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Abstracts

Content

Albania

Innovative GNSS Interference Mitigation Technique based on Electric Field Vector Cancellation via Polarization Nulling approach

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Introduction to Jamming Theory: While the importance of GPS is unquestionable, the increasing availability of jamming technology is proving to be really problematic. The low level of the GPS signals makes them extremely susceptible to interference effects. The ability of a receiver to accomplish critical functions is characterized by its anti-jam capability.

Possible anti – jamming techniques for standard GNSS receivers: Interference to civilian receivers is likely to increase in the future due to the rapid growth of telecommunications and other wireless data transmission systems. Although these systems may not transmit on the same frequency as GPS, intermodulation products and other out-of band transmissions may lie in the GPS band. Military users also need to take under consideration intentional jamming.

Null Polarizing Technique: A single GPS antenna with an adaptive polarization response can be used to reject interferences with polarizations other than the GPS signal. The key idea of polarisation cancellers is thus to reject the interference by adaptively mismatching the polarisation response of the antenna to the polarisation of the interference signal.

Electric Field Vector Cancellation technique: In this section I will introduce this innovative technique aiming in the cancellation of the jammer /interference influence in the GNSS signal based only on the polarization information of the signal itself.

Algeria

Refection of National Geodetic Infrastructure Using GNSS Technique

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The GPS technique in Algeria is currently used and applied in various areas. It is widely used for basic equipment of the country as geodetic networks of different orders. The production of support points for mapping industrial areas using satellite image such as in the south of Algeria or touristic regions.

The Algerian two dimensional Geodesy started in the 19th century and allowed to establish a network of triangulation by classical techniques based on the National Geodetic System called "North Sahara 1959" calculated on the Clarke 1880 ellipsoid. The altimetry was performed with chains of precise levelling.

To improve the quality of the cartographic products and monitoring the distortions associated with the classic local system, studies are being performed on the GNSS contribution for an overhaul of the National Geodetic System. They concern the following aspects:

- The value of the National Geodetic Network (scale and orientation) and the evaluation of the National Geodetic Network distortions "North Sahara 1959" from GPS measurements. The use of GPS has now become an indispensable tool for geodesy and topography, this requires the setting of the local system (Nord Sahara 1959) on the overall system GPS (WGS-84). Thus, the accuracy of the transformation parameters depends mainly on the quality of the data provided by the two systems.
- The establishment a new national three-dimensional 3D datum, based on GNSS technology, compatible with the international systems as ITRF for various applications of spatial positioning, using in a first time, seven GPS permanent stations..
- The determination of a precise local geoid model consists on a new vertical datum dedicated

mainly to support the GPS levelling operations in order to densify the lower orders networks.

The GPS technique is also used to provide some control points to establish satellite image of small scale in the Saharian regions. It is also used to establish networks of support points for surveying industrial zones (petrochemicals platform of Arzew) or tourist regions.

Bosnia and Herzegovina

Possibilities and benefit of the online GNSS PPP - free services for GNSS applications, the accuracy and reliability

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Several free on line GNSS PPP services established by different worldwide universities and institutions with objective to on-line process GNSS observation data. Use of PPP has become possible since the resent advancement and availability of precise satellite ephemerides and clock corrections from IGS.

This paper represents a research on the accuracy and reliability of the free online GNSS services (APPS, CSRS, GAPS, magicGNSS), on sample data of EPN SRJV permanent station as well as of some BIHPOS (Bosnia and Herzegovina Positioning Service) stations.

The paper gives short fundamentals of PPP methods, as well as PPP free services (APPS, CSRS, GAPS, magicGNSS) described and their characteristics were presented.
Daily observation files of 22 BIHPOS stations were divided into the intervals of 3 hours, 6, 12 and 24 hours. Files in the RINEX format were uploaded to the different PPP online services, in two/tree time series, in order to get the results processed with ultra rapid, rapid and final IGS products.

The results were presented. Standard deviations of the coordinates (calculated from comparison between known BIHPOS coordinates and on-line processed data using IGS products) presented that all available GNSS PPP services provide the similar accuracy after one day of observation. Pretty good results also archived when rapid products used and sometime is not reasonable and necessary to wait for final products to be available.

