case study indicates that most oil spills are found along the major shipping routes and in anchorage area, as well as in those areas with intensive large-scale oil production activities with leakage or tank-washing discharges. The results will show locations of potentially vulnerable areas, and serve as an alarm system for the implementation of effective routine monitoring operations along the UAE offshore.

The aim of this study is to determine marine and coastal affected areas in the events of oil pollution, through the compilation and editing of the first satellite image Atlas for oil spills in the UAE, in a standard GIS format for the West and East coasts of UAE.

Study areas

The study areas are situated in the Arabian Gulf. -It is a shallow sea with its long axis oriented in NW-SE direction, and its average water depth is about 36m. The Evaporation and wind are the main driving forces for water circulation in the Arabian Gulf. Evaporation is stronger in winter due to high wind speed, than summer when the water surface temperature is higher. The overall circulation in the inner Arabian Gulf is cyclonic, with relatively fresh water entering through the Strait of Hormuz.

The study areas have one of the busiest and most important tanker shipping lanes in the world; one ship passes the strait approximately every 6 minutes, another statistic indicates that more than 40 % of the world's total oil transportation passes through the region. About 15.5 million barrels of oil per day is transported through the Strait of Hormuz. Contamination influx is mainly from tankers releasing ballast, tank cleaning, and leakage from drilling rigs and production

No	Date	Volume of spilled oil (tones)	Oil type	Location
1	2001/01/14	1,300 – 1,500	Fuel	1 mile offshore Jabal Ali
2	2001/01/24	300 – 900	Heavy	7 mile NE offshore Abu Dhabi
3	1998/01/07	5,000 – 10,000	Crude	5 miles offshore Ajman
4	1994/03/30	16,000	light	9.6 miles offshore Fujairah

Table 1: Major oil spill incidents offshore UAE

platforms, and maritime accidents.

Located at longitude 52oE and 56o45'E, latitudes 24o15'N and 26oN, the study area covers two sub-areas -one offshore of Abu Dhabi and northeast wards to Ras al Khaimah in the Arabian Gulf, and the other offshore Fujairah in the Gulf of Oman (Figure 1).

Methodology

More than 300 satellite images have been examined during this study (Table 2). ERS-1/2, RADARSAT, and ENVISAT C-band SAR data has been used for the great majority of oil spill detection operations. However, other satellite images including optical sensor images have shown good detection capabilities. Therefore, we looked for all available image data archives and selected more than one hundred images derived from different platforms that covered most of the offshore waters of the UAE. We conducted a search of ERS-1 and 2 data archives to compile a list of all images acquired over the study areas. To evaluate their suitability for slick detection, historical wind conditions for corresponding SAR images were obtained. For each acquisition date, surface wind speed histories were reconstructed using historical records.

The method used for image data analysis is based on manual interpretation. We start by defining target areas based on historical records and on personal observation, then we select imageries satisfying minimum wind conditions and covering study areas, we reconstruct surface wind speed histories, geometric image transformation, image contrast/brightness manipulation to optimize slick discrimination, an overlay analysis incorporating oil well location layer to discriminate ships and oil production facilities. Finally we perform manual image interpretation to discriminate various oil slicks and conduct the comparison between different satellite sensors (Berry, 1995). Some field pictures of historical oil contamination in the UAE waters were obtained from NOAA historical oil spills information.

Results and discussion

The manual interpretation results indicate that certain coastal areas of the UAE face frequent oil spills. Striking examples of oil slicks are shown on figure 2, offshore Fujairah (centered at the coordinates 25o30'N/56o25'E). Here considerable spill concentrations have been found within successive JERS-1 OPS, Landsat-7 ETM+ images and ERS-1/2 SAR browse images. Figure 2 compares images from 29 June 1992, 21 May 1995 and 28 May 2000 for the same area of offshore Fujairah. Oil discharged from both anchored and moving vessels can be observed in each image. Immediately after discharging flush ballast water, the simmering water surface can be seen as bright silver to gray colour patches on the surrounding water. Based on the size of the image pixel, most of the vessels are super tankers whose hull is more than 300 m in length.

