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Volume IV, Issue 7, July 2008

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- **Synchronet**
- **HRSI vs. Aerial Photography**

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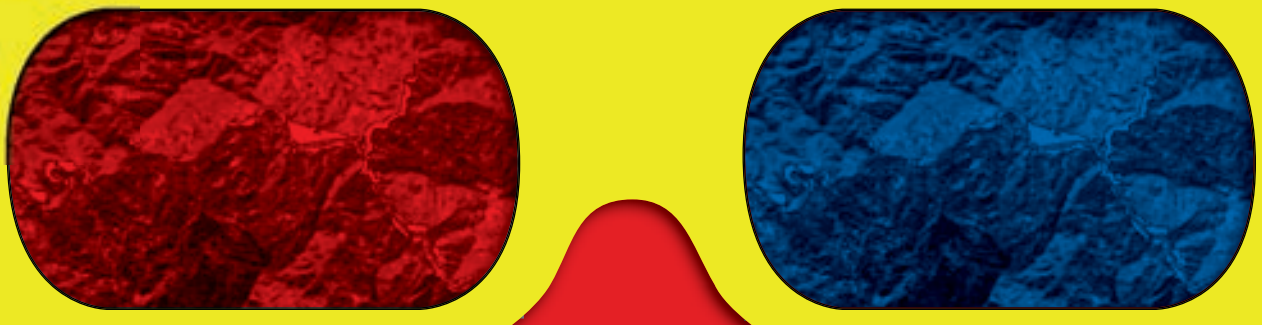

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Articles

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This issue has been made possible by the support and good wishes of the following individuals and companies Prof Dr Armin Gruen, Daniele Cretoni, Deren Li, Enrico Varriale, Franco Gottifredi, Dr Kirsten Wolff, Manvendra, Monica Gotta, Shridhara Murthi and Shunji Murai; and AAMHatch, Antrix, Bentley, Deimos, HemisphereGPS, HP, Magellan, Navcom, Novatel, Sanding, South, Spirent, uBlox; and many others

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This issue of Coordinates is of 40 pages, including cover.

And life has moved on...

A cyclone hit Myanmar and earth quaked in China

Thousands of fellow living-beings were dead

Millions injured. Many orphaned. Many more became homeless.

While, government machinery is engaged in managing the crisis,

Human intelligence reinforces its struggle to find ways to handle such disasters.

And experts once again dwell on nitty-gritty of disaster management.

What about those for whom life ended that very moment.

Also, with them for whom life has changed forever, thereafter.

With their sorrow,agony and grief.

Life moves on.

Bal Krishna, Editor
bal@mycoordinates.org

Synchronet - an innovative system

SynchroNet is a GNSS based time and frequency transfer system that allows to exploit high accuracy synchronization of accurate clocks

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A central issue in designing complex networked systems for critical applicative domains is the possibility of keeping each node of the network synchronized with respect to a given system time scale. The problem is even more critical when the synchronization accuracy determines directly the performances of the whole system. In this paper a distributed synchronization infrastructure is proposed providing:

- high accuracy synchronization performances (nano and pico seconds)
- flexible and scalable service topology (up to global scale)
- ease of integration in pre-existent infrastructures
- ease of customization, both at user level and at system level, in terms of performances and security

Introduction

High performance synchronization is a fundamental feature in many applicative domains, in particular it may be directly bounded to:

- Positioning, localization and range based applications
- Complex monitoring and control systems spanning wide inter-node baselines
- Financial transactions
- Distributed production lines
- Power distribution lines
- Environmental monitoring systems for SoL and civil protection applications and, in general, to every, heavily loaded, time-tagging based distributed system.

SynchroNet is an innovative system, patented by Thales Alenia Space Italia, that aims to be the sole solution for every application type which needs an high-accurate synchronization covering all levels of performance and coverage requirements with the added value of the ease of integration also in pre-existent infrastructures and systems.

Therefore, SynchroNet is able to cover, with a complete, flexible and high-performance product, the synchronization needs of a wide range market for any application domain.

GNSS Based Synchronization

In metrology, the synchronization of two clocks is the process required to determine the relative behavior of one clock with respect to the other. In particular clock synchronization can be defined as the process required to compute at least two parameters: **time offset** and **time drift**.

Time offset is the relative, instantaneous, difference between the two time scales (i.e. the phase offset) divergence trend of the two clocks (i.e. the frequency offset).

It should be noted that, if the relative behavior of the two clocks is known, they can be considered synchronized even if no physical adjustment is carried out.

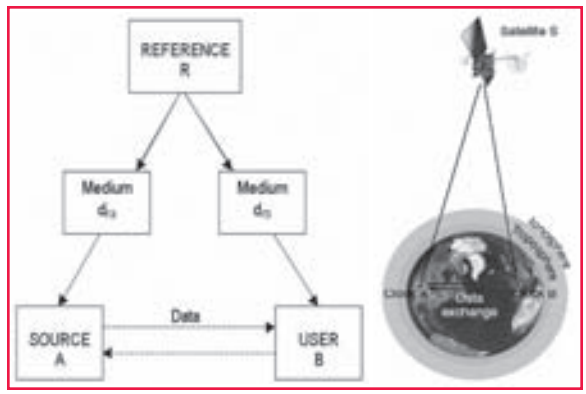

Figure 1: CommonView Process and CommonView method

Figure 2: SynchroNet High Level Architecture

While synchronizing two co-located clocks could be as easy as measuring 1PPS offsets over time by mean of an accurate Time Interval Counter (TIC), synchronizing several kilometers away clocks with nanosecond accuracy and precision performances could be much more difficult.

To solve this problem GNSS based techniques have been preferred over other methods for many reasons, among which:

- availability of the GNSS navigation signals
- performances
- diagnostic information about GNSS system health

GNSS based synchronization could be carried out by mean of the CommonView technique which exploits navigation signals broadcasted by GNSS SVs (Space Vehicles) which are in a condition of "common view" from the observation points of the two sites to synchronize.

A schematic representation of this method and the related process is given in Figure 1.

The CommonView method is very simple in its theoretical formulation but requires that a number of issues are carefully assessed and resolved.

From the sketch above, can be identified at least two such issues:

- Delays compensation
- Data exchange

Delays to be compensated are mainly due to the propagation in the atmosphere (i.e. Ionosphere and Troposphere). For each segment a delay factor is computed using mathematical models. The residuals of delay corrections are among the limiting factors for the CommonView synchronization performances.

While Delays affect only the synchronization computation, Data Exchange affects, also, other aspects that system designers have to take into account:

- Data acquisition process methodology
- Data types and formats
- Data and Identity Spoofing
- Data preprocessing and quality assessment
- HW equipment status monitoring

Synchronet Overview

SynchroNet is a distributed approach to synchronization with centralised monitoring and control facilities (see Figure 2).

To provide a synchronization system that deals with all issues described in the previous paragraph, SynchroNet implements a networked infrastructure around the core time transfer algorithms and distributes the synchronization process over a hierarchic network with hierarchic network nodes roles. This approach allows to distribute and keep balanced the processing load and limits the propagation of failures.

In the SynchroNet system three kinds of nodes are present:

- The Control Centre
- The MRT's
- The SyN's

Figure 3 provide an overview of the SynchroNet network topology involving each kind of node.

The *Control Centre* provides centralised monitoring of each node of the network in terms of equipment health status, connection link and security and synchronization performances. The CC is also responsible for network management allowing the supervisor to change the network topology (add a new node, remove a node, assign a node to a different MRT) and reconfigure per node or network-wide parameters (acquisition periods, performances thresholds, etc)

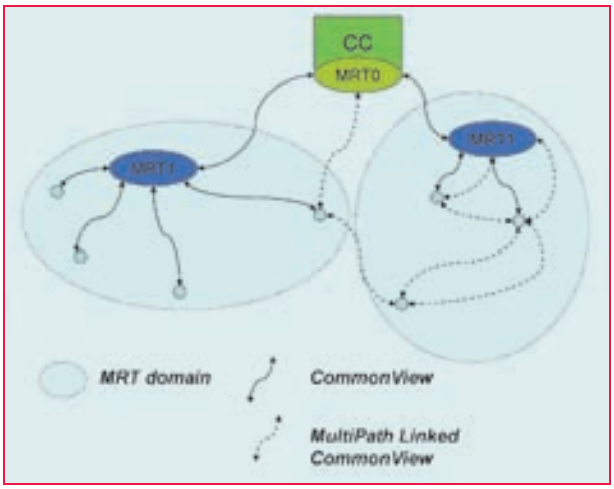

Figure 3: SynchroNet network topology

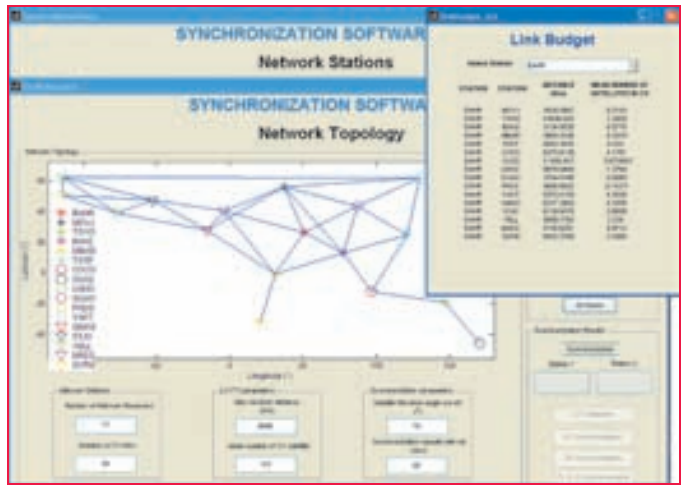

Figure 4: Preliminary analysis tool for optimal baseline determination

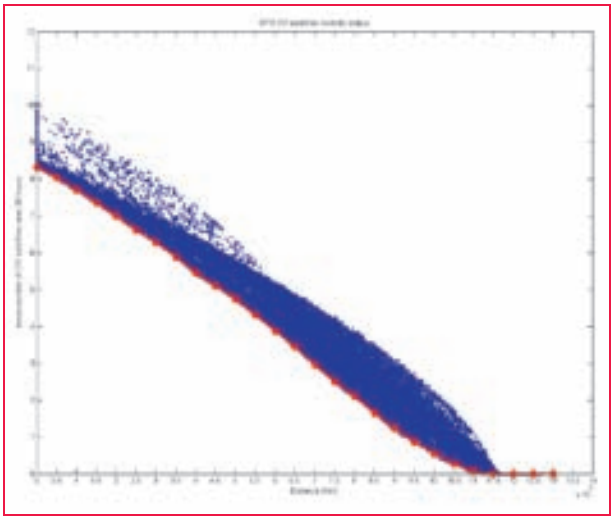

Figure 5: Number of satellites in common view for different baselines

MRTs are the distributed time references and form the hierarchic synchronization backbone of the system. Each MRT computes synchronization of the allocated SyNs and receives the synchronization parameters from higher level MRTs.

SyNs are the leaves of the graph representing the SynchroNet network; they collect GNSS observables and send them to the controlling MRT which, in turn, computes and returns the synchronization parameters and the performance status information. The SyNs are, computationally, passive elements for what concerns synchronization.

SynchroNet is characterized, at each level, by a strong modularity of its components also at node level.

Each SynchroNet node can be seen as a functional logical entity composed by many sub modules interacting with each other by mean of well defined interfaces and protocols; this means that a single node deployment may span many physical/ virtual machines.

Each sub module is well defined in terms of pre and post conditions and follows the principle of OOD (Object oriented Design) providing information hiding and interface based asynchronous and concurrent access to the implemented service.

Inter-nodes data exchange is guarded by Networking Module which applies a second, packet level, encryption and crypto signature to the outbound data before routing information through the SynchroNet VPN.

Additionally, each node provides synchronization interfaces by exporting synchronization products in many different ways, for example:

- Exporting files describing computed clock models and integrity statistics
- Outputting corrected PPS and 10MHz signals by mean of a pico-stepper

These products are exposed through standard interfaces (i.e. standard analog frequency and PPS signals, filesystem objects or TCP/IP based connections); this approach is consistent with the modular nature of the system and allows SynchroNet to be regarded as an higher level service providing black box, entirely defined by its interfaces. This design allows the easiest integration of SynchroNet in pre-existent infrastructures and permits effective maintenance cycles.

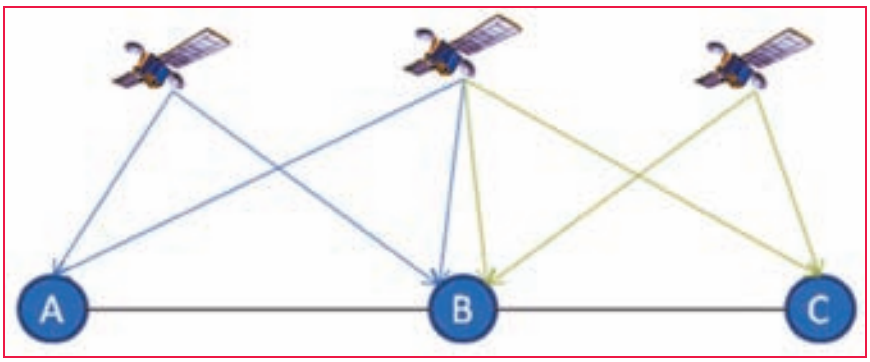

Figure 6: LCVTT technique

Synchronet Distributed Synchronization

The choice to design a distributed commonview based synchronization system has been driven by the following considerations:

- Algorithmic efficiency
- Synchronization performances
- System and service scalability
- System and service robustness
- Nodes hardware costs and upgrades scheduling

In particular one of the main design goals was to have a system that could be able to scale to an arbitrary service coverage area without requiring recurrent upgrades due to the increased load of servers and network equipment and that could cope with some limitations of the CommonView and Linked CommonView synchronization techniques.