We concluded that free on-line GNSS PPP services offer good opportunities for scientist and professional from developing country to process observing GNSS data without investment in expansive GNSS software.

Bulgaria

Geodynamical Study of the Territory of Balkan Peninsula from GPS solutions

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The present geodynamical investigation is a complete four seasonal study of up to now investigated behaviour of Balkan Peninsula (BP) GNSS permanent stations, accomplished only within each particular season - winter, spring, summer, autumn. GPS one week data in 2006, 2007, 2008, 2009 and 2010 of 29 free available GNSS permanent stations on the territory of BP have been processed with the Bernese software, version 5.0 in ITRF2005. Station velocity vectors have been estimated from combined solutions for every season. The estimated seasonal horizontal velocity vectors have been compared and station behavior has been analyzed.

Chile

Seismic Deformation Analysis Using GNSS Technology and the Chilean Reference Frame: 2010 Maule Earthquake

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Chile is located just above the subduction zone between the Nazca and the South American plate. In this zone the Nazca plate moves underneath the South American plate causing a drift of 2 cm/year in the north east direction. This physical phenomenon is the responsible for all the seismic, geological and volcanic activity that characterizes the region.

GNSS technology, especially the continuous GPS stations (CGPS) has provided high quality and almost real time information related to deformations and dynamics of the surface, close to mm precision. Also it has improved the availability of the data, since CGPS stations can be deployed in almost any type of terrain in a fast and easy way. The capability of connecting them to the internet allows the data to be obtained and processed daily, increasing its availability.

Each one of these continuous GPS stations is programmed to record data every 30 seconds, for 24 hours a day. Through this data it is possible to obtain a spatial position for the station, one for every day. So during a year it is possible to obtain a maximum of 365 Cartesian coordinates, related to the national reference frame "SIRGAS Chile". By creating the time series graph for each station, a detailed analysis of the ground displacement can be performed, obtaining its magnitude in cm/year. This represents the effect on the surface of the interaction between the Nazca and South American plate. Any event produced beneath the surface, where the plates are located, is going to be perceived over the surface as a displacement different from the regular one.

The February 27 2010 Maule mega thrust earthquake, has provided a unique opportunity to fully study a geophysical event through GNSS technology. The fact that the Chilean reference frame has as its main core a continuous GPS network distributed all over Chilean territory and that these stations had been daily collecting data around the country since 2000, for the first time made it possible to obtain an important amount of information related to the regular drift of the region previous to the event, a detailed picture of the main earthquake period and its effects on the landscape and an even more precise information about the post seismic stage.

Previous to the earthquake, there had been a total of 16 continuous GPS station working in the affected area since 2000. From the information collected, it was possible to fully appreciate the regular interaction between the plates prior to the earthquake, especially the rate and direction of it in the affected region. This displacement was approximately 2 cm/year in the north east direction. Also when the earthquake took place, these stations created a detailed picture of how the surface moves during the event from beginning to end, this is known as the coseismic displacement. After February 27 2010 a total of 40 CGPS were deployed in the affected region in places where no CGPS were available, in order to obtain better and detailed information of the postsiesmic stage.

The analysis of all the information gathered has provided a clear picture of the deformation during the earthquake, finding displacements of entire cities that range from 0.3 mt. to more than 4 mt south west direction, proving that the behavior of the land is far from being linear and constant. Also the deformation produced by the post seismic period has been irregular in magnitude and direction.

All data gathered is very important to understand the complexity of the interactions of the plates in the subduction zone and GNSS technology is playing a key role providing the frame on within these studies are being performed.

China

Update of BeiDou System and its Applications

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The China Beidou Navigation System has started offering free civilian positioning and navigation services over the Asia-Pacific region since December 27, 2012. The Beidou satellite network will provide

positioning services with an accuracy of 10 meters, or 33 feet. Speed estimates are within less than one foot per second, and time measurements within 10 nanoseconds.