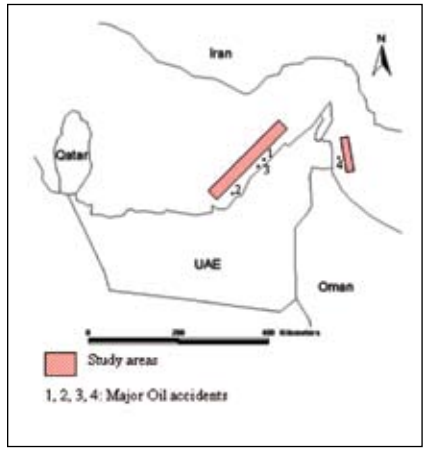

Figure 1: Demonstration Study Areas. Remarkable Oil accidents in the Gulf region

SATELLITE SYSTEM	NUMBER	SENSOR	Band Wavelength	Ground Resolution	DATE
JERS-1 (Japan)	64 scenes	SAR	L (23.5cm)	18m	May 1992– July 1996
Shuttle Imaging Radar (US)	37 segments	C/X-SAR	C (5.6cm), X (3cm)	10m	1998
ERS-1/2 (EU)	15 scenes	AMI (A, D)	C (5.6cm),	12.5m	April 1996 – May 1999
Radarsat (Canada)	3 scenes	SAR (A, D)	C (5.6cm),	25m	Oct. 2001 – May 2002
Envisat WS (EU)	7 scenes	ASAR (A, D)	C (5.6cm),	150m	July 2003
Hexagon KH-9 (US)	12 scenes	KH-9 camera	N/A		Nov. 1973 – Aug. 1977
Landsat-7 ETM+ (US)	15 scenes	VIS, IR, TIR	0.525-0.605 0.63-0.69 0.75-0.90 10.40-12.5µm	30m, 60m	2000
JERS-1 OPS (Japan)	92 scenes	VNIR,	0.52-0.60 0. 63-0.69 0.76-0.86 1.60-1.71µm	24m	June 1992 – May 1995
Terra ASTER (Japan/US)	95 scenes	VNIR	0.52-0.60 0.63-0.69 0.76-0.86 0.76-0.86µm	15m	June 2001 – July 2002
Shuttle Handheld Camera Photographs	50 photos	Shuttle Photograph	N/A		1998

Table 2: Satellite imagery investigated during the study project

Fujairah Port Authority has introduced Fujairah Offshore Anchorage Area (FOAA) since February 1993 to restrict and prohibit anchoring in the area from Bidiya (north of Khor Fakkan) to Dibba. Shipping routes bordering the UAE with relatively frequent incidences of oil spills include the offshore area running parallel to the coast of Abu Dhabi, Dubai, Sharjah and Ajman, where intensive oil production activities exist, and the routes through the Strait of Hormuz. Attention was focused on monitoring natural seepage of oil in the area with coordinates 54° 00′ E/25° 15′ of the offshore of Abu Dhabi. The analysis was carried out using images from, ERS-2 SAR, and RADARSAT-1 SAR images.

Beside the SAR images, other sensors were tested to detect oil slicks in the study areas. In the thermal infrared band images an oil slicked surface shows a lower brightness temperature than the surrounding clear water surface (Figure 3). The image data observed at night time is a more reliable method for determining water temperature because it avoids the influence of solar illumination on the difference between seawater and oil slicks.

This study is probably the first time that oil pollution has been monitored and mapped at National level over quite a wide sea area in the UAE, using high spatial resolution satellite images of varying sensor types. Standards followed to produce the atlas follow international standards; well known international examples (Al-khudhairy, 2002; European Commission, 2001) were consulted. Examples of maps appearing in the oil spills Atlas are presented in figures.

Conclusion

Results of this study demonstrate and confirm that the offshore UAE faces frequent occurrences of oil spills both in the Arabian Gulf and the Gulf of Oman. In particular offshore Fujairah in the Gulf of Oman there are considerable spill concentrations found in the multi-temporal image analysis. The spills are thought to be caused by high oil content ballast water discharged from giant oil tankers. It is worth stressing here that the identification of such areas is an important step for any effective monitoring scheme based on space-borne imagery, which is attainable with the current acquisition conditions.

Shipping routes bordering the UAE with relatively frequent incidences of oil spills include the offshore area running parallel to the coast of Abu Dhabi, Dubai, Sharjah and Ajman, where intensive oil production activities exist, and the routes through the Strait of Hormuz. The analysis showed numerous small oil slicks caused by natural seeps from the seafloor. Visual overlay analysis revealed a close relationship between spills, oil fields and shipping routes.

The production of the actual oil Atlas is a milestone on the road to achieve an early warning system against oil pollution in the Gulf. Gulf States coastlines host most of its capitals, greatest cities and water desalination plants making them highly vulnerable to any offshore oil accident.

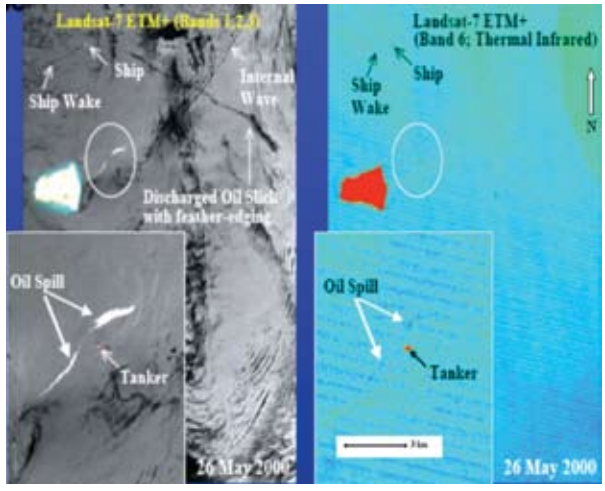

Figure 3: Comparison between Landsat-7 ETM+ visible bands composite and thermal infrared band images.