By running both short term and long term performance analysis of Common View algorithms exploiting the IGS (International GNSS Service) network was found that a minimum optimal number of satellites in common view is five. Again processing GPS almanac data and cross correlating with IGS stations network was found that a direct Common View synchronization is possible along maximum baselines of 6000Km (given the requirement of at least five satellites in CommonView).

For longer baselines the LCVTT (Linked Common View Time Transfer) approach should be applied. A generalization of the LCVTT technique is represented in Figure 6 Synchronization between station A and C is carried out by computing

$$\Delta T(A,C) = \Delta T(A,B) - \Delta T(B,C)$$

Where each ΔT is computed by mean of the direct common view method

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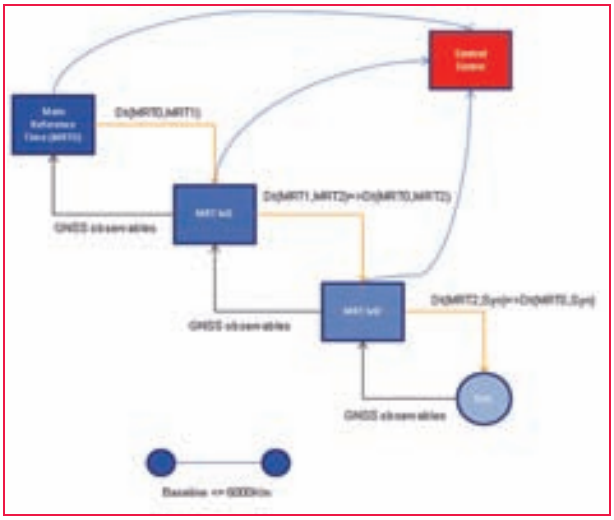


Figure 7: SynchroNet distributed synchronization process

described earlier. This technique can be, in theory, iterated for chains of arbitrary length; in practice error propagation due to satellite pseudorange correction algorithms residuals (iono and tropo factors), equipment noise, multipath, EMI (electromagnetic interference) and other sources of errors that cannot be fully compensated by heuristics and models, limit the length of synchronization chains to which the LCVTT method can be applied. The next step strategy in order to extend GNSS based synchronization range, is the MPLCVTT (Multi Path Linked Common View Time Transfer) technique. By mapping the stations taking part in the synchronization process as nodes of a dynamic graph G(V, E,T) where V is the set of nodes (i.e. the observing stations), E is set of tuples (r,s) where r, s belong to V and T is a time interval (T=(t1, t2)). For each observation interval T, (r, s) belongs to E iff between a and b there are satellites in common view during the given time frame (common view gaps tolerance in observations is a parameter that should be assessed taking into account the interval length, the sampling interval, the gap length, etc).

The first improvement given by wrapping synchronization into a dedicated homogenous network is the ability to distribute the computational process. Each node (which is guaranteed to be, at nominal conditions, not farther than 6000Km from its direct reference station) sends collected GNSS data to its reference node (MRT) and receives back synchronization products (clock model, synchronization noise, synchronization propagation errors, stability statistics and a summarizing synchronization integrity indicator).

The synchronization loop is depicted in Figure 7 for a three level depth network.

Each MRT is in charge of computing the synchronization and the detailed monitoring parameters only of lower level SyNs and MRTs; furthermore a status report is sent to the Control Centre. This architecture allows a higher level of customization both of the network topology and of the synchronization process.

Network, by mean of data meta-routing (implemented at the Data server module) which allows information being routed to multiple destination, may have, for example, multiple Control Centers (a Control hierarchy could be implemented to face network growth just as paging and indirect indexing methods works for computers operating systems).

This flexibility allows a different approach to Multi path Linked CommonView that can be realized by sending observables data to different, higher level MRTs. The CC defines, when nodes join the network, the path set for MPLCVTT by knowing the detailed status of each node already in the network and their performances; paths can be recomputed when events happen: nodes moved, added, removed, status change (synchronization performances, link, observables quality, …).

SynchroNet, not only provides a configurable and customizable synchronization network but allows a runtime automated or semi-automated network reconfiguration capability. In particular SynchroNet can take automatic actions in case an MRT goes down by reallocating the whole branch under the failing node. An example is given in Figure 8.

All the configuration steps are carried out by the main Control Centre which is, in general, the only authority able to modify the network topology (add, move, remove and fully configure a node). In particular each node is connected to the Control Center by a dedicated VPN which is separated by the network used for data exchange between other network nodes.

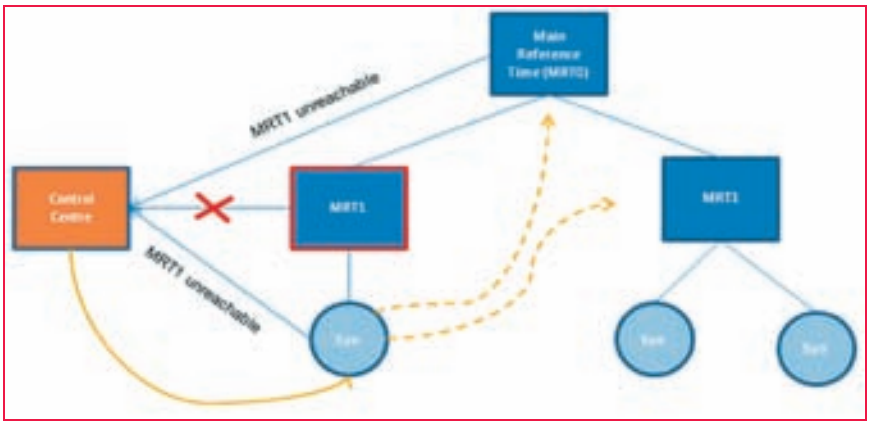
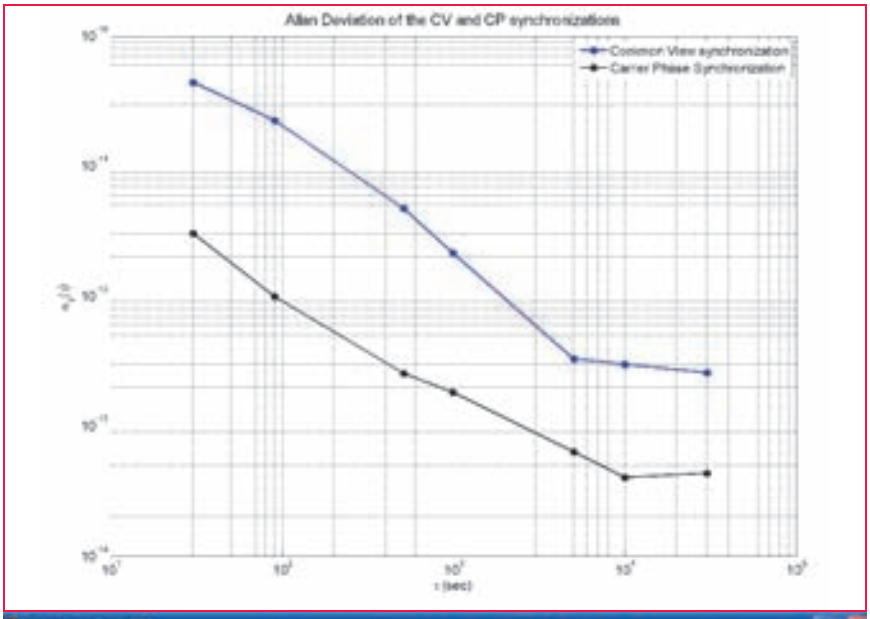
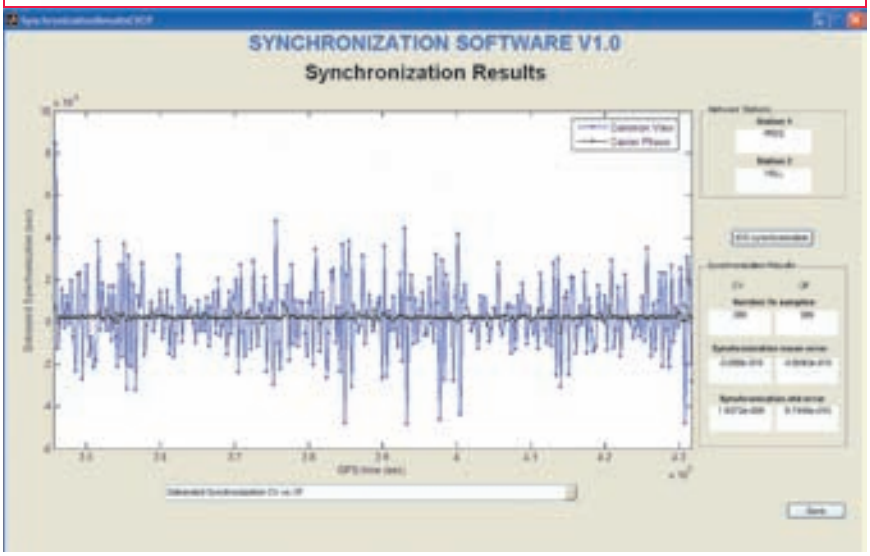


Figure 8: SynchroNet runtime fault recovery

Implementation and Test Results

The main issue is the validation of SynchroNet core synchronization algorithms in their many components: ionospheric and tropospheric models implementation, code (i.e. pseudorange: Code and Phase) based CommonView, phase based CommonView (L1 and L2), clock stability characterization by mean of CV and





comparison to direct synchronization in lab (PPS biases analysis).

IGS was selected as a test bench for algorithms validation thanks to the wide set of products available allowing a significant statistical analysis.

Hereafter are presented some results of both validation test results and of performance assessment of SynchroNet algorithms.

SynchroNet is at its v1.0 verification phase but its kernel is already running as core service for the Galileo Test Range (GTR), an advanced research facility for the experimentation and analysis of the Galileo Signal, for testing and certification of user terminals and support services for the development of application services. In the frame of this project, SynchroNet is used for synchronization of pseudo satellites OCXO driven Rubidium clocks used for ranging measurements with a requirement of 5ns (~1.5m) 1σ accuracy. In this context the main reference time (MRT0) is a free running Active Hydrogen Maser atomic clock while Control center features are customized and integrated in the Control centre facility of the GTR.

Conclusions

SynchroNet is a GNSS based time and frequency transfer System that allows to exploit high accuracy (nanoseconds and picosends level) synchronization of accurate clocks over large baselines by wrapping the synchronization service in a robust and flexible infrastructure providing security and scalability features.

Through separated and successful validation campaigns using IGS network and in a full deployed system (the GALILEO Test Range), SynchroNet has proven its customizability and performances.

Currently SynchroNet is going through a further design and research phase in order to consolidate and expands its features at infrastructure level to match critical systems requirements in order to become a high performance synchronization solution for every applicative domain.

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Can High Resolution Satellite Imagery replace Aerial Photography?

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The answer is yes and no at this moment.

Why no?

Small and medium scale maps 1:50,000 up to 1:10,000 (possibly 1:5,000 in near future) at most can be replaced by High Resolution Satellite Imagery (HRSI), though we need ground survey of many objects which cannot interpreted from the HRSI. I agree that the cost performance to produce the smaller scale maps with HRSI would be much higher as compared with aerial photogrammetry if the cost of HRSI is not much high. However, the current commercial price of HRSI is about two times higher than aerial photography according to the survey in Europe. The advantage of mapping with HRSI is much simpler than aerial photogrammetry and efficient in terms of mathematical modeling and the coverage area.

A trend of high frequent orbit such as FORMOSAT with several repetitions in a day would overcome the weakness of optical sensors against cloud coverage. In addition, high resolution SAR with 1m or less such as TERRASAR X may bring a breakthrough for real time mapping in the environment and disaster management.

Why yes?

In Japan, aerial survey with airborne digital cameras and airborene laser scanners is drastically increasing to produce larger scale maps with 1:2,500 and larger. DEM (digital elevation model) with 0.5 or 1 meter grid is being made from high resolution airborne digital cameras and/or laser scanners, while majority of grid size is 5m practically.

In those countries which are controlled by military, aerial photography will be operated only governmental survey/ mapping agency with conventional analog aerial photogrammery with less budget limiting about five year interval of updating national maps. However non-military countries such as Japan, can apply any high technologies of airborne digital cameras, laser scanners, unmanned airborne vehicle (UAV) etc. for private and commercial purpose. Aerial photography with high resolution digital cameras is now operated with more than 80 % overlap for along and cross tracks, which can produce so called “true ortho-image”. “Pictometry” with a set of a vertical looking camera and four oblique looking cameras is being operated daily for a new market based on easily understandable geospatial objects. UAV will become a new tool to produce “bird’s eye view” for a local area mapping or monitoring. Particularly disaster monitoring will be a good application in Japan as Japan is a disaster prone country. In meeting such demands, aerial photography with various cameras and sensors is a “must” as HRSI cannot solve those problems.