BeiDou System is committed to provide stable, reliable and high quality satellite navigation services for global users. Together with other GNSS, BeiDou System will push forward the development of GNSS career and promote human civilization and society progress, ultimately serve the world, benefit the mankind.

The system has been used in transportation, weather forecasting, hydrological monitoring, and mapping for tests. The Beidou navigation system is developed based on a "three-step" strategy. Currently in its second phase, the system now offers regional service with 16 satellites.

Progress of the International Centre for GNSS Science Technology and Education

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The establishment of an International Centre for GNSS Science Technology and Education was proposed in already existing higher institutions in the United Nations International meeting on the applications of GNSS on 12-16 December 2011 in Vienna. As the top university in Space education in China, Beihang University has taken actively response to above recommendation and organized a series of activities, including set up the Beidou international exchange and training center which sponsored by the China Navigation Satellite Office, organize the first international summer school on BeiDou/GNSS technology frontier, organize the first master degree program on GNSS for international participants, actively involve the activities of the ICG 7 meeting Working group C which held in Beijing, participate the Asia-Pacific Promotion of BeiDou system and etc. Besides of introducing some more details about the activities we have organized, I am going present the plan for the International Centre for GNSS Science Technology and Education which hosted at Beihang University in my presentation. The goal, structure, education curriculum, teaching facility, participating scholars, experiment and practice, quality assurance/assessment, target audience and logistics of the center will be discussed.

China

Analysis of Architecture and Characteristics of Compass Location Based Service Network

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Presently, assisted by the rapidly developed Global Navigation Satellite System, the widely applied wireless communication technologies and smart mobile devices, as well as a series of support policy, location based service (LBS), which is marked as the forefront of GIS science and technology, has been improved ever-changing in China. In this paper, we will analysis the environment and opportunity of Compass GNSS based LBS network (CLBSN), and discusses its' architecture. Based on such architecture, we will analysis the characteristics of CLBSN which are brand new with respect to most of currently existing LBS system. The goals of our research are to study the contents and construction mode of CLBSN, and to make the construction target of CLBSN clearer. It can be taken as a reference for the construction of location based service network in China.

Estonia

GNSS Permanent Stations as the Part of Integrated Geodetic System in Estonia

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Integrated geodetic systems are used to monitor different geodetic observables at the same location, which includes tide gauges, high precision benchmarks, absolute and/or relative gravity points and

satellite positioning measurements (or CORS) as well atmospheric observables. Sometimes SLR or VLBI measurements are also added to the integrated system.

Nowadays in Estonia there are about six stations which have at least three mentioned observables available. In the paper the possibilities to tie different observables to the integrated geodetic system are shown and as well the foresight to the future is given.

Germany

GNSS Data Acquisition and Processing-Application for Sustainable Development of the Transportation Infrastructure

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In the recent years the development of Mobile Laser Scanning with terrestrial and water-based vehicles in various engineering fields has a rapid progress. The main usage of MLS systems is concentrated in the detection of streets, highways and railway roads.

As a response of the rising interest to the MLS technology and its applications for engineering purposes (such as streets and railway roads detection, deformation analysis) a worldwide measurements with a-posteriori data adjustment and management were performed by technet-rail. The goal was to be proved the usage and of the laser- scanning technology with integrated IMU and GNSS equipment for monitoring of the transportation infrastructure objects. The measurements carried out in the last years confirmed the technical possibility of the system to provide fast, high accurate and complete scanning not only of the main road but also of the overhead wires and the neighbour streets or railway lines. The data acquisition and processing are done in a continuous way which minimizes the error factors. The software packages developed by technet-rail provide the basic tools for the point clouds analysis and ensure high accuracy transition from the raw measurement data to 3D point clouds into desired coordinate system especially in chainage based railway reference systems. The software data processing ensures high quality, reliability and accuracy of the adjusted measurements. The end products are base for performing of real time determination and monitoring of the transport infrastructure objects.