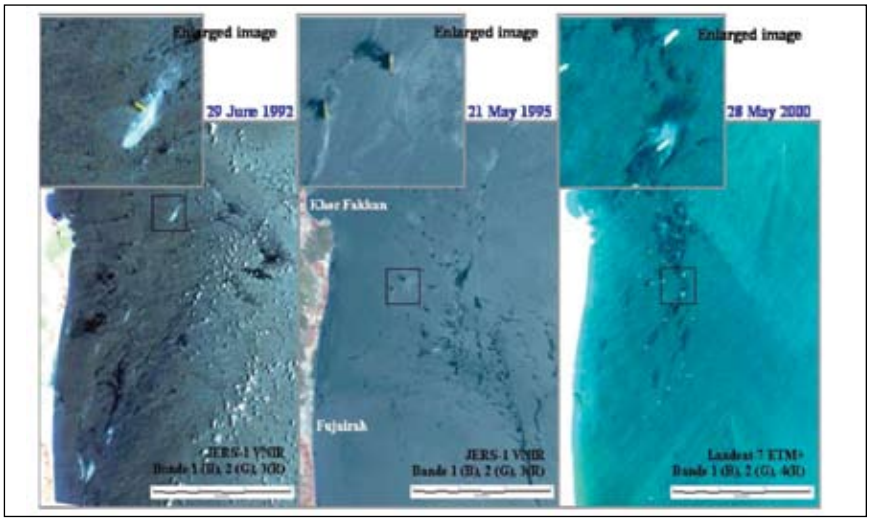

Figure 2: JERS-1 OPS and Landsat-7 ETM+ showing oil discharged, offshore Fujairah, oil tankers anchorage points in the Gulf of Oman. Images are from 29 June 1992, 21 May 1995 and 28 May 2000

References

Berry, J. L., 1995. Detecting and evaluating oil slicks on the sea surface. Space Congress on Remote Sensing for Oil Exploration and Environment, 23-24 May, Bremen, Germany, pp. 90-110.

Al-khudhairy, D. H. A, 2002. Marine oil pollution: Technology and methodologies for detection and Early Warning, European Commission, Italy.

European Commission, 2001. A Mediterranean Sea surveillance system using satellite imagery in order to detect and monitor oil slicks, http://ramses.esrin.esa.it

U. S. Coast Guard, 1990. Update of inputs of petroleum hydrocarbons into the oceans due to marine transportation activities. National Research Council, National Academy Press, Washington, D. C.

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Geography in Action

ESRI's International User Conference draws more than 14,500 attendees

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In his opening remarks at ESRI's 28th annual international user conference, company president Jack Dangermond presented his views on the impact of GIS in promoting a sustainable future. "While we face many problems today, GIS is a proven technology that allows us to better analyze and understand the underlying conditions that have lead to many of these problems and apply methods that can mitigate them. Geography in Action isn't simply a phrase; it is a methodology for creating a sustainable future. GIS technology is beginning to make a difference, changing the way we see and do things. But more than technology is required. It will take vision, dedication, and hard work. GIS professionals working together can implement this new approach and create a sustainable future for everyone."

Peter Raven, noted botanist, environmentalist, and president of the Missouri Botanical Gardens, gave the keynote speech at the conference. Raven's talk focused on the need for biodiversity and species preservation and he praised the use of GIS in contributing to the efforts of those involved in these conservation activities.

The capabilities of ESRI's ArcGIS Server 9.3 provided the thousands of attendees with a look at a powerful platform to meet the increasing need for enterprisewide GIS solutions. Demonstrations included the provision of a common operational picture for multiple agencies involved in an emergency situation and the integration of different basemaps and operational data for the construction of a mashup for Web 2.0 distribution. By using the new ArcGIS API for JavaScript extension, Web developers can integrate ArcGIS Server map, image, data, and geoprocessing services with Google Maps and Microsoft Virtual Earth applications. ArcGIS Image Server was used to demonstrate dynamic image processing for GIS analysis and display. Looking ahead, ArcGIS Server 9.4 will continue to extend the platform's scalability and security by expanding UNIX/Linux and Java support, dynamic map performance, and rich Internet application support (Flex).

Peter Raven, president of the Missouri Botanical Gardens, presents the keynote speech at the conference

Acknowledging excellence in GIS applications and implementations from the user community is a time honored tradition at the ESRI user conference. This year, the President's award went to the City of Philadelphia. Making a Difference awards were presented to U.S. Secretary of the Interior Dirk Kempthorne and Rosario Giusti de Pérez and Ramón A. Pérez, architects/urban designers from Venezuela. The Centre for GIS in Qatar won the Enterprise Application Award.

Once again, the Map Gallery proved to be a major attraction at the conference. With more than 900 maps and nearly 20 special displays in this year's exhibition, gallery traffic was predictably high. Included in the special displays this year was NASA/JPL—This World and Others: GIS at NASA, National Geographic Maps, and The United Nations Showcase: One UN.

Several seminars and preconference events were held during the weekend prior to the conference. The 2008 ESRI Survey & Engineering GIS Summit offered presentations given by celebrated keynote speakers. Colonel David Madden, commander of the Global Positioning Systems (GPS) Wing at the Space Missile Systems Center, discussed the large avionics integration and installation program at the U.S. Department of Defense, and Timothy McCormick, senior vice president for Dewberry's Hazard Engineering and Geospatial Services Group, spoke about GeoFIRM, the company's flood mapping solution.

At the Census Summit, Keynote Speaker Dr. Paul Cheung, Director of the United Nations Statistics Division, discussed the 2010 World Population and Housing Census Programme. "GIS is getting so important, the statistical community must wholeheartedly and aggressively embrace this technology," he said.