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Role of photogrammetry and Remote Sensing in Wenchuan earthquake

Deren Li
Laboratory for Information Engineering in Surveying, Mapping and Remote Sensing
Wuhan University
Wuhan, China *drli@whu.edu.cn*

AN earthquake, measured 8.0 on the Richter scale, struck Wenchuan County, Sichuan Province at 14:28 on May 12, 2008. The epicenter was at Yingxiu, a town in Wenchuan, as shown in Figure 1. As indicated in Figure 1, the middle segment of the Longmen Mountain earthquake zone encloses the epicenter, Yingxiu, with the Longmen Mountain zone being part of the north-south earthquake zone in China. According to records, there have been 9 earthquakes larger than a grade of 8 occurring in the north-south earthquake zone from 1739, and 7 of them were after 1897, when the greatest one was at Haiyun in 1920 and at Chayu in 1950, both of them measured 8.5.

In Wenchuan earthquake, the worst hit areas include Beichuan and Qingchuan, with the earthquake intensity measured at 11, with the maximum being 12 by the Chinese seismic survey standards. By 12:00 pm on June 14, 2008, the death toll read 69,170, with 374,159 people injured, 17,428 people missing, and a population of 48,270,000 severely affected by this huge disaster. Figure 2 shows the beauty of Beichuan before the earthquake against the destruction and devastation after the earthquake.

Under the leadership and organization of the Chinese government and Premier Wen Jiabao, and with the support of many countries and people around the world, the Chinese people braved against the devastating earthquake, and carried out timely and active disaster relief work. Photogrammetry and remote sensing, as high-tech, has played an important role in the fight against this natural disaster.

In Phase I, rescue of people buried under the rubbles was the main goal. High-resolution aerial and satellite imagery were used to locate buildings collapsed in the worst hit areas so that rescuers were dispatched. In Phase II, prevention of and

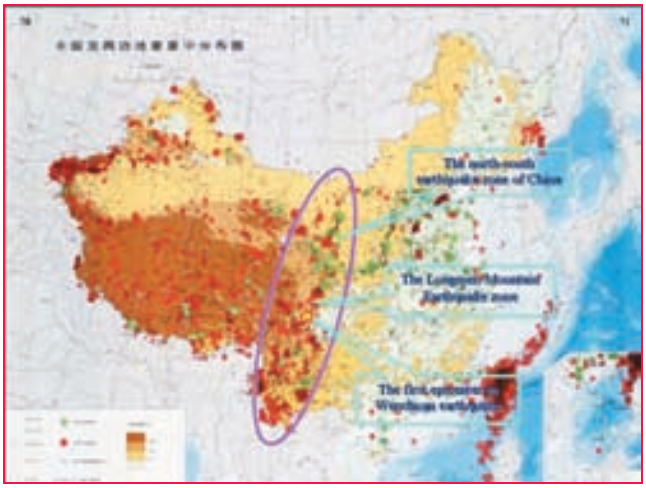


Figure 1. The Wenchuan earthquake in context

Figure 2. Pictures showing Beichuan before and after the earthquake.

Figure 3. Aerial photography f own with ADS40 (GSD: 0.3 m) showing what was left of Yingxiu Town in Wenchuan after the earthquake on May 15, 2008.

Figure 5. The change of river water ways due to the forming of quake lakes in Tangjiashan, as indicated by white regions generated by comparing SPOT5 (10 m resolution) images taken before (November 10, 2006) and after (May 16, 2008) the earthquake.

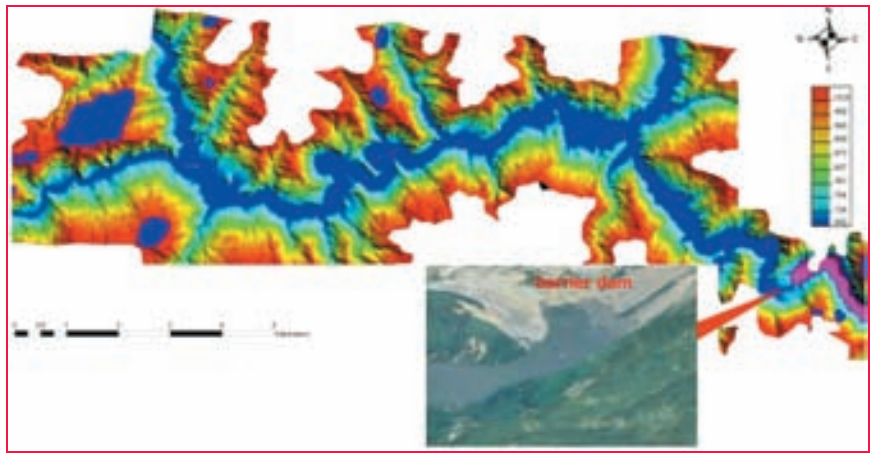


Figure 6. The DEM of the quake lake in Tangjiashan, Mianyang city, Sichuan Province, one of the area worst affected by Wenchuan earthquake, which was generated based on ALS50 II air-borne LiDAR data with a sampling interval of 2 m, f ight date, May 31, 2008, by the State Bureau of Surveying and Mapping, Wuhan University, and Wuda Geo Information Company (the barrier dam is shown with a inset picture)

preparedness for secondary disasters, i.e., landslides and mudslides, especially, those in and around the quake lakes or barrier lakes that are formed when a landslide plugs a river, top the agenda. Air-borne and space-borne optical imagery and radar data are required for identifying, assessing, and decision-making regarding locations prone to such secondary disasters. Phase III is concerned with disaster assessment and reconstruction. It is then necessary to undertake topographic mapping at 1:10,000 scale in the region with an areal extent of 120,000 km2 based on the technique of aerial photogrammetric survey without ground control points, generating information products, such as DEMs, DOQs, and DLGs. Topographic mapping in urban areas is performed at a larger scale of 1:2,000. These will better serve the people in the disaster areas so that they can outline reconstruction of their homes.

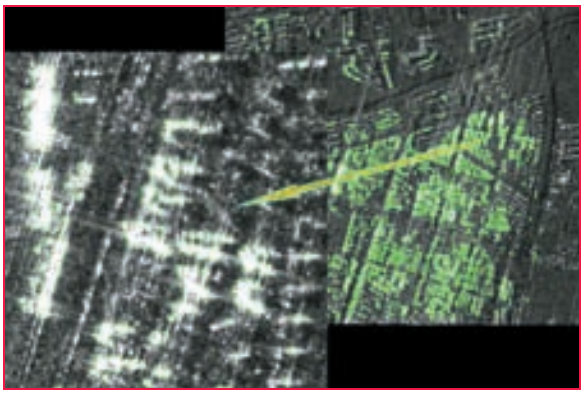


Figure 4. The image acquired by Cosmo (at a resolution of 1 m) indicating the locations (white segments) where buildings are likely collapsed after the earthquake; up to 14.8% of the areas were suspected to be results of collapsed buildings.

In the struggle against the destructive quake in Sichuan, Chinese photogrammetry and remote sensing professionals have, with supports from colleagues around the world, made various contributions as follows. For Phase I, rapid surveys and assessment of the disasters are important, as shown by Figures 3 and 4, with the former being aerial photography flown with ADS40 (GSD: 0.3 m) showing what was left of Yingxiu Town in Wenchuan after the earthquake on May 15, 2008, the latter being an image acquired by Cosmo (at a resolution of 1 m) indicating the locations (white segments) where buildings are likely collapsed after the earthquake; up to 14.8% of the areas were suspected to be results of collapsed buildings.

Phase II was marked by the prevention of and preparedness for secondary disasters, i.e., landslides and mudslides, especially, those in and around the quake lakes or barrier lakes. Figure 5 clearly highlights

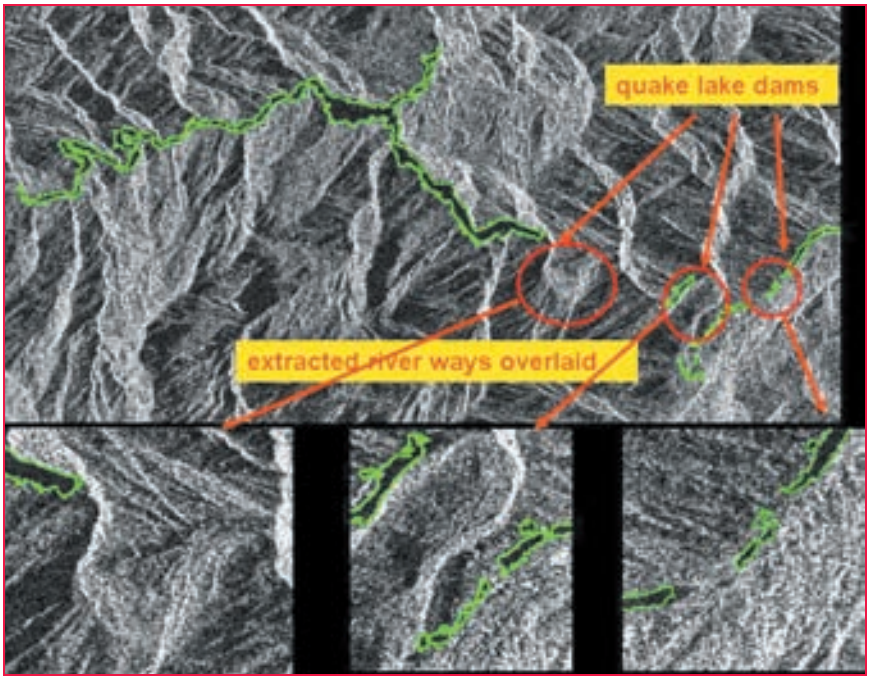


Figure 7. The boundaries of rivers in the quake lakes, Tangjiashan, Mianyang city, Sichuan Province, as indicated by the green lines against the background Radarsat imagery at a resolution of 7 m, acquired on May 17, 2008.

the change of river water ways due to the forming of quake lakes in Tangjiashan, as indicated by white regions generated by comparing SPOT5 (10 m resolution) images taken before (November 10, 2006) and after (May 16, 2008) the earthquake. Figure 6 shows the DEM of the quake lake in Tangjiashan, Mianyang city, Sichuan Province, one of the area worst affected by Wenchuan earthquake, which was generated based on ALS50 II air-borne LiDAR data with a sampling interval of 2 m, flight date, May 31, 2008, by the State Bureau of Surveying and Mapping and Wuhan University (the barrier dam is shown with an inset picture) in collaboration. The boundaries of rivers in the quake lakes, Tangjiashan, Mianyang city, Sichuan Province, are shown in Figure 7, as indicated by the green lines against the background Radarsat imagery at a resolution of 7 m, acquired on May 17, 2008.

In addition to disaster relief efforts, D-inSAR can also be used for scientific research on earthquake. Preliminary results derived from ALOS PALSAR satellite acquisition on June 11, 2008 are released at www.gmat.unsw.edu.au/LinlinGe/Earthquake, as shown in Figure 8, thanks to the efforts of the team led by Dr Linlin Ge. Dr Ge used predicted orbit data in order to produce and deliver the result in NEAR REAL-TIME: 17 hours and 46 minutes, from image capture to results posting on web. The Japanese ALOS PALSAR sensor acquired the Path 477 image on 11 June 2008 1:37 Sydney Time AEST (10/06/2008 15:37:07 UTC; 10/06/2008 23:37 Bejing Time). Image data were available to download from ERSDAC at 11:24AM. Image data (using predicted orbit) were downloaded to UNSW on 11/06/2008 at 16:55. D-InSAR results were generated on 11/06/2008 at 19:05. Post-processed D-InSAR results were uploaded on 11/06/2008 at 19:23.