Hungary

GNSSnet.hu – Experiences and Developments

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The Hungarian Active GNSS Network (GNSSnet.hu) provides real-time corrections, data for post-processing and also an automatic central post-processing solution on the basis of measurements of 54 permanent stations. All of the inland stations can track both GPS and GLONASS satellites.
In 2012 there were several significant developments in the network. For the users the most important was the introduction of an ionosphere monitoring solution, which enables the tracking of the state of the upper atmosphere. The most important point was the establishment of a new, fully backed up data processing system. The shift to the new system caused only about 40 minutes outage in the services. In practice it turned out how easily the system can handle eg. a hardware failure and switch automatically between the servers. Besides that a new permanent station was set up at the Satellite Geodetic Observatory, Penc and was proposed to the EUREF Permanent Network (EPN). This will be the first Galileo capable permanent station of GNSSnet.hu. Later the upgrade all of the Hungarian (including other EPN stations) is expected to be able to track Galileo satellites.

The first novelty of the present year was the start of the *autopostGNSS* service, which is an automatic, central data processing system. With this solution the users only need to create a – RINEX format – observation file and upload to the server. Just in a few minutes the precise coordinates and a few quality control indexes can be downloaded.

The *autopostGNSS* service is expected to increase the number of registered users, just like the precision agriculture. In 2012 the number of agricultural users was doubled causing a significant rise of the online time of users. In 2013 further growth is awaited.

Indonesia

Status and Plans of GNSS Applications for Space Weather Monitoring in Indonesia

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Space weather is the conditions on the sun and in the solar wind, magnetosphere, thermosphere, and ionosphere that can influence the performance and reliability of space-borne and ground-based technological systems and endanger human life or health. The technological systems that are affected by space weather are Global Navigation Satellite System (GNSS), satellite telecommunication systems, ionospheric radio propagation, geomagnetic surveys for geological interpretation, directional drilling surveying, high voltage power transmission grids, active chatodic protection against corrosion of pipelines, long distance telecommunication cables and possibly railway signalling. The performance and reliability of GNSS are significantly affected by space weather particularly the conditions of ionosphere that can affect propagation of GNSS signals. In GNSS navigation and positioning the ionosphere-induced range errors, ambiguities in phase due to phase fluctuations and loss of lock due to ionospheric scintillation can not be ignored. Fortunately GNSS technique itself provides a unique opportunity to be used for monitoring of ionospheric activity continuously on regional in real time to provide corrections and early warning of ionospheric disturbances. Indonesian Permanent of GNSS Stations Network (IPGSN) established by Geospatial Information Agency of Indonesia can be used for near real time space weather monitoring. This paper describes the status and plans of GNSS applications for space weather monitoring in Indonesia.

Israel

Using Location-Based Social Media for Crowd Sourced Transportation Systems and Apps

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Cyberspace and Social Media have become an integral part of life in developed countries. Nations use cyberspace to communicate with the public, disseminate information, collect government payments, and even referendum voting. Smartphones and computers enable nearly anyone to communicate from almost everywhere, and enable creating, generating and sharing of information and data, including location-based information.

The transportation application market leverages a wave of multiple game changers recently introduced in the GNSS, mobile, consumer, transportation and geographical information industries, as well as dramatic changes in consumer's disclosure behavior:

Mobile industry – smartphone adoption grows rapidly, as of March 2012 half of US cellular subscribers own smartphone[1], recent US research shows that 50% of drivers use smartphone while driving[2]; Smartphone application usage and retention rate grows rapidly[3]; The recent advancement of smartphone capabilities makes every user a potential passive information source; More users are permissive regarding their location disclosure, with US 63% growth in users active location contribution[4]; The advancement in checkout solutions (Apple's In-app purchase, Android's operator-based checkout solutions, mPayment solutions) allows more people to easily pay for smartphone services; Sociological serendipity and interaction in the smartphone and social-networks era provides a solid ground for viral, rapid distribution of location-based services, and for user-generated markets, examples are: *Waze*, the world's fastest-growing community-based traffic and navigation app., *Airbnb* for an online marketplace allowing anyone from private residents to commercial properties to rent out their extra space, *GetTaxi* for virtual Taxi stations,

Moovit for crowd-sourced bus-transportation information.