–Jim Baumann (jbaumann@esri.com)
Jim writes about international GIS-related topics for ESRI.

US PND market doubles in Q2

Shipments of portable navigation devices (PNDs) in the United States almost doubled in the second quarter (Q2) of this year at 3.7 million units, compared to the 2.8 million units in Q2 2007, but prices are still dropping, according to market research firm Canalys. At this time last year, unit volume shipments were depressed following an inventory build-up resulting from extremely high sales into the channel in the final quarter. While shipments have grown, Canalys estimates that average selling prices have dropped approximately 40 percent drop year over year.

Canalys estimates that Garmin remained the US market leader with 47% share, up 4% on its Q1 position, but down slightly on the 50% it had a year ago. TomTom, in second, saw year-on-year growth substantially above the market average, almost trebling its shipments, and giving it a share of 25%. Despite this high growth, this was down on the 28% it had in Q1, meaning that Garmin increased its lead by several percentage points sequentially. Magellan retained its third place with a reduced 11% share. These three vendors have consistently taken more than 80% of the market for several quarters. Outside of the top three, several vendors posted high year-on-year growth, notably Mio Technology, Navigon and Nextar, albeit on much lower volumes. *www.canalys.com*

MapmyIndia's GPS Navigator launched in Kerala

MapmyIndia announced the launch of their "sophisticated" all India GPS device, MapmyIndia Navigator, in Kerala. Rajesh Mehta, Vice President, CE Info Systems (P) Limited, promoters of MapmyIndia, said with this new in-car GPS navigation device, "travel anywhere in Kerala or India will become comfortable, easy and secure." *www.business-standard.com*

Palm unveils Treo Pro to Battle iPhone and BlackBerry

After leaking a presentation of its newest smartphone, Palm Inc unveiled Treo Pro, the handset described by the company as "the best looking Palm ever." Palm developed the Treo Pro in order to keep the pace with rival producers such as Research In Motion's BlackBerry and Apple Inc.'s iPhone. *www.efluxmedia.com*

Nokia takes Navigation to the next level with Nokia 6210 navigator

Nokia has introduced Nokia 6210 Navigator in India, first GPS-enabled mobile device with an integrated in-map compass for pedestrian guidance. It comes with Nokia Maps 2.0 and offers real-time voice and visual turn by turn guidance using in-built GPS support, optimized one-box map search, 2D/3D and night mode map views, opportunity to tag and share your favourite locations, save and share routes amongst many other interesting features. It comes pre-loaded with maps of 8 cities in India and a 6 months navigation bundle.

SatNav ties up with RT Outsourcing

SatNav Technologies, company in Navigation and GPS Technology in India has tied-up with RT Outsourcing as their service partners. RT Outsourcing will serve the SatNav customers who own company's GPS Devices. RT outsourcing is an end - to - end warranty service provider with a presence across several dozen locations in India. With 3500+ staff strength, it is an ISO-9001 company with its head office in Okhla, New Delhi. The company has a state-of-the-art Call Centre and Technical Support Centres in New Delhi and Noida (India). *http://news.moneycontrol.com*

LG unveils 8 megapixel phone with GPS

LG has announced the launch of the LG KC910 touch screen handset. This slim touch camera phone claims to be the successor to the LG Viewty. It comes with an 8MP auto-focus camera that uses Schneider-Kreuznach optics and has a Xenon flash; it's able to record video with VGA (30fps), QVGA (120fps) quality, ISO sensitivity of up to 1600. The phone is fully equipped with Dolby sound, DivX and XviD for video playback, built-in GPS, a geotagging feature for photos, multiple codec support and much more. *http://infotech.indiatimes.com*

TomTom goes full gear with connected services in Europe

At the IFA trade show in Berlin, TomTom unveiled a line of connected Personal Navigation Devices (PNDs) for the European market. The range of "TomTom GO x40 LIVE" (three models: GO 540, 740, 940) will start at €349 and the "LIVE" service subscription will cost €9.95 per month. These models will be available in Germany, UK, France, Netherlands and Switzerland during the autumn.

Loopt switch from Tele Atlas to Navteq for Verizon Wireless

Navteq has said Loopt, a developer of location-based social networking applications, is now using its map data. Loopt was initially launched in 2006 and has been using Tele Atlas map data until now. Tele Atlas and Navteq are aggressively competing to seduce mobile LBS start-ups which might generate tomorrow an important source of revenue – today mobile LBS applications account only for a few percents in Tele Atlas and Navteq revenue and most of it is generated from navigation applications *.www.gpsbusineesnews.com*

Panasonic HDD Navigation System

Panasonic introduced its latest HDD Navigation system, dubbed CN-HW830D. Apart from guiding you with directions this Navigation system connects to the iPod and can play anything from an Audio CD to a DVD. This 2 din system features an 800 × 480 pixels 7 inch touchscreen, SDHC card slot, Bluetooth connectivity and a TV tuner. It bundles up a GPS with 3D display of the routes.*www.techgadgets.in*

EMRI joins hands with GEOMED for enhancing emergency response service

Emergency Management and Research Institute (EMRI) and GEOMED Research Forschungsgesellschaft mbH signed an MoU to work together on shared goals regarding the improvement of GIS based emergency health systems data utilization and related research and emergency response services internationally.