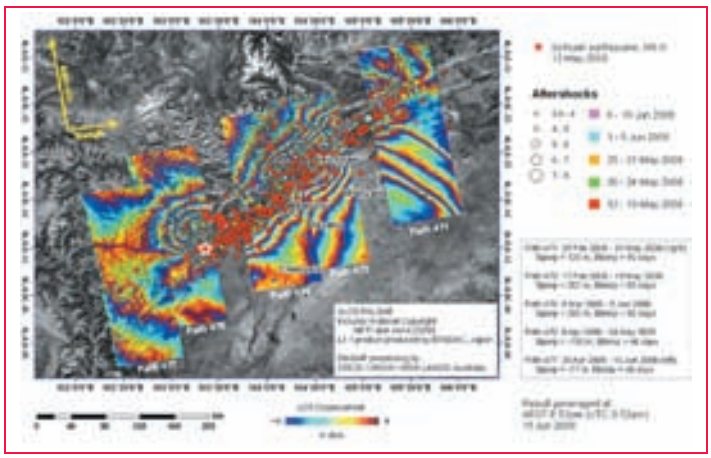
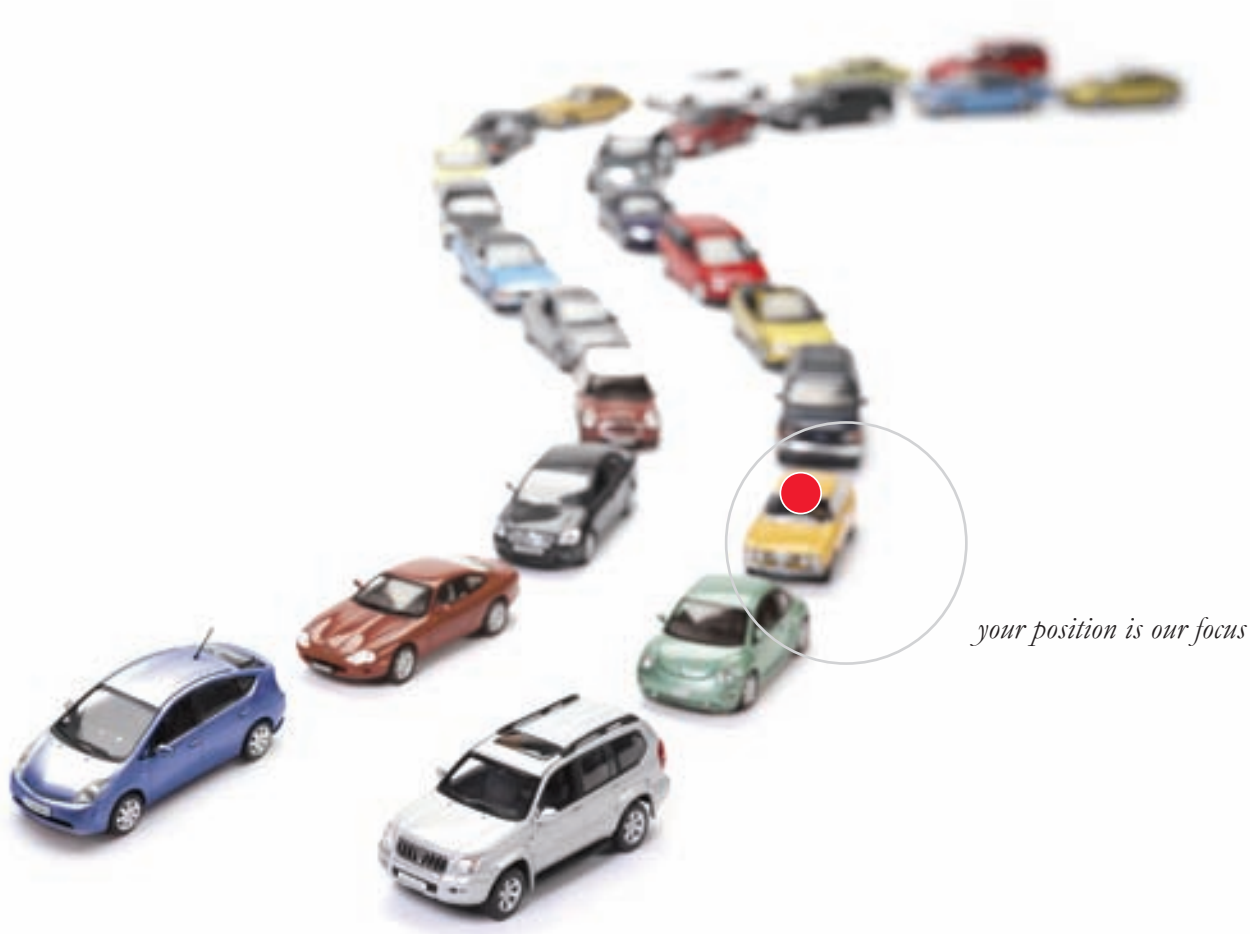


Figure 8. The image showing the aftershocks, generated by D-inSAR technology based on ALOS PALSAR sensor acquisition, Path 477 image on 11 June 2008 1:37 Sydney Time AEST.

Some concluding remarks are as follows. It has been demonstrated that photogrammetry and remote sensing has played a crucial role in the aftermath of the earthquake in Wenchuan, Sichuan. The rapid data acquisition and information services, especially, those featured with fully automatic, near real-time remote sensing systems without ground control, have contributed greatly to the rescue work and disaster relief efforts. The specialty of photogrammetry and remote sensing is becoming increasingly visible and its roles are growingly recognized. It is important to develop a national disaster rapid response system that corroborates the work by different agencies and facilitates data and resources sharing. It is necessary to further develop China's National Spatial Data Infrastructure. Moreover, it should be on the agenda to enhance the capability of high-resolution earth observation systems. Last but not the least, it is necessary to strengthen international cooperation in spatial information science and technology, like International Charter and CEOSS from GEO.

Acknowledgements

Many institutions and people have helped with data acquisition and provision of materials during the project concerning rapid response to Wenchuan earthquake. The diligent work by and kind helps from colleagues home and abroad are gratefully acknowledged.



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3D mapping from space?

Neither the goals nor the procedures of 3D mapping are clearly defined yet

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LATELY we observe an amazing increase in earth-observation platforms equipped with ultra high-resolution imagers. With the recent deployment of WorldView-1 we have reached the 0.5 m footprint level. This raises the issue of 3D topo-mapping from space, in a more pressing way than ever before. Topo-maps of medium and larger scales (1:50,000 and better) are still missing in some parts of the world, in others they are hopelessly outdated. Up-to-date aerial images, as a traditional data source for mapping, are not always and everywhere available. In contrast, high-resolution satellite images with stereo capabilities constitute an interesting tool for mapping and the image providers advertise their use quite extensively.

Topo-mapping is worldwide controlled by specifications, which may differ from country to country. Therefore it is difficult to give general recommendations with respect to the question which sensor would be feasible for which map scale. In addition, digital mapping is largely scale-free, which makes the issue even more controversial.

In the literature we find many predictions and recommendations on 3D mapping from space, but mostly without substantial empirical evidence. 3D mapping is very often reduced either to the generation of ortho-images or/and to the geo-referencing accuracy and DTM generation accuracy. But mapping is much more, as we all know. 3D mapping from satellite imagery is still a topic which causes many misconceptions. We hope we can contribute with this paper to a clarification of some of the issues.

What is 3D mapping?

A consistent definition of 3D mapping is missing. We are well used to conventional 2D and 2.5D mapping, resulting in an analogue map as final product. 3D mapping however gives us many more options, but also raises more questions.

With such new technology of digital mapping we have to address a number of problems, which are not necessarily all new, but so far only sparsely treated in R&D. Among those are:

+ 3D mapping – how does this differ from traditional 2D and 2.5D mapping?
+ Which objects have to be mapped and at which resolution and accuracy?
+ How should truly 3D objects be modelled in terms of geometry, topology and possibly also texture?
+ How should these objects be represented in the database?
+ Digital mapping - how much automation is currently possible?
+ Image interpretation – which pixel size do we need in order to bee able to extract features and objects that are required for topo-mapping at a certain scale?
+ Image quality – what are the differences in image quality (and thus interpretability) between aerial and satellite images of the same Ground Sampling Distance (GSD)?
+ Orientation/geo-referencing – how accurately can we georeference the new satellite images (with and without GCPs) in planimetry and height?
+ DSM generation – what are the expected accuracies in automated DSM generation, which parameters determine the accuracies of the DSMs and what is the reliability of the estimated surface models?
+ DSM-DTM reduction - what are the most successful approaches for DSM to DTM reduction and what are the main problems to be solved?

3D mapping requires totally new approaches to modelling. Most of the traditional procedures and commercial software packages, which have been developed under 2.5D assumptions will inevitably fail under strict 3D requirements.

From 2D maps to 3D landscape models

Worldwide databases like Google Earth have given a wider audience access to geo-referenced data. This data is useful for all kind of planning and inspection purposes, but usually does not satisfy the demands of a professional map user. However, it has sharpened the mind for what can be done with geo-data, in terms of visualization and interactivity. And it has set a certain standard in perception of terrain and other geo-related data. Has Google Earth even changed irreversibly our perception of a map? If yes, then what do we, as experts or occasional users, expect form modern maps after Google Earth?

Mapping has grown way beyond the traditional domain of topo-mapping and thematic mapping. Markets for geospatial technologies include nowadays applications in insurance and risk management, natural and man-made hazards, real estate, Location-based Services, environmental monitoring, car navigation, oil and gas, homeland security and many more. However, the data contained in topo-maps (or "landscape models") can in the future serve as the backbone of these diverse applications.

The flexibility in handling of and in modifying digital data has brought up the issues of "real-time mapping" (see recent disasters in Myanmar and China), "mapping on demand" (individualized data collection), "personal mapping" (representations for a particular purpose or person). Mobile Mapping platforms on cars, trains and UAVs allow for real-time raw data collection at an unprecedented speed and flexibility. New devices like mobile phones and PDAs in LBS-related applications bring up the notion of "ubiquitous mapping".

How does this all relate to the task of topo-mapping?

There is a large amount of data already now available which would qualify for "3D maps": 3D city models, forestry models, Cultural Heritage models, etc. Should this data form a joint database with the more conventional content of a traditional topographic map?

This all requires us to reconsider radically our mapping goals, tasks, procedures and products.

First steps in this direction have been taken. The Swiss Department of Lands ("swisstopo") has defined a countrywide map system on the basis of a Topographical Landscape Model (TLM). This Landscape Model includes all objects that are currently represented in topo-maps, but in truly 3D form. This includes terrain, buildings, water objects, public transportation, public spaces and facilities, landcover, administrative borders and "points of interest". Compared to the situation before this model features some novelties, as for instance

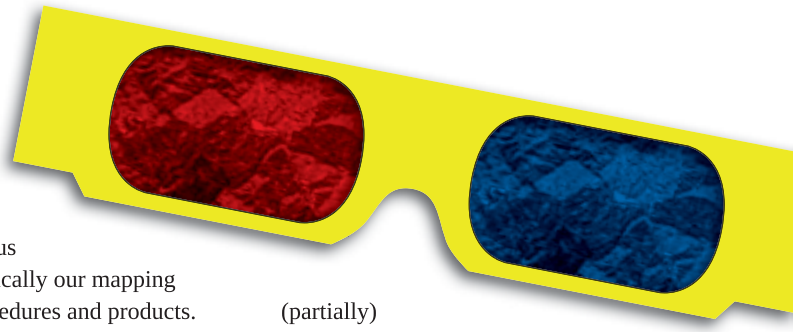
- It serves as the basemodel for the whole country. Subsequent level models for cartography and for representation (at varying scales) are defined, which are derived from this unique dataset of the basemodel. Therefore all the objects of the basemodel are geometrically correctly modelled. There are no displacements of elements and no generalizations.
- The data is always actual. It is continuously updated, and not only at certain fixed intervals.
- The accuracy is very high. The object accuracy is specified to 1 m.
- The data is truly 3D. Therefore all objects can be correctly modelled and no information has to be suppressed because of lack of modelling tools.
- The data model is set up such that it is ready for extensions.

At this point the data is still acquired from aerial images, as of January 2008 only from digital cameras like the Leica ADS40.

This Landscape Model is interesting from a conceptional point of view. It remains to be seen how it performs in practice.

3D Landscape Models from aerials or satellite images?

With the increased availability of ultra high-resolution satellite images and



(partially) dropping prices this becomes a burning question. Both data sources do have distinct advantages and disadvantages, which are briefly listed here:

Pro satellite images:

- The satellite platform is operational 365 days of the year
- Frequent re-visit times (e.g. every 4 days or even more)
- Imagery is post-processed relatively quickly
- There are no Air Traffic Control restrictions
- Large area footprints decrease the need for block adjustment and creation of image mosaics
- The satellite can easily access remote or restricted areas
- No aircraft, cameras or otherwise expensive equipments are required (by the end user)

Contra satellite images:

- The image acquisition geometry is not flexible
- The image resolution is fixed for a particular sensor and low compared to most aerial imagery
- The radiometric resolution is often too low (problems in shadows and saturation areas)
- The image quality is often impaired by different factors and artifacts
- The typical off-nadir viewing angle of up to 25° is problematic in image matching
- The reliability of capture and delivery of imagery can be poor at times
- Strong possibility of cloud cover and thus occlusions
- The cost of the imagery may be too high (when compared to aerials)

The selection of any one of the data sources depends on many factors. The decision can only be made efficiently when all the project parameters are available. We have reported about an extreme case in Bhutan (Fraser et al.,

2008), where access to aerial images is impaired and where pilot projects are underway to use satellite imagery for the generation of a new topo-map 1:25,000.

In our following pilot test for topo-mapping we compared map objects derived from IKONOS 1m GSD stereo images with map data from the Swiss topo-map 1:25,000, which is usually derived form aerial images at scale 1:30,000 (which in turn corresponds to an image pixel size of about 0.5 m).

Geo-referencing

Today geo-referencing from satellite images is well understood and controlled. It is the least problem we encounter in 3D topo-mapping. In previous projects we have collected a lot of experiences in geo-referencing. We have used SPOT-5, ALOS/PRISM, Cartosat-1, IKONOS and Quickbird images over different testfields worldwide (Germany, Italy, Japan, South Africa, Switzerland, Turkey, Vietnam). We have developed the software SAT-PP (Satellite Image Precision Processing), which includes several strict models for the most important sensors and also the related Rational Polynomial Function (RPF) approaches. With this software we have obtained consistent results in the subpixel domain, both for planimetry and height and for all sensors, using few (2-5) GCPs only. We could show that RPCs usually provide good relative orientation, while the absolute orientation has substantial systematic errors. These kinds of errors depend on the satellite/sensor. In the best case they represent just a bias (shift in coordinates), in other cases we diagnosed higher order terms. In any case the distortions can be removed with the concept of bias-corrected RPCs and the use of 1-3 GCPs.

DTM generation

DTM generation is a key issue in topo-mapping. If produced in manual mode this does not constitute a problem, it only needs time – a lot of time. Therefore we turn towards automated DSM generation by image matching. Image matching - in its essence - is still an unsolved problem. With our software SAT-PP, which includes an advanced matching module, we obtain height accuracies between 1 and 5 pixels from high-resolution satellite images, depending on the type of terrain, land cover, image texture and image quality. While RMS errors in such tests show good results we must note that in all these cases substantial blunders (10 times the RMSE and more) still exist in the data. This is not acceptable. This can only be solved by substantial and time-consuming post-editing of the DSM or by efforts to better understand the reasons for such blunders in image matching, with the aim to get rid of them. Therefore the avoidance and/or detection of blunders in the automatically generated DSM is a critical point for future research and development.