Mapping and GIS industry shift – navigation services that are based on *OpenStreetMap*, a crowd-sourced open-source map solution, were not achievable up till the recent growth of active map contributors[5], thus requiring navigation vendors to purchase maps via companies like *NavTeq* and *TeleAtlas*[6]. Using commercial databases influenced their business-model. Companies such as TomTom and iGo had to turn for new markets with the introduction of free services to the end user such as *Waze*[7], and the introduction of cloud-based navigation solutions such as *CloudMade* and *MapQuest*.

Recently market leaders have shown growing interest in Israeli crowd sourced transportation and mapping technologies application and platforms. In few major event such as the Apple Mapocalypse those applications where suggested as the most accurate and updated information sources worldwide.

As technology advances, people are increasingly more connected and connected communities have the opportunity to create a reliable real time and free to the public geographic database. Using social networks, GNSS-based applications can support daily activities of users helping them arrive faster to their destination, provide a decision support tool to drivers public transportation users and city planners.

The presentation will (1) provide a wide view on enablers (2)present case studies of the use of cyberspace and social networks in transportation applications (2) provide possible GNSS based social media approach for transportation applications (3) offer possible international cooperation to increase efficient use of those applications (4) present the challenges ahead and recommendation on the national level.

[1] *http://blog.nielsen.com/nielsenwire/online_mobile/smartphones-account-for-half-of-all-mobile-phones-dominate-new-phone-purchases-in-the-us/*

[2] *http://autos.sympatico.ca/auto-news/15099/half-of-those-under-30-use-smartphones-while-driving*

[3] *http://www.localytics.com/blog/2012/app-user-loyalty-increasing-ios-beats-android/*

[4] *http://pewinternet.org/~/media//Files/Reports/2012/PIP_Location_based_services_2012_Report.pdf*

[5] *OpenStreetMap, a collaborative map launched in 2004, aims to provide a comprehensive world map based by harnessing location data uploaded by an army of volunteer cartographers, now numbering well over 930,000 registered members around the globe, and has become the go-to refuge of other companies looking to flee Google Maps over the past year, including Wikipedia, Foursquare and Craigslist. See: http://osmstats.altogetherlost.com/*

[6] *Such business collaboration led to the acquisition of Teleatlas by Tom Tom on 2008 for $4.3B on 2008 today Tom Tom's market cap is only $1B see: http://www.gpsbusinessnews.com/TomTom-completes-Tele-Atlas-acquisition-reshuffles-management_a882.html and http://www.google.com/finance?q=AMS%3ATOM2&ei=QhauULCQH8j1wAPZVQ*

[7] *Such example is the shift iGO and TomTom ,market leaders, made from PNA to car industry infotainment market*

Latvia

Sun Activity Influence on Measurements in GNSS Reference Station System LatPos

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Latvia Coordinate System was founded in 1992. New coordinate set was determined in August 29, 1992, totally with 20 GPS receivers. Each Year geodetic network was improved. In Year 2004 decision about establishing Next generation geodetic network – RTK GPS base station Network was agreed. Base station established at the end of Year 2005. System consists of 19 base stations and one data center. System uses Leica Spider software. In Year 2010 additional 3 reference stations was installed. To improve reference station system 2 stations was moved to new locations. All receivers upgraded to receive GLONASS satellite systems. LatPos system in Year 2012 includes 23 stations. There are 140 real-time users and about 100 post processing data users. Real-time users use wireless (GPRS) connection to cell phone providers to connect to internet and to system. System is working 24 hours a day and 365 days in Year. Main problem why system goes down is data lines from base stations to server and main power failure, where processing center is located. System preciseness is controlled with measurements on control points – on geodetic network. Control measurements were done in all country. Coordinate compatibility with old fashion geodetic network, inside of LatPos system network reaches two centimeters. As base stations are not placed near country border, measurements outside network are possible. Maximum error reached is four centimeters. Coordinate compatibility with old pre-historic geodetic network – triangulation network can reach level of twenty centimeters because of coordinate determination with transformation from old coordinate systems. Another problem shows up is local network fragmentation as LatPos is

homogenous network in all country. Each local network raises problems to be kept up and running because of many constructions going on. Height measurements with RTK are possible with Latvia geoid model. Geoid model preciseness is eight centimeters. New Geoid model is in progress. Combined Geodetic Network will be created. Second GPS RTK network – Riga has five stations. System compatibility test on ten control points in Riga territory was carried out. There was compatibility within five millimeters between system's measurements. Sun spot activity will raise maximum in Year 2013. To improve RTK fixing time and preciseness of measurements, research has been done. All user connections analyzed and best time for measurements found. Instructions for instrument fixing problem solutions released.