GEOMED's focus is on the development and application of geography-based methods and technologies in public health and health care. Research and development projects deal with planning and allocation of resources in emergency or secondary care, innovative health monitoring and surveillance applications or decision support in the context of urban health. Continuous cooperations exist with research institutions, health services and authorities across Europe, Northern America as well as in India and China.

PHR to map health medical centres with GIS in Yemen

Yemen Partners for Health Reforms (PHR) project funded by the United States Agency for International Development (USAID), is training a group of decision makers in the Health Ministry Bureau, launched a course to target provinces that are instructed in the use the GIS in order to map the health medical centers in all Yemen's provinces. *www.yobserver.com*

AU Professors to evaluate GIS project

To ensure quality and take guidance in the implementation of the GIS project, the Vijayawada Municipal Corporation (VMC) is contemplating hiring the services of faculty of the civil engineering department of Andhra University. The VMC had asked the civil engineering department to evaluate the job of Hyderabad-based Speck Systems, which was entrusted the task of satellite imaging of the city. The VMC would enter into a Memorandum of Understanding (MoU) with the civil engineering department of the university shortly. the latter would play the role of a 'third party' in implementing the project. *www.thehindu.com*

Indian Ministry of Rural Development to implement NLRMP

The Government of India has decided to use technologies such as GIS and GPS for updating records and conclusive titles in the rural areas of the country. The scheme envisaged by the department of land resources (DLR), under the ministry of rural development, would provide land titles to more than 950 million rural population, relying on high-resolution satellite imagery. The ministry plans to work with state governments to replace the present system of registration of land deeds and documents as provided for in the Registration Act.

CIST, China wins contract for Aerophotogrammetrical Surveys

China Information Security Technology, Inc. has announced that the Company has been awarded two contracts to construct aerophotogrammetrical surveys and digital maps for China's Bureau of Land and Resources. One contract, for the city of Nanning, in Guangxi Province, is valued at $1.3 million and the other contract for the city of Jiaxing, in Zhejiang Province, has a contract value of $3.3 million. CIST expects the contracts to be completed by October 2008. The contracts will require production of Digital Elevation Models (DEMs) and Digital Orthophoto Quadrangles (DOQs), which are often used in Geographic Information Systems. *www.chinacpby.com*

Intermap Technologies introduces New Malaysia Mapping Program

Intermap Technologies has announced that the Company has entered into a new distribution program with the Sabah Lands and Surveys Department in East Malaysia. The program, called Digital Sabah, will make available high-resolution 3D digital elevation data and imagery covering the entire State of Sabah. Sabah, located on the Island of Borneo and the Malaysia Borneon state, encompasses one of the worlds few remaining rain forests, boasting wild elephants, orangutans, and other endangered species. Available now, the high-resolution data will be used to enable the State of Sabah to manage environmentally sensitive areas using Intermap's highly accurate imagery and elevation data. Expected uses are geospatial applications within the environment, hydrology, forestry, plantation, and mining sectors. *www.Intermap.com*

Laser Survey in Kalimantan

Jakarta-based company, PT Suprabari Mapanindo Mineral, recently carried out an aerial survey as part of the construction of a new mine site in Central Kalimantan. Suprabari holds permits for coal mining exploration covering 23,940 hectares of the island. It is a privately owned-company focusing on the natural resources business in Indonesia. An aerial survey of Central Kalimantan was recently undertaken as part of the construction of a new mine site. The mining concession, which covers about 15,500 hectares, was surveyed using a Harrier-56/3G airborne laser scanning system built by TopoSys in Germany. The operation was contracted out to PT Credent Teknologi, a subsidiary of Credent Technology in Singapore.

Garmin gets Netherlands bicycling maps

Waypoint, a Netherlands-based retailer specialized in recreational navigation has launched this month OnRoute, the first GPS bicycle map for the Netherlands dedicated to Garmin devices. Costing €89, the map data comes as a CD for use in combination with outdoor devices and PC-based Garmin software Mapsource and as pre-installed SD card for use in the Garmin Nuvi. In the Netherlands the SD-version of the map will be distributed by Garmin and target the mass market via retail chains like Halfords, Mediamarkt and ANWB.

GLONASS-K Birds go into production

Information Satellite Systems - Reshetnev Co. has begun the production of the K-series of GLONASS satellites for Russia. The first launch of a GLONASS-K satellite is scheduled for launch in 2010, according to Russia's Federal Space Agency. GLONASS-K is the third generation of Russia's GLONASS positioning satellites. In contrast to GLONASS and GLONASS- M satellites, which have relatively short service lives of only a few years, GLONASS-K has a planned service life of 12 years, a depressurized platform, and a decreased weight, according to Reshetnev.