The next problem we are faced with is the reduction of the DSM, produced by the image matcher, to the DTM, as represented in the landscape model. Although there are some attempts available to automatically perform the reduction, the results are not convincing, because these algorithms are purely based on geometrical considerations. What is needed however is an image or point cloud interpretation approach which lets us understand what kind of object we are dealing with in the reduction process at a particular location.

Object extraction

We have experience with automated and semi-automated feature and object extraction, primarily in 3D city modelling and 3D road extraction. In 3D city modelling we use our semi-automated procedure CyberCity Modeler (CC-Modeler) for building extraction. With some examples derived from IKONOS and Quickbird images we could show to what extent and at which resolution these objects can be modelled from satellite imagery.

In road extraction we have developed "LSB-Snakes" (Least Squares B-Spline Snakes), a semi-automated technique which allows us to model roads in 3D.

In addition, the well-known technique of monoplotting can be used for object extraction (Fraser et al., 2008). This procedure works usually well, but with limited accuracy, depending on the quality of the underlying DTM.

In the following test the measurements of the topographic features (buildings, forests, streets, lakes, single trees and contour lines) for the map scale 1:25,000 were done by an experienced stereo operator of our group. For the other special topographic features we got support from an experienced topographer from swisstopo.

Pilot mapping project Thun

A key issue in mapping is the interpretability of images of a particular resolution. Currently this topic is in the center of our interest, because we believe there are misconceptions on this issue. We are conducting investigations to find out which objects can be extracted under which geometrical resolutions. Here we present some preliminary results. For more details please see Gruen and Wolff, 2008.

For a first test we selected the test area of Thun, Switzerland. This is a fairly flat urban zone which is composed of areas with single family and apartment houses with parks, an industrial area, a military airport and forest areas. This area contains many of the important features of a topographic map. For the manual drawing of contour lines we extended the area to a hilly region, including forest and open areas without any substantial buildings.

The aim of this investigation was to analyze the possibilities to identify and map buildings, roads and other individual features for a 1:25,000 topographic map by using high resolution satellite images data. For such a mapping scale we assumed that a GSD of 1m or even higher is required. In conventional mapping and map updating aerial images of scale 1:30,000 are used (which corresponds to a GSD of about 0.5 m). For our test area Thun two IKONOS panchromatic stereo images (December 2003, GSD 1m) were available.

(a) Reference data for mapping

As reference data we used a digital version of the national topographic map 1:25,000 (Pixelmap) and the vectorized map

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Figure 1. Comparison of the 10 m reference contour lines (black lines) and the manually drawn contour lines (dashed lines).Left: open area; middle: steep forest area with two small creeks; right: mixed area

(VECTOR 25) of this area, both products of the Swiss Federal Office of Topography. The planimetric accuracy is given as 3-8 m (corresponding to the map accuracy), which is by far worse than the geo-referencing and object measurement accuracy in IKONOS imagery. For quality control of manually measured contour lines we digitized the 10 m contour lines of the map.

(b) Manual drawing of contour lines

10 m contour lines were measured in an area of 4 x 5.5 sqkm by an experienced stereo operator of our group using Stereo Analyst, a 3D feature extraction tool of the ERDAS IMAGING system.

For the visual quality evaluation we defined three sub-areas with special land use patterns (Figure 1: open area (left), forest (middle) and mixed flat area (right)). As expected, we got the best results for an open area with only a few houses and less good results in the steeper woodland. The IKONOS-derived contours resulted in a distinctive smoothing effect of the smaller geo-morphological features. Therefore the problem is not so much the limited metric accuracy of the IKONOS-derived contours (the reference contours also had only an accuracy of 3-4 m), but the loss of geo-morphological detail. This of course is also caused by the fact that trees and bushes are restricting an accurate interpretation of the scene.

Figure 2: Overview of the measured buildings, roads/streets, railway, small airport, forests and single trees of the test area Thun.

(c) Object extraction

We used the Stereo Analyst also for the extraction of all map features. The identification and mapping of buildings and roads/streets was done by our own stereo operator. But for the classification of roads/streets and for the identification of several individual features special knowledge of an experienced topographer is required. Here we received the support from our Federal Office of Topography (swisstopo) in form of one professional operator, familiar with the map legend of the Swiss topo-maps.

Both operators did not have any pre-information about the test area and did not use the reference data as pre-information for the measurements.

Figure 2 gives an overview of the measured buildings, roads/streets, railway, small airport, forests and single trees of the test area.

(c1) Identification and mapping of buildings

In the map buildings are presented by their footprints. Our operator measured

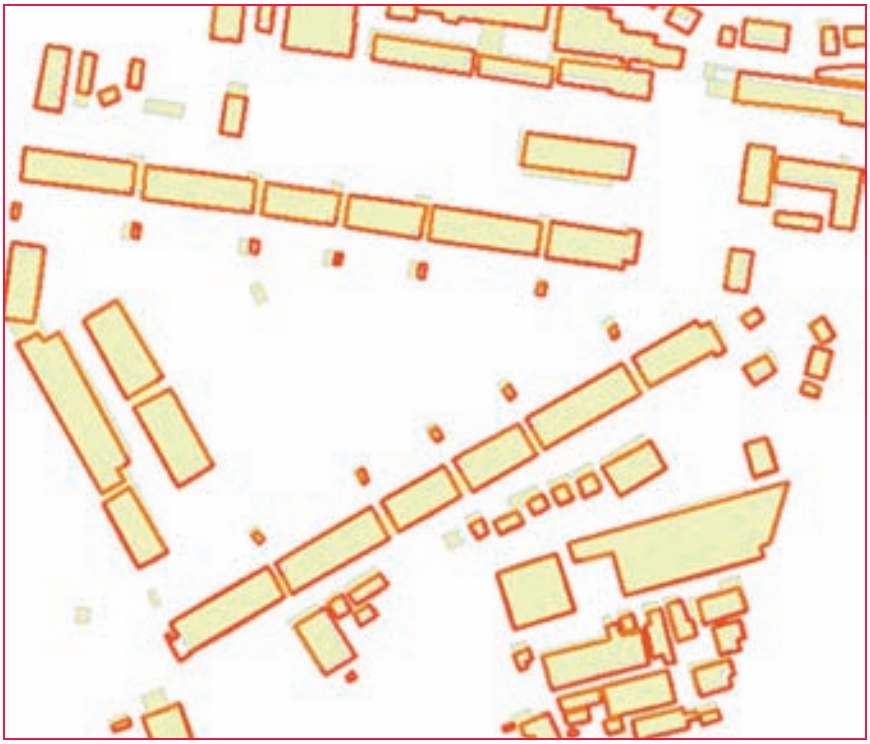

Figure 3: Overview of a sub-area of the urban test area. Filled colour: VECTOR 25, contours: IKONOS – extracted houses.

the buildings in 3D, but for comparison only the 2D footprint of the roofs could be used. For a more detailed analysis we sub-divided the whole area in two kinds of sub-areas: industrial (160 buildings) and residential areas (165 buildings). For quality control we compared the extracted shapes of the houses with the VECTOR 25 data set visually. The main focus was on the identification of houses and their shape and less on the metric analysis of their correct position. The results are classified into the following 6 categories:

Equal: shape and position of the houses considered as equal
Partial loss: parts of the houses are missing, same position
Total loss: the house could not be extracted
Forest: the house is covered by trees
Different position: same shape, different position
Improvement: the extracted shape or position is better.

In case of differences in position of an individual building it can be assumed that the IKONOS mapping gives better planimetric accuracy than the given, cartographically modified (generalized and shifted) building data (see Figure 3).

Table 1 gives an overview of the results of the visual quality control of the extracted buildings. For a fully detailed analysis of the differences, an inspection trip into the field would be necessary. The results clearly show that the object identification from IKONOS imagery is not reliable enough.

Table 1: Summary of the results of the visual quality control of the extracted buildings.

Classes	Industrial area		Residential area	
	absolute	%	absolute	%
Equal	113	70.6 %	108	65.5 %
Partial loss	11	6.8 %	12	7.3 %
Total loss	16	10.0 %	6	3.6 %
Forest	7	4.0 %	-	-
Diff. position	7	4.0 %	24	14.5 %
Improvement	6	3.8 %	15	9.1 %
Total	160	100 %	165	100 %

(c2) Identification and mapping of roads

The approximate mapping of the centerline of the roads was done by our operator without cartographic experience. In urban areas it was more difficult to measure the centerline than outside the town. Without an in-depth background in national mapping it was not possible for her to classify the streets in relation to the official classes of the national map. Some parts of smaller streets were covered by high buildings and trees. In such areas the interpreter tried to guess the run of the streets by analyzing the surrounding structure of the houses and trees. Altogether 163 street segments were analyzed. 11 (7%) of them could not be detected by our operator.

The classification of the streets and roads was investigated by two cartographic specialists. The main criterion for the classification was the width of the streets. We have 6 classes of roads: R1: >6m, R2: 4.2 – 6m, R3: 3 – 4.2m, R4: <4m, R5: dirt roads and R6: trails. Because of the limiting 1m resolution of the used images, it is very often not possible to distinguish between two neighboring classes. The images were taken in December, a period when dirty roads and trails are not used regularly and therefore it was difficult to identify them in several cases. The highway, railway rails and traffic circles could be easily identified and measured.

In future, additional features like pavements will be taken into account by swisstopo for a detailed classification. Such small details cannot be extracted from 1m resolution satellite images any more.

(c3) Identification and mapping of individual map features

For the evaluation of individual map features like forests, bridges, airports, power lines, churches etc. the two cartographic operators used the whole imaged area of Thun. Some features like forests, rivers > 2-3 m, fruit orchards, soccer grounds, a golf course, a camping ground and a harbor could be identified. Other features like churches where only observable in less dense areas or when they

had a special, traditional architecture.

Conclusions

We have pointed out that neither the goals nor the procedures of 3D mapping are clearly defined yet. The available new technologies require a totally fresh approach to mapping.

Satellite images are an interesting source for 3D mapping. However, they still do have a number of substantial disadvantages when compared to aerial images. As spatial and hopefully also radiometric resolutions improve in the future their suitability for landscape model generation and for medium scale topo-mapping has to be continuously evaluated.

In our tests with manual mapping from IKONOS stereo images we found problems in reproducing small geo-morphological details in contours, especially in cases of vegetation covering the bare earth. From these satellite images less map features could be interpreted compared to aerial images, and definitely not with the same reliability. However, the experienced topographer, using empirical knowledge, including also the special characteristics of the country, found many more features than we expected. All in all the IKONOS images were not sufficient for the production of 1:25,000 map data. But even if we consider that satellite images are already now available at the same spatial resolution as aerial images (WorldView-1 with 0.5 m GSD) we still have to take into account the lower radiometric quality of satellite data. Especially digital aerial images provide us with a hitherto unsurpassed image quality, which is very crucial when it comes to the interpretation of map features.

However, these statements refer to the map specifications of Switzerland. In other countries these specifications may not be as stringent.All the previous results were obtained by manual measurements. We should clearly understand that we are currently still very far away from any reliable procedure of automated landscape model or map generation. This remains a key topic for further research.

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ProMark 500

THE WINNING COMBINATION

Competitive Advantage:

- **BLADE™ GNSS technology**
- **Enhanced RTK accuracy**
- **Wide range of communications**
- **Cable-free lightweight design**
- **Rugged base & rover solution**
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ProMark™ 500

Multi-constellation RTK Surveying by Magellan

The new ProMark™ 500 offers GPS+GLONASS+20 years of field-proven Magellan technologies. Designed by our GNSS experts, this powerful survey solution delivers state-of-the art RTK features in a light, cable-free rover that gives you maximum mobility and flexibility in the field. Its unique GNSS engine insures fast initialization, long-range accuracy, robust signal tracking, and secures future constellation evolutions.

Offering extensive equipment interoperability via the new FAST Survey™ field software, ProMark 500 is also the only survey equipment featuring a handheld GPS as field terminal ready for navigation and GIS data collection.

ProMark 500 encompasses all the RTK features that land surveyors expect for productive and reliable positioning and concentrates the best Magellan technologies for the survey market.

To learn more about the ProMark 500 winning combination, visit www.pro.magellanGPS.com today

MAGELLAN®
PROFESSIONAL

"IRS is better positioned to meet the user demands"

K R Sridhara Murthi,
Managing Director, Antrix Corporation Limited

How much more evolved is Cartosat 2A from previous satellites of Cartosat family?

Cratosato-1 provides along-track stereo data of 2.5m resolution, whereas

Cartosat-2 offers 1m resolution data. Cartosat-2A is similar to Cartosat-2, substantially increasing the data availability.

What impact you foresee of Cartosat 2A on high resolution imagery market.

IRS Cartosat series of satellites are important members of the high resolution satellite family. Worldwide, there is a great demand for High-Resolution data and more number of satellites increase the choice to users besides improving timely availability of data. I am sure that Cartosat satellites will enhance the user satisfaction.

There are many other players in the high-res imagery market. What edge Cartosat imageries have vis-à-vis them?

Cratosat-1 is a unique mission in the civilian domain where comparable systems are rare to be found. In addition to cost leadership, the opportunity to merge with other IRS members like Resourcesat Multispectral data will be the advantage of Cartosat when it comes to colorizing the data.

How do you see the demand for Indian Remote Sensing Satellite Data Products internationally? Is the competition growing?

Having multi-temporal, multi-spectral and multi-resolution satellites in the constellation, IRS is better positioned to meet the user demands. Currently, IRS data is being received directly by 22 International Ground Stations (IRS

IGS) and more than 20 resellers globally. While the completion is growing, it is good to see that the demand is also growing apace.