Moldova

GNSS Applications in the Educational System of the Technical University of Moldova

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In 2011 TUM in cooperation with Land Relations and Cadastre Agency finalized project focused on development of a High Capacity Real-Time GNSS Positioning Service for Moldova (MOLDPOS) in the frame of the International German-Moldavian scientific cooperation project "MDA 09/025" (http://www.moldpos.eu). In the frame of this project a High Capacity Real-Time GNSS Positioning Service for Moldova MOLDPOS was designed and 3D-datum transformation problems for territory of Republic of Moldova were solved using COPAG software based on finite element related mathematical modelling (FEM). The height transformation problem was solved using DFHBF software in a Finite Element (FEM) concept. In order to monitor GNSS stations in the amount of few millimetres GNSS-reference-station MONitoring by the KArlsruhe approach and software (MONIKA) has been implemented. The results of the project are implemented in educational process in order to modified curriculum of Master Program and PhD Program.

Starting from January 2012, the Technical University of Moldova is involved, as a partner, in a collaborative FP7 Project **EEGS2 «EGNOS Extension to Eastern Europe: Applications»** (http://www.eegs2-project.eu/). The results of the project will be implemented in Master Program.

At the moment TUM is involved as a partner in TEMPUS project GIDEC "Geographic information technology for sustainable development in Eastern neighbouring countries" (http://gidec.abe.kth.se). In the frame of this project a new GNSS and reference systems curricula will be developed.

In the future we are planning to develop new Curricula on GNSS-related Geodetic Infrastructures, Mobile IT and Precise Navigation Technologies, as Prospective and Globally Economy-relevant Core Disciplines of Geodesy and Geoinformatics.

Nigeria

Ionospheric Response to Space Weather during Satellite Anomalies

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Over the years, there have been reports of satellite loss in space, some of which may be due to component malfunction and effect of space weather. In this work, a number of satellite losses due to the effects of space weather were identified. Total Electron Content TEC behaviour 5 days before and 5 days after the disappearance of each satellite studied were observed. The variabilities of the following space environment parameters; southward component of the Interplanetary Magnetic Field Bz, Disturbance storm time index Dst, Solar wind speed and Electron Density, were also examined during the periods of investigation per satellite loss. Comparative analysis was carried out among TEC and space environment parameters for each of the scenarios investigated. Efforts were made to discuss the response of the

ionosphere to changes in space environment during different cases of satellite loss.

Pakistan

GNSS Technology Developments in Pakistan

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The obvious advantages of Multi-GNSS technology in almost every sphere of life have led to numerous technology developments and applications in Pakistan. GNSS technologies have been adapted in land surveying, computerization of land records, road construction, hydrographic-surveying, water quality assessment and characterization of large water reservoirs, precision farming, urban mapping, disaster management, vehicle tracking, corporate fleet management, marine asset management and many other fields. This presentation describes the Multi-GNSS technology developments and its applications, which directly contribute towards the economic development and uplift of associated communities. Keeping in view the economic advantages offered by accurate GNSS solutions, development of RTK based precision GNSS navigation correction service covering the national economic capital city is covered. International cooperation for GNSS technology demonstration and educational activities is also highlighted.