Illegal to use GPS from Smartphone in Germany

According to Pocket GPS World, the courts in Germany have deemed that it is unlawful to operate a GPS navigation system on a smartphone while driving because of the phone ban in the country. Currently, there are some in-car navigation systems that lock you out of operating the unit while the unit detects that you are in motion. It seems unclear as to whether the law would mean that by operating a GPS system attached to the phone means using the system and programming in destinations while at a stop or if it means having the GPS on the phone running at all. This move will prevent GPS through cellular connections like those offered through TeleNav. *www.pocketnow.com*

KSRTC goes hi-tech: GPS to track movement of buses

R Ashok, Karnataka Transport Minister has announced that GPS would be introduced in the state to keep track on movement of KSRTC buses. He said GPS would not only help in monitoring movement of buses but also send messages on accidents, if any, to the control room automatically. He also announced that nearly 100 bus stops would be opened with digital display of timings of bus arrival and departure. *http://mangalorean.com*

Galileo update

Industry officials predict current procurement plan will delay

The heads of Europe's two biggest satellite prime contractors urged the European Commission to accelerate its procurement of the Galileo satellite navigation system or face what might become politically unacceptable delays in getting the service started.

Attending an information conference of European Union space ministers here July 20-22, the chief executives of Astrium Satellites and Thales Alenia Space said the current Galileo procurement process, which began July 1 and is scheduled to continue through May 2009, is unnecessarily slow

"The procurement has been substantially delayed and this schedule introduces more delays," said Evert Dudok, chief executive of Astrium Satellites. "We need procurement decisions in 2008 to keep to the service introduction date." Dudok made his remarks here July 21 during a tour of Europe's Guiana Space Center spaceport as part of a delegation that included French Research Minister Valerie Pecresse and European Commission Vice President Guenter Verheugen.

Dudok was addressing Pecresse because France assumed the six-month rotating presidency of the European Union July 1. Dudok said France, which has identified space policy as one of the key priorities of its six-month presidency, could use its influence to accelerate the Galileo procurement. Dudok urged Pecresse and Verheugen to use their influence to get the European Commission permission to remove what he said were needlessly complicated rules on the Galileo procurement.

In an interview, Dudok said it is his understanding the commission has the leeway to bypass some of its procedures to speed up the procurement as long as the major concerns — fair bidding and inclusion of subcontractors that are not part of the prime contractor's corporate family — and other concerns are respected.

Thales Alenia Space Chief Executive Reynald Seznec agreed. In an interview, Seznec said Astrium Satellites, Thales Alenia Space and its major subcontractors have assembled a contract proposal that distributes work throughout Europe and limits the prime contractors' dominance in a way that complies with European Commission concerns. "We really believe we have come up with a contracting profile that responds to the commission's concerns and that we could negotiate a final contract much sooner" than mid-2009, Seznec said.

The European Commission, which has assumed overall authority for Galileo and has delegated the European Space Agency (ESA) as contract oversight authority, issued detailed procurement rules July 1 for the six Galileo work packages. *www.wibw.com/weather/headlines/26238124.html*

ISRO to forecast crop behavior

The Gokhale Institute of Politics and Economics has tied up with the Indian Space Research Organisation (ISRO) for the project to forecast crop condition and drought-like situations with the help of satellite images. Satellite images of the ground where the crops are harvested will be matched, analysed and calculated with the data provided by the India Meteorological Department (IMD) and a conclusion will be arrived at. Initially, the project will be carried out in Karnataka on a pilot basis. Later, it will be implemented in other major agricultural states like Maharashtra. *http://timesofindia.indiatimes.com/*

Iran launch of Omid successful

Iran has launched country's first domestically made satellite, Omid. It was successfully fired on the birth anniversary of the last Imam (prophet) of Shiites, Hazrat Mahdi (who is believed to reappear at the end of the world) illustrated the auspicious name of the Imam in the space. The Satellite will pass over the country six times a day. *www.chinadaily.com.cn*

National Remote Sensing Agency becomes an ISRO Centre

National Remote Sensing Agency (NRSA), an autonomous society under Department of Space (DOS) has been converted into a full-fledged Government organisation called National Remote Sensing Centre (NRSC) on September 1, 2008. NRSA was established as a registered society under the Department of Science & Technology in 1974. The administrative control of NRSA was transferred to the DOS during early eighties and with the growth of indigenous efforts in space borne remote sensing It is expected that, with the conversion, NRSC will, as part of the Indian Space Research Organisation (ISRO), fully integrate with other ISRO Centres in the development and operations of the ground segment of the large constellation of India Remote Sensing Satellites and will also take a bigger role during the R&D phase of IRS programme.

NRSC as a Government entity, is expected to fulfill its goals playing a major role in important national programmes, through linkages with all concerned Government departments/agencies such as Ministries of agriculture, water resources, urban development, Home Affairs, etc., including the National Disaster Management Authority

Dr V Jayaraman has been appointed as Director, National Remote Sensing Centre (NRSC), Hyderabad and he took charge from Dr K Radhakrishnan, the out-going Director. Dr Jayaraman holds a Bachelor's degree in electronics engineering from University of Madras, Master of Science in electrical engineering from IIT, Madras and a Doctorate in Physics from Bangalore University.

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SOUTH

Honeywell selects Spirent GPS simulator for NASA's Orion project

Honeywell has selected a Spirent GPS/ Inertial simulator to develop, integrate, and verify the navigation system for NASA's Orion project. The simulator includes comprehensive modeling of the space environment and will provide multiple radio frequency outputs. It will include multiple SimINERTIAL units Spirent Inertial interfaces that provide Honeywell engineers the capability of emulating Inertial sensor output while simultaneously simulating GPS RF signals.