Ten satellites into orbit together for the first time? What does it signify for Indian Space Program?

This signifies our proven technology and growing satisfaction among the international customers. It also boots our confidence to take up more challenging projects. Till today we have launched 16 international satellites aboard PSLV and more customers are eager to opt for Indian launches on PSLV and GSLV.

My experience with GPS licensing

PHOTOGRAPHY happens to be my current favourite hobby. Recently I developed interest in geocoding my photographs. By geocoding photographs you can associate a geographical location with the photograph. This involves putting the latitude, longitude and altitude in the photographs EXIF tags. Exchangeable image file format (Exif) is a specification for the image file format used by digital cameras. This is trivial if you use a GPS receiver. Last year, I had succeeded in making necessary interface to my Nikon D200 camera with a GPS receiver. You can read about it in detail at *http://my-equipments.blogspot.com/*

As a school kid, when Rohini was launched, I was fascinated by satellite communication, It was with great interest, I looked forward to getting a GPS receiver. After doing some reading on the net, I narrowed on a GPS receiver being manufactured by a Taiwan firm named Holux. The model was Holux M-241 GPS receiver. The good thing about this receiver is that it runs on one AA battery. It also as a LCD screen which displays the geographical position. It also has enough memory to record 130,000 positions. I also managed to locate a ebay merchant called plumbargains, who had the best price I could find on the internet. So on 13th Mar, using my paypal account, I placed the order. The merchant promptly shipped the item on 14th Mar via EMS. With excitement I started tracking the package. It reached Mumbai on 14th Mar and got dispatched to Chennai. After that all I could see that the package has reached Chennai customs on Mar 17th. After that it seemed a long wait for the package to arrive. Finally 12 days later, on 25th Mar, I receive a letter dated 19th Mar 2008 from Office of Commisioner of Customs, Postal Appraising Dept - Air, Chennai asking for the following

1) Commercial Invoice
2) Purpose of import

The letter did manage to stress me a bit as it stated that if documents are not submitted within 15 days, the parcel will be treated as unauthorized as per Export-Import policy, custom act and postal regulations and appropriate action will be taken. Being a law abiding citizen, with extreme worry on my face, I replied the same day with the commercial invoice and a letter telling the customs that the GPS receiver will be used for my photography hobby. I even tried calling the customs office. But somehow I was never able to get through to the officer. Either the officer didn't happen to be in his seat or my lack of Tamil hampered my ability to communicate. After a wait of another eight days, I again received another intimation on 02 Apr (letter was dated 28/03/2008). To my shock and utter disbelief, the customs department was asking me for a WPC licence. The WIRELESS PLANNING & COORDINATION (WPC) Wing of the Ministry of Communications, created in 1952, is the National Radio Regulatory Authority responsible for Frequency Spectrum Management, including licensing and caters for the needs of all wireless users (Government and Private) in the country. It exercises the statutory functions of the Central Government and issues licenses to establish, maintain and operate wireless stations. After finding this information about WPC on the net, you can imagine the worry I had. I felt as I have done some major goof up in India's wireless spectrum by ordering this tiny receiver.

At this stage I decided that this was not right. Mobile phones with built-in-gps are being allowed without any problem. There are plenty of sites in India itself who are selling these GPS receivers at double the cost. So I couldn't figure out how I could disturb the wireless spectrum of India by using this receiver. But to be on the right side of the law, I decided to find out if WPC licence is required or not. If it was required, I decided that I would write to WPC and pay the necessary license fees to operate the receiver.

I came across two articles in Coordinates (www.mycoordinates.org) - GPS imports - Derestricted From this article I came to know that GPS imports was derestricted in Jan 2004. The article also provided relevant notifications and the ITC(HS) Exim Code 8526 91 90. I also went to the DGFT website, got the relevant email addresses and wrote an email to DGFT and WPC asking for help and clarification in this regard. I also faxed a letter to P.K. Garg - Wireless Adviser to the Government of India, Ministry of Communications & IT, New Delhi. Somehow, it seems that all my emails went into some kind of black hole. Never got any reply to any of my emails or fax.

Some of my friends suggested giving bribe. But I was sure that I didn't want to do that. So almost giving up, I drafted my reply to Chennai Customs, with copy of the notifications, and Chapter 85 of the new ITC(HS) classification which deals with the exim code 8526 91 90. In my letter I also mentioned that I have asked DGFT and WPC for clarification in this regard. Also stated that there is no WPC licence required and the parcel should be released after studying the material which I have provided.

I had given up all hopes and on Apr 11th 2008, I have the postman knocking on my door with the parcel. They collected the duty @32.011%. Absolutely no visit to the customs office. But the thing which made me happy the most was the fact that there was no bribe paid. It looks like that the custom officials were not aware of the latest notifications. I have now been using my GPS receiver and hope that this experience will help other law abiding Indian Citizens to import these GPS receivers legally without any hassles. Other than the fact that it took almost a month to get the parcel and none of the officials responded to any of my emails, I am very satisfied that at least there was no corruption involved in this exercise.

So my suggestion is, if your GPS receiver gets held up in Customs for WPC license, you need to provide all the notifications/ circular mentioned in the article by Bal Krishna in the article "GPS Receivers - Derestricted". Also send the relevant pages mentioning the exim code 8526 91 90 in Chap 85 of the new ITC(HS) code. You can download that at *http://www.infodriveindia.com/content/Exim/DGFT/ITC-HS-Codes-Import-Schedule-1/ch%2085.doc*

Manvendra
mbhangui@gmail.com

Carlson Software to give users CAD platform choice

Bruce Carlson, president and founder of Carlson Software Inc., announced the addition of the ability to run on IntelliCAD (ICAD) to the 2009 releases of Carlson Software. These include Carlson Civil 2009, Carlson Survey 2009, Carlson Hydrology 2009, Carlson Mining 2009, Carlson Takeoff 2009 and Carlson GIS 2009. *www.carlsonsw.com*

Cypress unveils Multi-Touch all point touchscreen

Cypress has recently unveiled its TrueTouch touchscreen system based on its programmable system-on-chip architecture. It includes a single-chip touchscreen that can interpret up to 10 inputs from all areas of the screen simultaneously. This will enable creation of new usage models for mobile handsets, portable media players, GPS systems, and other products. *http://app.cypress.com*

New u-blox GPS Module

u-blox AG has released NEO-5Q, miniature GPS module. It is a stand-alone GPS module in a 12 x 16 x 2.4–millimeter package. Its ROM-based architecture does not require an external Flash EPROM. It features an engine with 50 channels and more than one million correlators capable of simultaneously tracking GPS and GALILEO signals. It also includes u-blox's new KickStart rapid, weak-signal acquisition technology. *www.u-blox.com*

SiGe Semi debuts small dual-antenna GPS receiver

SiGe Semiconductor introduced its SE4150L GPS radio receiver featuring dual-antenna input capability, and housed in a low profile 4 mm x 4 mm package. It features a multi-bit output, which improves sensitivity and interference resistance for GPS applications. The device achieves a system noise figure of 1.0 dB and input third-order intercept performance (IIP3) of better than 0 dBm. *www.sige.com*

National Instruments Unveils GPS Simulation, Test System

National Instruments took the wraps off its GPS Toolkit for LabVIEW, an extension of the company's graphical system design environment that expands its module hardware RF PXI platform to include multi-satellite GPS signal simulation. Using NI LabVIEW software to create waveforms that simulate up to 12 satellites (C/A codes in the L1 band), engineers can test receiver characteristics such as sensitivity, time to first fix, and position accuracy with the NI PXIe-5672 RF vector signal generator, according to the company. *http://digital.ni.com*

Electronic navigation for future soldier program

Honeywell shall provide EADS a miniature electronic navigation aid - a Dead-Reckoning Module - that ensures accurate personnel location data in environments where GPS signals are unavailable. In urban warfare environments it is essential for soldiers to know where colleagues are so missions remain coordinated and cohesive. *www.gpsdaily.com*

NavCom Software updated for RTK, StarFire Network

NavCom Technology has released updated software for its RTK and StarFire products. StarFire is a satellite-based augmentation system that provides decimeter positioning accuracy on a worldwide basis. By increasing the StarFire constellation from three to six satellites, users are now provided with fully redundant global coverage, as well as increased performance assurance, as the GPS receiver now automatically selects the highest elevation satellite out of the six available *http://ipcommunications.tmcnet.com*

Hexagon acquires company in Fleet Management Machine Control

Hexagon has acquired the Swedish software company Viewserve AB. It is a service and software company offering a web based fleet management system to the construction market. It facilitates monitoring of vehicles and work activities, and can be used to notify individual consumers about work carried out. *http://investors.hexagon.se*

SatNav, India secures $7 million from Sequoia Capital

SatNav Technologies has recently attracted investment of $7 million from Sequoia Capital. The investment will be used to enhance the product portfolio of SatNav besides boost the depth of the company's map content. *www.financialexpress.com*

Wal-Mart expands PND selection, adds Magellan to line up

US mass merchant Wal-Mart's electronics departments now offer "an expanded selection of GPS, including touch screen displays in some stores and in all stores the addition of Magellan to the current GPS offerings of Garmin and TomTom", said the company. *www.gpsbusinessnews.com*

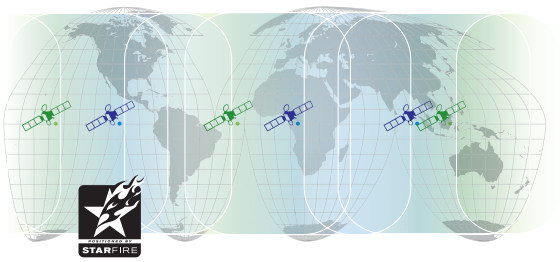
Navigon and Navteq ink 3-year deal

Navteq has reached a 3 year agreement to provide Germany's Navigon with its maps. The agreement covers onboard navigation across all Navigon's PNDs, plus software products for other PND brands and mobile phone customers worldwide. This is in addition to a recent contract to supply mapping products for Navigon's off-board business. *www.gpsbusinessnews.com*

Toshiba's laptop with GPS

Toshiba has unveiled several new laptops in its Qosmio range, including the Qosmio F55, the first Toshiba laptop with built-in GPS and Garmin's navigation software. Positioned as a "gaming machine that also takes mobility seriously", the Qosmio F55 has a 15.4" screen and a gamin grade Nvidia graphics card. This laptop is expected to debut this summer at a starting price of $1,150. *www.gpsbusinessnews.com*

Expand Your Horizons with StarFire™ and Ultra RTK.™



StarFire™ and RTK just got better.

How could we possibly improve StarFire™ and RTK? First, we doubled the number of StarFire™ satellites from three to six, providing signal redundancy and coverage all the way down to the user equipment. Then, we created Ultra RTK,™ which combined with our industry-exclusive RTK Extend,™ lets you work further from base stations and maintain RTK-level accuracy even during radio outages.

Want to double your competitive edge? Put NavCom's StarFire™ and RTK advantages to work for you. To learn more, call us at **+1 310 381 2000**.

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Spectra Precision introduces rugged data collector

Spectra Precision has released Spectra Precision® Nomad™ data collector running its new Field Surveyor 2.0 field software for its FOCUS® 10 Total Stations and EPOCH® 25 GPS Systems. It provides increased functionality for various surveying applications. The Nomad comes standard with an 806 MHz processor, 128 MB of memory and integrated Bluetooth technology. *www.spectraprecision.com*

Leica DX10 Field Controller PDA and Leica mojoRTK auto-steer system for agriculture

Leica Geosystems has released Leica DX10 Field Controller. It delivers maximum performance and reliability and meets the military's rigorous MIL-STD-810F standards for vibration, shock and temperature extremes. It comes with an IP67 rating against water, humidity, sand and dust. It has an ergonomically shaped case and the hand-strap at the back. *www.leica-geosystems.com*

Leica mojoRTK revolutionises the agricultural industry with a new auto-steer system that provides repeatable 5cm RTK accuracy with 99% reliability. It provides an affordable solution for farmers who need to see repeatability pass to pass and year to year. Plus, with Leica Virtual Wrench™, the agriculture industry's first remote service and diagnostic tool, Soilessentials technicians can view the same console screens and settings the farmer sees in the cab. *www.leica-geosystems.com*

CARIS Releases Target Tracking in Web-Mapping Software

CARIS has released version 4.3 of its web mapping software, Spatial Fusion Enterprise, featuring real-time target tracking. It is a web mapping engine for the integration of existing data from many sources, formats and locations and introduces geospatial visualisation and analysis tools to support strategic short and long-term decision.

Galileo update

Boeing considering submitting bid for EU's Galileo project

Boeing Co is considering submitting a bid in the forthcoming tender for EU's Galileo satellite navigation project, Handelsblatt said, citing a Boeing spokeswoman. Handelsblatt said Boeing is interested in participating in the tender for 26 position satellites, which make up one-third of the overall budget for the estimated 3.4 billion euros Galileo project. The Galileo project would be divided into six segments -- satellites, launchers, computer programmes, ground stations, control stations and system operation. EU officials have previously said the European Commission and the European Space Agency would launch public tenders by the middle of this year, with a view to first contracts being signed before 2009.*http://www.hemscott.com/news/*

Third meeting of the Steering Board of Russia-EU

Dialogue on space activities established in accordance with the "Road Map" on the Common Economic Space. C reading was signed on May 10, 2005 in Moscow, President of the Russian Federation Vladimir Putin, Prime Minister of Luxembourg Jean-K.Yunkerom, Chairperson of the Commission of European Communities Zh.M.Durau-Barroso and EU High Representative for Foreign Policy and Security H. Solana. During the meeting, co-chaired by were: the Russian side - the head of Roscosmos N. A. Perminov; the European side - Director General of the European Space Agency (ESA) F-Zh.Dorden and head of the Directorate-General for Industry and Enterprise European Commission H. Zurek, examined the results of the Dialogue established seven working groups for the period since the previous meeting (Moscow, March 21 2007), and plans for their work for the period until 2009 and beyond.