Pakistan

Continuously Operating Reference Stations (CORS) Network for Disaster Management and Emergency Response

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Global Navigation Satellite System (GNSS) provides Positioning, Navigation and Timing (PNT) services through navigation satellites orbiting earth and transmitting ranging signals. With the advancement in GNSS technology, surveying grade accuracy can be achieved by establishing the CORS Network as a national positioning infrastructure. This infrastructure plays an important role in meeting the demands of positioning and navigation application with high accuracy, precision and integrity. CORS Network consists of GNSS base stations permanently installed at fixed locations for constantly receiving the GNSS signal and transmitting it to main processing hub i.e., the Control Center. Control Center processes the GNSS data and provides the correction parameters to geo-spatial users. CORS Network is being utilized for many applications around the world for example, surveying and mapping, precision agriculture, health monitoring of high rise buildings and bridges and plate tectonics etc. CORS Network is playing an important role in the disaster management and emergency response in many countries. Countries are utilizing the GNSS services for early warning, emergency response and disaster management etc. Pakistan lies on Indian and Eurasian Plates and has faced recently devastating earth quakes in 2005 and 2009. CORS network can provide the useful data to research to study the crustal movement in Pakistan. Further this infrastructure can also be helpful for mapping the affected area and publishing maps online for emergency responses and disaster management.

Romania

EGNOS Extension to Eastern Europe: First Flight Trials in Romania

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Romanian Space Agency

The European Geostationary Navigation Overlay Service (EGNOS), Europe's first venture in GNSS, is a Satellite Based Augmentation System (SBAS) developed by the European Space Agency (ESA) under a tripartite agreement with the European Commission and the European Organization for the Safety of Air Navigation (Eurocontrol).

EGNOS is currently certified for Safety of Life applications since March 2011, making it suitable for aircraft of maritime navigation. It is worth mentioning that its ownership was transferred to the European Commision since 2009 when it became operational as an open service. Many countries in Central Europe already developed EGNOS based procedures for some of their airports (Germany, France, etc).

Although the system is continuously improving and extending its services in terms of data quality as well as coverage, at the moment of writing, the EGNOS APV-I 99% performance is limited in the eastern part of Europe. Some of the countries are partially covered while other are not covered at all by the services.

Since 2010, the Romanian Space Agency is involved in projects addressing this specific issue. The first project (EEGS) co-founded by the EC under FP7 aimed to prove through demonstrations that it's possible to extend the EGNOS services to Eastern Europe by infrastructure development or, in the case of Romania, only by algorithm modifications. In the frame of this project a series of static and kinematic trials were undertaken in each of the three eastern countries involved in the project.

A follow-up of EEGS started at the beginning of 2012. Also co-founded through FP7, it aims to prepare the national civil aviation service providers for the future usage of EGNOS. In order to prove and disseminate the benefits of EGNOS extension, a series of flight trials are planned at each partner level. For Romania these trials will be the first flight trials to be conducted based on an EGNOS-like signal.

The trials will be undertaken at the beginning of April in the vicinity of the *International Airport Delta Dunarii* in Tulcea and will be conducted by ROSA together with GMV (consortium leader) and the National Institute for Aerospace Research "Elie Carafoli" (INCAS).

The authors aim at having a first dissemination event of the results and conclusions of the trials at the UN/Croatia Workshop on GNSS.

Russian Federation

Economic Benefits of Using Industry-Sector Monitoring Systems Based on GNSS

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Nowadays the usage of GNSS is becoming the real global mean to stimulate the development and enhancement of state's economic potential. As a result thanks to new applications, there is a need to develop and improve already existing technologies.

Moreover, at the moment multi-constellation has become one of the top priorities of satellite navigation: the operational GPS system has been joined by the Russian global satellite navigation system – GLONASS; the Chinese COMPASS system is being tested now; the first satellites of the European Galileo system are operating on the orbit.

Monitoring systems based on GNSS are broadly used in many fields of our modern life in our time:

- To ensure safety and security in transportation, including aviation, marine, railroads, highways and others. It's expected that in coming future GNSS technologies will take a core place in transport infrastructure of the big cities. Two main tasks of satellite navigation in transportation sector are safety and efficiency improvement. Both are directly effecting state's economy.
- GNSS is widely used in civil economy fields such as telecommunication, energy sector, data transferring synchronization, land management, emergency response, agriculture, control systems for mining equipment.