Autodesk shares coordinate system software with open source community

Autodesk, Inc., has donated the source code for CS-Map coordinate system technology to the open source community, and is seeking to establish it as part of an official OSGeo Foundation project for coordinate reference systems. It's the third major contribution, following its MapGuide Open Source and Feature Data Object Data Access Technology donations.

Transformer and calculator combined by Blue Marble

Blue Marble Geographics has announced the release of an all-in-one Geospatial Data Definition and Transformation Desktop. It allows users to work with the features of both the Geographic Transformer and the Geographic Calculator in a single interface together.HYPERLINK "http://www.bluemarble.com" *www.bluemarble.com*

Trimble debuts scalable GPS Surveyor device, acquires SECO

Trimble has introduced a scalable Trimble® 5800 GPS System. It adds greater flexibility and versatility for a variety of survey, construction, civil engineering, and asset management applications. Surveyors can begin with the L1, post-processing-only configuration. Two upgrades are available for higher performance: L1/L2, post-processing only and L1/L2, full Real Time Kinematic. *www.trimble.com*

Trimble has acquired SECO Manufacturing Company of Redding, California. SECO is a leading manufacturer of accessories for the geomatics, surveying, mapping, and construction industries.

Topcon releases TopNET+ 7.12

Topcon Positioning Systems has released TopNET+ version 7.12 reference station software with data modelling. "The new software upgrade adds a new and improved RTN (network RTK) engine, and for network spacing where network real-time kinematic is desired, the new version 7.12 RTN engine provides faster initializations, improved performance, and support of a larger number of reference stations being used in modeling on a single server," said Eduardo Falcon, Topcon senior vice president of business development. The enhancements of the new software include: support for 100 reference stations from a single server; station spacing up to 43 miles and an interactive web browser viewer. *www.topconpositioning.com*

Kapten GPS Navigation without screen

French company Kapsys is launching a mini portable GPS navigation called Kapten, which does not have a screen at all. All interfaces are done with voice recognition and text-to-speech feature. It is mostly intended for use in pedestrian mode. *www.navigadget.com*

u-blox GPS technology to power Microsoft MapPoint 2009 USB Stick

Microsoft has selected, u-blox 5, for a new "GPS Locator" USB stick. It will be bundled with the next release of MapPoint, map software package. It is a highly integrated, cost-efficient GPS engine that offers users accurate positioning in a small package without compromising on performance. *www.u-blox.com*

Hemisphere and CPAC Systems agreement. Expands Precision Farming Guidance Line

Hemisphere GPS has entered into an agreement to supply CPAC Systems AB with custom-built LV100 GPS Compasses for use in embedded control systems. The LV100 is a GPS compass and positioning assembly using a patent-pending design that features a single carrier board with integrated GPS antennas. It is driven by the company's Crescent Vector technology.

The Outback S3 precision farming system combines the Outback S2 and the Outback 360 with the latest developments in Crescent GPS receiver technology. The 8.4-inch high-resolution touchscreen displays job data in real time. It has guidance patterns and the ability to set multiple guidance lines and return points in a single job.

Pitney Bowes Software to ramp-up India R&D centre

Pitney Bowes Software, encompassing Pitney Bowes MapInfo & Pitney Bowes Group 1 Software has announced that it is expanding its India development centre with a threefold increase in planned investment over the next 3 years. It shall also triple its headcount at the Noida centre during the next 18 months. *www.pb.com*

SIRF loses court case

SIRF, has failed to persuade the US International Trade Commission to overturn a finding that rival Broadcom did not infringe its patents. It had asked the commission in Washington DC to reverse an agency judge's ruling that there was no violation of SiRF's patent rights for GPS technology. California-based SiRF and Global Locate, a rival GPS chipmaker that Broadcom bought last year, are vying to be the top provider of semiconductors for Garmin and TomTom. *www.australianit.news.com*.au

NovAtel invests in Network Timing Startup

Brilliant Telecommunications Inc. has completed its second round of financing with investment lead by NovAtel Inc., raising $11 million in capital. Brilliant designs, develops, and distributes network timing products designed to address the timing and synchronization requirements for telecommunications service providers as they transition to IP backhaul, mobile WiMAX services, and

in-home basestations, or femtocells. It's range of products includes GPS-referenced network time protocol (NTP) servers.

DMTI Spatial Joins the BlackBerry ISV Alliance Program

DMTI Spatial (DMTI) has joined the BlackBerry® Independent Software Vendor Alliance Program gaining access to support services from Research In Motion (RIM) as well as business and marketing resources. Using the company's Location Hub™ Technology Platform, DMTI will develop enhanced mobility solutions for customers with mobile workforces and field assets. *www.dmtispatial.com*

AAMHatch launches Pictometry in Asia

Pictometry® was officially launched in Asia last month. AAMHatch GM, Mr Brian Nicholls said, "AAMHatch is pleased to announce the launch of Pictometry in Asia. Data capture across Australia's main cities is nearing completion, and planning is underway for the South East Asian region. Acquisition is scheduled to commence in November, with Malaysia being our preferred starting location before moving to neighbouring countries. AAMHatch is pleased to be the exclusive Pictometry supplier throughout South East Asia, and will work with Pictometry and the various government authorities to ensure that the full benefit of this exciting technology is available throughout the region." Pictometry is a unique information system that combines aerial imaging with an intuitive user interface and range of valuable measurement and navigation tools. *www.aamhatch.com.au*