All three sides gave a positive assessment of the work on all seven areas of interaction and stressed that the dialogue format allows more effectively seek new areas of cooperation and improve mechanisms for their implementation.

In doing so, with particular satisfaction the Co-Chairs noted the results achieved within the framework of joint programmes such priority as the Alliance Guiana Space Centre "and" The long-term manned transport system "(PCA).

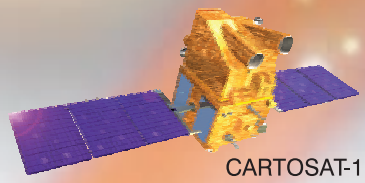
Also plans were approved works to ensure compatibility and complementarity of Global Navigation Satellite Systems (GNSS) GLONASS and Galileo, work on the integration of GNSS augmentations: SDKM Russian and European EGNOS, respectively.

In the field of remote sensing principles were agreed to exchange data and results of satellite observations for various tasks, including meteorology, environmental and agricultural monitoring, control precursors of natural disasters. *http://rescommunis.wordpress.com/2008/06/26*

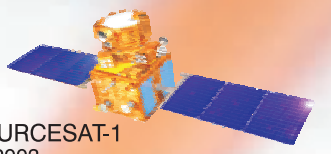
INDIAN REMOTE SENSING SATELLITE (IRS)

Roving Eye in the Sky

CARTOSAT-2
10.01. 2007
PSLV-C7

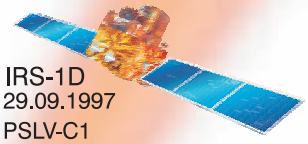


CARTOSAT-1
05.05. 2005
PSLV-C6

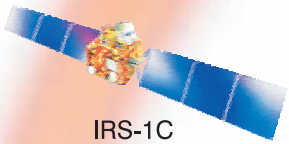


RESOURCESAT-1
17.10. 2003
PSLV-C5

OCEANSAT-1
26.05.1999
PSLV-C2



IRS-1D
29.09.1997
PSLV-C1



IRS-1C
28.12.1995
MOLNIYA

Offering High Resolution Imageries with multiple choices

Ernst Happel stadium, Vienna, 0.8m Color image from IRS Cartosat and Resourcesat satellites

Antrix Corporation markets images from the following satellites internationally through a network of 22 International Ground Stations and 20 Resellers

• **Cartosat-2** • **Cartosat-1** • **Resourcesat-1** • **IRS-1C/1D** • **Oceansat-1**

Data ranging from 1 meter to 360 meter spatial resolution for a wide range of applications.

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Credent aids in Myanmar's cyclone relief work

After NARGIS cyclone hit Myanmar and took the lives of about 100,000, an estimated 1.5 million victims are trying to survive in midst of chaos. Credent plans to extend assistance in the cyclone affected regions by providing the related map data from available resources including local organizations and the web. The development of the maps and GIS data is currently under Credent expense. To strengthen the provision of this vital information, any funding received will greatly improve the speed of the work. *www.credent-asia.com/*

The Hong Kong Lands Department chooses ESRI

Hong Kong Lands Department has awarded ESRI a US$4.9 million contract to replace its Computerized Land Information System (CLIS) containing digital map data by 450 users. ESRI will replace the CLIS with an enterprise GIS, allowing users throughout the department to work with one central geodatabase instead of disparate silos of data. It will better support the business processes and workflows of the department. *www.esri.com*

Compilation of a Carbon dioxide geological storage atlas

Carbon capture and storage (CCS) is one of the recognised mitigation measures for the lowering of greenhouse-gas emissions. Assessment of the potential for CCS in South Africa requires a detailed investigation into locating and characterising potential carbon geological-storage sites. The CGS, along with the Petroleum Agency of South Africa, has been appointed to compile and publish the resulting CO2 Geological Storage Atlas. *http://196.33.85.14/cgs_inter/*

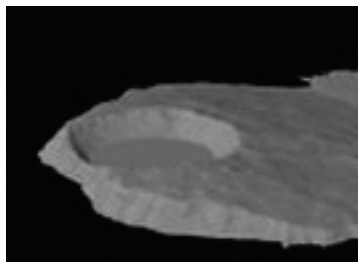
NAVTEQ expands APAC coverage to Indonesia

NAVTEQ has announced release of navigable map coverage in Indonesia, which includes over 250,000 km of road network. The greater Jakarta includes areas of highest coverage level, inclusion and verification of up to 260 road attributes. *www.gpsbusinessnews.com*

Tele Atlas to map the world in 3D

According to MD of APAC South for Tele Atlas, the company has deployed a fleet of camera-mounted vans canvassing the streets of major cities such as Singapore capturing 3-D information for its upcoming 3-D world maps. Each vehicle is equipped with up to six cameras capturing detailed information of its surroundings, including texture of building facades. It will be a couple of years before such capabilities come to the mass market. *http://web20.telecomtv.com/*

3-D modeling by Autodesk for better decision making



Easter Island is the most remote inhabited place in the world, more than 2200 km from the coast of Chile. As natural resources are being depleted at an alarming rate and tourism overwhelms the island's fragile infrastructure, the island is at a turning point – trying to limit further damage to their historical sites. Autodesk offers 2D and 3D design technology – began work with the government in Oct 2007, they've been able to help digitally document historical artefacts, natural resources and infrastructure. 3D models of the island are helping to better visualize and analyze how development plans will impact residents and resources, and promote sustainable decision-making.

China Earthquake Geospatial Research Portal

The Harvard Centre for Geographic Analysis and Harvard Fairbank Centre for East Asian Research have established a China Earthquake Geospatial Research Portal. It contains maps, GIS data and GIS analysis aimed at assist ongoing research on the recent earthquakes in China.

The site hosts a map server for the sharing and visualisation of datasets relevant to the earthquake and its aftereffects. Two GIS vector layers are available for download - the earthquake epicentres and aftershocks and the illustration of the impact zones.

Free GIS Services for earthquake relief in Sichuan Province

China TransInfo Technology has joined the Wenchuan Earthquake Enterprise Rescue Alliance headed by the ESRI, by providing free GIS services and products to the Sichuan earthquake relief effort. This Alliance has been providing real time information related to weather forecasting, transportation, electrical grids, and other areas in the disaster zone. *www.earthtimes.org/*

Coalition of Geospatial Organizations Formed in USA

Several national geospatial organizations have recently come together to create the Coalition of Geospatial Organizations (COGO). It was developed to provide a forum for organizations concerned with national geospatial issues that will 1) improve communications among the member organizations (and others), 2) provide educational information on relevant issues for their respective memberships, 3) align and strengthen their respective policy agendas, and 4) facilitate development of strategies to address

national issues. The participants are

- American Congress on Surveying and Mapping
- American Society for Photogrammetry and Remote Sensing
- Association of American Geographers
- Cartography and Geographic Information Society
- Geospatial Information Technology Association
- GIS Certification Institute
- Management Association for Private Photogrammetric Surveyors
- National States Geographic Information Council
- University Consortium for Geographic Information Science
- Urban and Regional Information Systems Association

Cadcorp announces new release of mSIS – mobile Spatial Information System.

Digital mapping and GIS software developer Cadcorp has announced a new release of its mSIS - mobile Spatial Information System ('mSIS') product. It is an easy-to-use field data capture application for the Pocket PC platform. It is supplied in two parts: a desktop based project management package - mSIS Office; plus the Pocket PC-based data capture software - mSIS Mobile.

Cadcorp is also looking for distributors in all territories. Those who are a systems integrator GIS developer, or an IT solutions company, can join the growing network of business partners from around the world.

Satellite technology to aid fishermen in India

The Indian Remote Sensing Applications Centre at Hyderabad has been giving readings of the remote sensing satellite to all the fishing harbors to help the fishermen to track the fish shoals. The system works on the basis of the GPS technology and satellite mapping of the seas. The government shall set up an earth station not bigger than a computer room with modern gadgets. *http://mangalorean.com*

Satellite pictures tell of human rights violation

A project launched by the American Association for the Advancement of Science (AAAS) aims to use satellite imagery to provide evidence of human rights atrocities. The AAAS worked with Human Rights Watch to produce a 130-page report on attacks on 8 villages across the remote Ogaden region of eastern Ethiopia, where "before" and "after" satellite images of villages were analysed. It shows blackened fields and destroyed homes where before there were whole villages. *www.sbs.com.au*

Indian Space Research Organisation to launch satellite to study climate change

Few issues have taken the global centre stage as did climate change recently, and images of melting polar ice caps and rising sea levels are now all too ubiquitous to ignore. But how much do we really know about global warming? What is the quantity of greenhouse gases in our atmosphere? How are they distributed around the world? Some answers might be brought back by I-STAG (Indian Satellite for Aerosol and Gases), a small satellite to be launched by ISRO in 2012. It will collect data on the quantity and distribution of green house gases and other content to estimate an impact on climate.

The satellite will have a special focus on the tropics and will monitor the spatial and temporal variation in the amount of these gases to assess their long-term effect on the climate and ecosystem. The experiments would also attempt to estimate the impact of biomass burning and forest fires on climate.

I-STAG will be developed jointly by the Indian Institute of Science, the Space Physics Laboratory in Thiruvananthapuram, the Physical Research Laboratory in Ahmedabad, and the National Atmospheric Research Laboratory in Tirupati.

I-STAG is part of the space organisation's "small satellites programme" for scientific experiments, said ISRO Chairman G. Madhavan Nair. "The first of the series of small satellite was the Indian Mini Satellite, which flew with CARTOSAT-2A.

Jason-2 successfully launched

CNES and NASA have launched the Ocean Surface Topography Mission/ Jason 2 satellite on 20th June to continue charting sea level, a vital indicator of global climate change. The mission will return a vast amount of new data that will improve weather, climate and ocean forecasts.Measurements of sea-surface height, or ocean surface topography, reveal the speed and direction of ocean currents and tell scientists how much of the sun's energy is stored by the ocean. Combining ocean current and heat storage data is key to understanding global climate variations. NOAA will use the improved data to better predict hurricane intensity, which is directly affected by the amount of heat stored in the upper ocean.

GPS system used to slow speeding cars

Cars will be fitted with test systems which tell drivers of speed limits and reduce vehicle speeds if they fail to slow down, as part of a new road safety trial in NSW, Australia. It will be a $1 million, 18-month trial involving 100 cars. The cars will be fitted with GPS devices. It will also warn drivers if they are speeding. In addition, 40 of the cars will be fitted with separate technology limiting fuel to the engine if a driver fails to slow down, automatically forcing a reduction in the car's speed. *http://news.theage.com.au*

GPS based Fleet Management by Oilfield construction firm

Pipeline construction firm Arnett and Burgess has selected the SmartFleet® GPS fleet management system for their fleet of light and heavy duty vehicles. It will provide online tools to help manage the safety of employees and the productivity of equipment. *www.pr-usa.net*

NYC makes buses hijack proof with remote controlled device

NYC has installed a new GPS device in thousands of local commuter and tourist buses. The device is attached to the bus computer system and it relays information about its speed and direction to a dispatcher. In the event of a hijacking, the dispatcher can remotely slow the bus down and prevent it from being restarted. Slowing the bus down is intended to give terrorists extra time to rethink their position before doing something drastic. *http://gizmodo.com*

GPS clocks to maintain train punctuality

As many as 32 railway stations in between Tirupattur and Pothanur in the newly formed Salem division, India will soon have clocks that run on the GPS technology to maintain uniform train timing and punctuality. An estimated Rs 16 lakhs would be spent on the clocks. *www.newindpress.com*

Lockheed Martin, Oz proceed with modernized train management

Australia is looking to GPS and inertial sensor technologies as the basis for a modernized train management system, using Lockheed Martin to help develop it. The company has received a US$74.8 million contract from the Australian Rail Track Corporation Ltd. for the proof-of-concept phase of the Advanced Train Management System (ATMS). It will use inertial guidance technology and GPS tracking to feed train data such as location, speed, and weight to a central management system, which will in turn monitor train separations on the same sections of track. *www.lockheedmartin.com*

IGNSS Society announces new President

Matt Higgins was appointed the President of the International Global Navigation Satellite Systems (IGNSS) Society earlier this year. The IGNSS Society is a not-for-profit organisation supporting the Global Navigation Satellite Systems (GNSS) industry in Australia. Matt is an internationally recognised specialist in his field and was recently nominated as one of the 50 leaders to watch in the international global navigation industry by top industry publication GPS World. He also holds the prestigious position of vice president of the International Federation of Surveyors (FIG) from 2007 to 2010. In this position, Matt will represent FIG on the United Nations International Committee on Global Navigation Satellite Systems.

Twenty-First Century Plant Hunter Survey UK National Trust Gardens

The UK's biggest ever plant hunt began recently when gardeners and volunteers at Killerton in Devon kicked off a survey that will cover tens of thousands of plants at more than eighty significant National Trust gardens. A photo will be taken of each plant, a GPS grid reference will be recorded using the Magellan MobileMapper CX running DigiTerra Explorer 5 software and each plant will be identified by experts.