Undoubtedly, GNSS technologies application are becoming more popular and have more influence on social and economic sectors for better standard of living.

As far as the Russian navigation market is concerned, it demonstrated trend to boom last years. In particular, production of GLONASS/GPS navigation units for the automotive applications tripled again, year-on-year. The same dynamic growth rate is expected in this year as well. According to the conducted analyses, demand for GLONASS based equipment has increased 10 times after the launch of large scale GLONASS implementation projects.

User requirements are getting stricter and more sophisticated. There is a demand emerging for the navigation within new environments that drives development of integrated systems featuring positioning technologies.

To sum up, GNSS technologies (in particular, industry-sector monitoring systems based on GNSS) have become today a growth driver of the world social-economic development. It's hard to overestimate the impact of every company and organization participating in this process in providing the true conditions for economic growth, national safety, increasing welfare and quality of life of our society.

The Netherlands

Topcon GNSS Solutions Supporting Mapping, Surveying Activities and Disaster Management

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Interest to use GNSS technologies in land surveying, road construction, hydrographic-surveying, precision farming, GIS data collection, urban mapping, disaster management and many other fields is continuously increasing. Topcon is providing different GNSS solutions to these different applications. Different applications need

- Different accuracy levels
- Different field data sets (therefore and sometimes, also…
- Different and additional sensors and devices.

In this presentation I would like to introduce first our TopNet Live DGNSS/RTK network solution.

This regional network helps to have higher accuracy on the field for different users in real time, or after the data collection (post processing). After the brief introduction to TopNet Live, I would like to give some very short examples how the increased field accuracy, and – in some cases – additional sensor devices help

- Control the agriculture parcel mapping,
- Disaster relief, or
- Urban mapping and
- Utility infrastructure survey.

Uzbekistan

Determination of Transformed Parameters between CS42 and WGS84 for Uzbekistan Territory

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The establishment of national reference frame is not an easy task because Earth's crust continuously undergoes various deformations. Since today's geodetic space techniques provide station coordinates at the 1 cm or subcentimeter level, it is necessary to model the various deformations at the mm-level. Tectonic movements are frequent in Uzbekistan and can affect coordinate system, CS42. Crustal deformation, earthquake, tides and polar motion studies in Central Asia region have been done since 1990. For solution of these purposes there are used a GPS technologies based on WGS84. Geodetic point coordinates are always obtained in a system that has been constructed itself using real observations, a geodetic datum: a physical realization of a coordinate system used for describing point locations. The realization is the result of choosing conventional coordinate values for Uzbekistan.

The coordinate transformation between two systems and creation of a baseline are one of main tasks of Uzbek mapping agency. Determination of preliminary parameters between CS42 and WGS84 are produced by Helmert and Molodensky methods. For model calculation there were used some points of CATS network which is in Uzbekistan. Although CATS points is not fit for creation geodetic network, there were selected 15 CATS points and 3 permanent stations(GPS, DORIS and CHAMP) for calculation of transformed parameters. The quality of the network geometry of the CATS network is in the order of 1-3mm for horizontal components and about 5 mm for the height. This is derived from Helmert transformation between the daily solutions and the campaign solution. The global network accuracy is in

the order of 1-2cm. Difference of a coordinates between two systems ($\Delta\lambda$= 2,977$''$, $\Delta\varphi$ = -0,222$''$,Δh = 28,84m), the 7-parameters

(ΔX=+23m, ΔY=-125m, ΔZ=-87m, k = $0.89 \cdot 10^{-6}$, α =0.165″, β=0.089″, γ=0.627″)
and velocity of Kitab micro plate, 29mm/y were calculated taken into account local condition.

In the future, the results of transformed coordinates will be the basic for building of a national geodetic network. For the best transformation model and reduce the fit errors, it is need to use data of satellite laser ranging. SLR provides mm/year accurate determinations of tectonic drift station motion on a global scale in a geocentric reference frame. In areas of high risk permanent GPS arrays play an increasingly important role. Geodynamic processes can also be monitored at stations equipped with DORIS receivers.