PCI Geomatics expands presence in India

PCI Geomatics has opened a new international office in New Delhi, India. It has also been appointed Master Reseller for India, Sri Lanka, Bangladesh, Bhutan and Nepal. *www.pcigeomatics.com*

Leica Cyclone 6.0, CloudWorx 4.0 and TruView 2.0

Leica Geosystems has released its flagship point cloud software applications: Cyclone 6.0; CloudWorx 4.0; and TruView 2.0. All applications now include intuitive, panoramic viewing of point clouds plus intuitive navigation of point clouds using "key plans" and scanner location icons. In both the software, opened views can be 360ºx360º panoramic views or 3D views. A panoramic view virtually places the user where the scanner was. Observing a scanned scene from that viewpoint is completely intuitive, while full 3D viewing lets users virtually fly around a scene to get unique perspectives. To easily navigate around a site, users can simply hop from one icon to another on the key plan, opening scan views as desired. Or users can click on scanner location icons visible within any opened view. Both of these intuitive navigation approaches can be used with Cyclone 6.0, CloudWorx 4.0 or TruView 2.0. *www.leica-geosystems.com/hds*

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3DGeoinfo@uos.ac.kr

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GIS'14 Conference
October 21-23, 2008
Hochiminh City
Phuoc.gis@uit.edu.vn

The European Navigation event,
October 7-8 2008,
High Tech Campus, Eindhoven,
The Netherlands
e.wendrich@jakajima.eu
www.jakajima.eu

NAV08/ILA38
27-30 October 2008
London UK
conference@rin.org.uk

November 2008

XXVIII INCA International Congress on Collaborative Mapping and Space Technology
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inca2008@sac.isro.gov
www.cmap.org.in

ACRS 2008
10 - 14 November
Galadari Hotel, Colombo, Sri Lanka
acrs2008@sltnet.lk

International Symposium on GPS/GNSS 2008
11 - 14 November, Tokyo, Japan
gnss@gnss2008.jp
http;//www.gnss2008.jp

International Symposium on Global Navigation Satellite Systems
Berlin, Germany, 11 - 14 November 2008
anette.blaser@senstadt.berlin.de
www.eupos.org

December 2008

GEOExpo 2008 China
2 - 4 December 2008,
Shanghai, China
sales@chinageo-expo.com
http://www.ChinaGeo-Expo.com

March 2009

Munich Satellite Navigation SummitConference
March 3-5, 2009
Munich, Germany
www.munich-satellite-navigation-summit.org

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GSDI 11 World Conference
Rotterdam, The Netherlands
http://gsdi.org/gsdi11/

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

August 2009

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

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ISDE 2009
Sept 9 to 12, 2009
www.digitalearth-isde.org

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INDIAN REMOTE SENSING SATELLITE (IRS)

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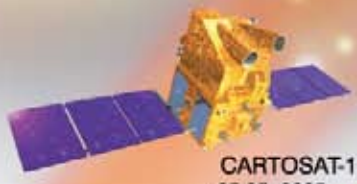
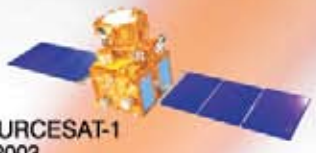
10.01. 2007
PSLV-C7



CARTOSAT-1
05.05. 2005
PSLV-C8



RESOURCESAT-1
17.10. 2003
PSLV-C5

OCEANSAT-1
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IRS-1D
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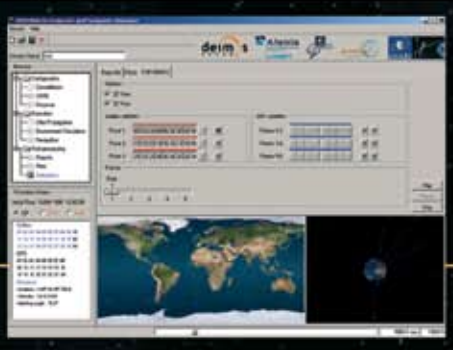

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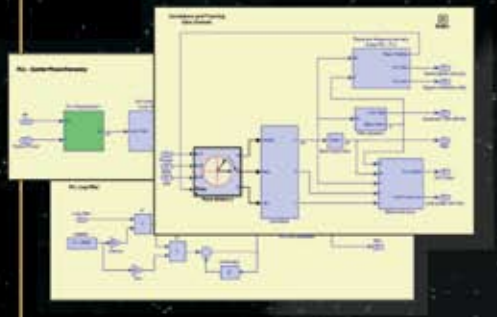

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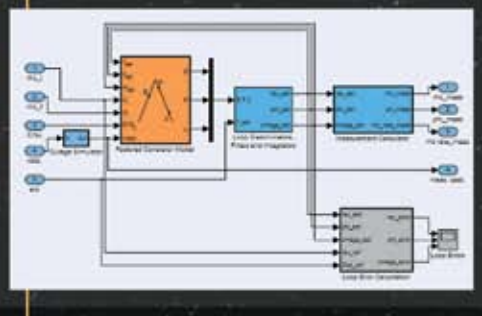

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