GPS failing? Blame it on Aurora Borealis

Scientists have discovered that the natural light shows of the Northern Lights – or Aurora Borealis – interfere with the signals from global positioning satellites, which are used by sat-navs to pinpoint the locations of vehicles, boats and aircraft. A study by the University of Bath's department of electrical engineering is the first to find that the aurora borealis, which can be seen from most parts of Britain, directly affects sat-navs. The research, published in the American Geophysical Union's International Journal of Space Weather, used three closely positioned sat-nav systems in Norway to measure the signal strength from satellites before, during and after an aurora borealis event.

They found the signal faded dramatically during the activity and the devices struggled to get a lock on the satellites. Under normal circumstances, the ionosphere, behave like a smooth plate of glass, allowing the signals from the satellites to pass straight through. But during the aurora, the ionosphere becomes "lumpy", which disrupts the signals. Prof Cathryn Mitchell, who led the research, said sat-nav errors were likely to become more frequent over the next four years due to increasing aurora activity. "Anywhere that the aurora is visible, it will cause disruption," she said. "Although most people in the UK can't see the aurora when it is happening, because of cloud or ambient light, it can still affect the GPS signal. We have just passed a minimum in activity but we are due to hit a maximum in 2012, which is when we would expect to see most disruption." The last peak in aurora activity came in 2000, when few GPS devices were in use.

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Compass added to GPS for Ricoh 500SE Camera

GeoSpatial Experts have introduced an integrated magnetic compass/GPS receiver module for the Ricoh 500SE digital camera It had a sole built-in GPS receiver, which enabled the camera to acquire the location coordinates of each photo and embed them with the photo as an attribute without an external GPS device. *http://sc.gpsworld.com*

Microsoft unveils OS for portable navigation devices

Microsoft has introduced its first operating system designed for manufacturers of PND's. Windows Embedded NavReady 2009, which is based on Windows Embedded CE, includes technologies for connecting PNDs to online services, mobile phones using Bluetooth, and Windows-based PCs. *www.informationweek.com*

Toshiba announces laptop with GPS, Garmin software

Toshiba has unveiled Qosmio F55, the first Toshiba laptop with built-in GPS and Garmin's navigation software. The built-in GPS system empowers users to determine their exact location in relation to their destination within moments. *www.i4u.com*

MWg enters Indian market

Mobile and Wireless Group (MWg) has rolled out their entrance into the Indian market and unveiled their latest Windows Mobile handsets, the MWg Atom V and MWg Zinc II. The MWg Atom V is a full-featured, touch-screen operated device with in-built GPS while the MWg Zinc II features a sliding keyboard and happens to be one of the first Windows Mobile 6.1 devices available in India. *www.varindia.com*

Asus brings its M930 mobile to India

Asus is launching its smartphone M930 in the Indian market. It features 2 screens, one is external for phone functionality and the larger one on the inside next to the QWERTY keyboard. It includes functions like GPS, HSDPA, WiFi, 2 MP camera with auto-focus, Bluetooth etc. *www.khabrein.info*

Tele Atlas unveils MultiNav development platform

Tele Atlas has unveiled Tele Atlas MultiNav, which provides digital map database delivered with a smaller data footprint. It will decrease developers' time-to-market by speeding the development process and allow a smaller run-time format for their applications. It also shall have map data enriched with qualified community content. *www.teleatlas.com*

Samsung launches iPhone rival

Samsung has launched a new touch-screen smartphone only three hours before Apple was unveiling its new version of the iPhone. Its called Omnia, looks similar to the iPhone, has a wide screen for viewing video and browsing the internet. It also comes with a 5 megapixel camera and runs Microsoft Windows Mobile software. *www.smarthouse.com.au*

Apple unveils new 3G iPhone – with GPS

Steve Jobs, Apple's chief executive, announced details of new 8GB iPhone. The new phone also has GPS, which means it will be able to locate itself more accurately via satellite, and will offer more services tailored to the owner's location, such as the ability to find nearby restaurants and businesses *www.apple.com*

Nokia launches N78 with GPS features

Nokia has launched N78 model with GPS features. A feature incorporated in N78 is it automatically tags location data to the picture, allowing users to save picture by date and by geographical coordinates. *www.telecomtiger.com*

Glofiish from Taiwan all set to enter Indian market

E-Ten shall introduce smartphone Glofiish into the Indian market soon. Initially the company is looking at launching its X610 model for Glofiish in the Indian region. It comes with windows mobile 6.1 professional, GSM/EDGE quad band and built in GPS & bluetooth capabilities. *http://news.ciol.com*

Garmin to debut in GPS phone market, teams up with Taiwanese handset makers

Garmin Ltd., shall soon debut a GPS phone codenamed Nuvifone in cooperation with Taiwanese handheld-device specialists formerly hired by HTC Corp. The company shall make its phones available at telecom carriers like AT&T. *http://news.cens.com*

Google Signs Five Year Map Agreement with Tele Atlas

Tele Atlas, announced that Google™, has signed a long term license agreement with the company that gives Google access to Tele Atlas maps and dynamic content in more than 200 countries around the world.

The agreement spans Google's current and future map-based services and navigation offerings across mobile, online and desktop environments. These include the Google Maps™ and Google Earth™ services and mobile applications such as Google Maps for Mobile™. The agreement also gives Tele Atlas access to edits for its maps from Google's community of users, whose suggested changes can help the company further increase the quality and richness of Tele Atlas maps.

Space weather zaps GPS units, cell towers

Space weather specifically electrical distubances in Earth's ionosphere -- can disrupt the accuracy of GPS units appreciably, a problem scientists are addressing. The ionosphere is the layer of the atmosphere extending upward from a height of about 60 miles. Its tenuous gas is electrically charged enough to affect radio signals.

GPS units calculate their locations by

analyzing signals from a dedicated group of satellites, but those signals can be delayed or distorted while passing through the ionosphere, explained Anthea Coster, an atmospheric scientist at MIT. If there's no sunspot activity, the average inaccuracy is about 16 feet (5 meters) for civilian handheld or car GPS units that only use one radio frequency. During sunspot activity, the inaccuracy can exceed 32 yards (30 meters).

Space storms, sometimes caused by sunspot activity, are also known to disrupt cell towers, causing dropped calls. Strong solar flares can disrupt all types of communications on Earth, including GPS, and even disable satellites. *http://news.xinhuanet.com*

Chrysler debuts Uconnect with in-vehicle navigation

Chrysler, the auto maker has unveiled an in-vehicle consumer electronics platform it has dubbed Uconnect, an umbrella for various options including GPS-based navigation. Uconnect GPS combines features from both Uconnect Phone and Uconnect Tunes with navigation and real-time traffic data. It includes an integrated voice recognition system and touch screen operation. The voice recognition system also recognizes more than 100,000 words and can be used for address input, according to the car maker. *http://www.detnews.com*

TV positioning trial in UK proves successful

Rosum Corp. announced that it has successfully completed a DVB-H positioning trial in collaboration with National Grid Wireless, provider of large-scale transmission infrastructure in U.K. Rosum's technology uses terrestrial television signals — whether analog, digital, or mobile — to provide accurate in-home location information, where GPS signals may be hindered. Rosum and National Grid Wireless conducted the trial at National Grid Wireless' DVB-H trial network in Warwick, U.K., and utilized DVB-H mobile TV broadcasts to precisely locate prototype receivers in a variety of environments, including multi-storey car parks where GPS signals are unavailable. *http://www.rosum.com*

Uttar Pradesh, India buses to have global positioning system

Uttar Pradesh State Road Transport Corporation (UPSRTC) plans to install GPS in its buses, an official said. "We would be able to keep complete track of all the buses (through GPS)," said A.K. Srivastava, UPSRTC chief general manager (technical). The GPS will be useful in finding the exact spot in case of an accident, he said. UPSRTC officials said that they are preparing a detailed project report on installation of the GPS in the buses. It has also undertaken an exercise to install speed-control devices in all its buses. "Speed-control device will help in checking over-speeding of buses that lead to road mishaps. We will ensure fitting of speed-control devices in about 7,000 buses owned by the UPSRTC," Srivastava said.

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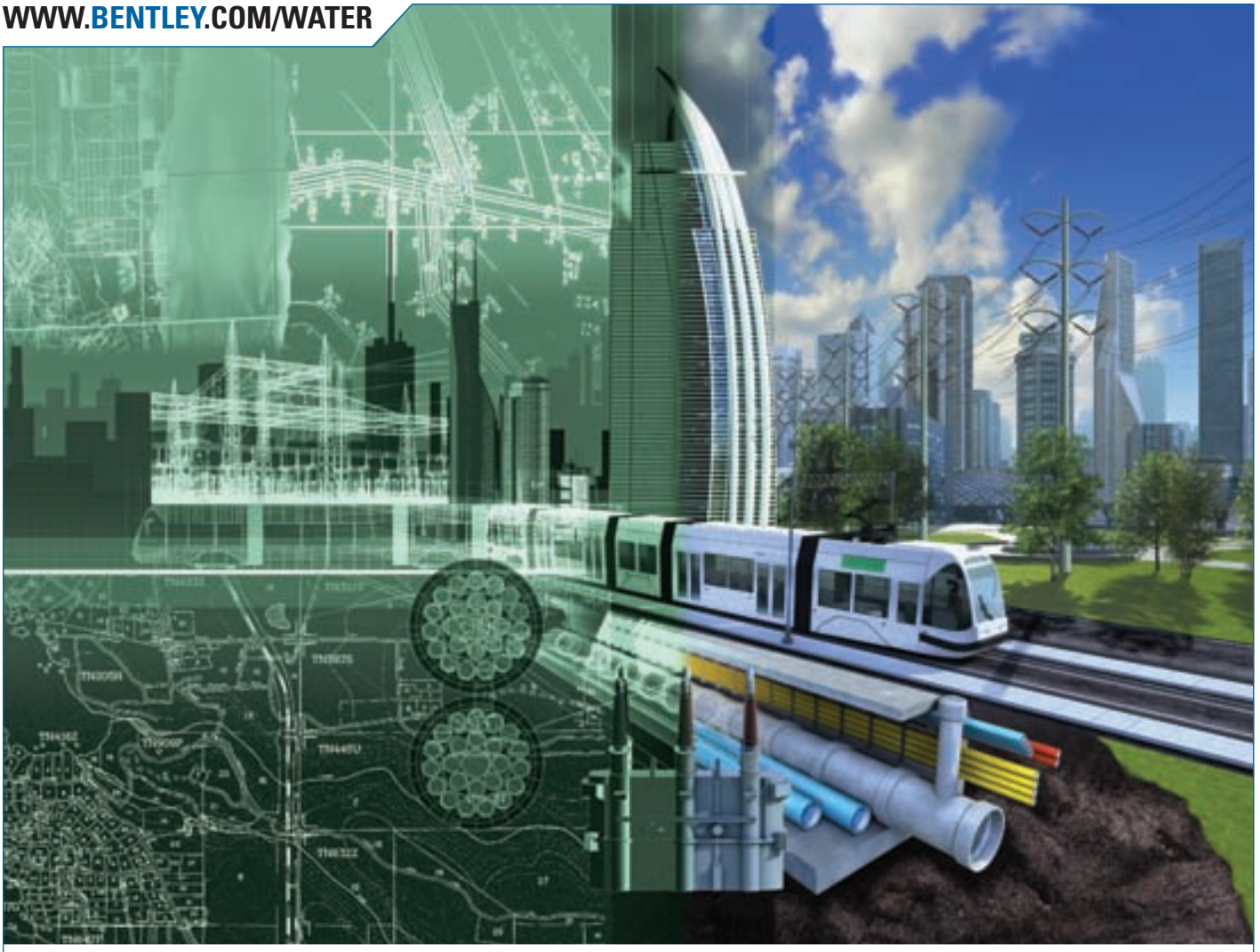

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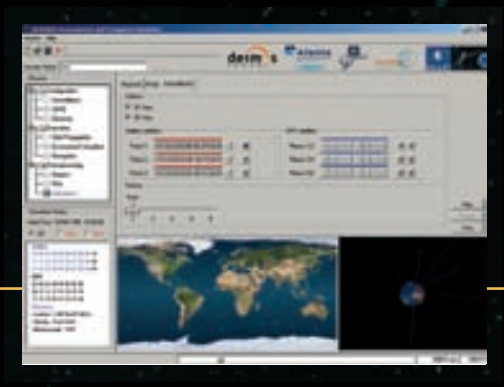

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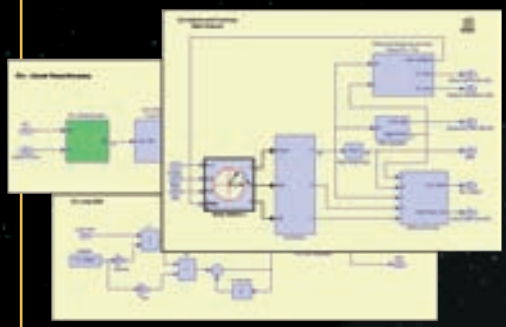

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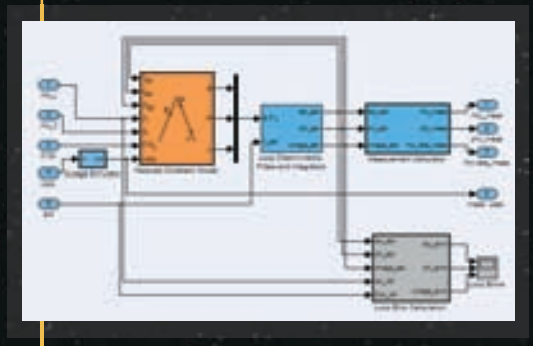

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