2009 Plenary: Urban Challenges

Plenary Speakers Focus on Mobile Phone, Robotic Vehicles

A s has become traditional in recent years, ION GNSS 2009 launched itself with a Tuesday evening plenary session addressing the topic, “Urban Challenges: Advances in Smart Wireless (Cell) Phone Navigation Systems and Robotic Vehicles (mobile robots).” Plenary organizer and moderator Larry Hothem led this dynamic discussion on the state of the art and future trends in the developments in smart phone and robotic ground vehicles.

Panelists included Dr. Cormac Conroy, VP, Engineering, QUALCOMM Inc., Dr. Frank van Diggelen, technical director for GPS systems, Broadcom Corporation, Dr. Alfred L. Wicks, associate professor, Virginia Technical Institute and co-leader of VTI’s DARPA Urban Challenge team, and the co-chairs of ION’s Mini Urban Challenge, 1st Lt. Casey Miller, and 1st Lt. Caroline New, both of the Air Force Research Laboratory.

In recounting the “happy story of GPSs and mobile phones,” van Diggelen traced the GPS technology evolution behind mobile telephone that has led to introduction of more than 200 GSM “smart phone” models with GPS today — up from fewer than 10 models five years ago. Tracing the “catalyst” for getting automatic location capability in mobile phones to the Federal Communications Commission’s E-911 mandate. The international nature of the event is reflected in more than 200 GSM “smart phone” models with GPS today — up from fewer than 10 models five years ago.

Co-leader of VTI’s DARPA Urban Challenge team; and the co-chairs of ION’s Mini Urban Challenge, 1st Lt. Casey Miller, and 1st Lt. Caroline New, both of the Air Force Research Laboratory.

According to program chair Dr. Naser El-Sheimy, this year’s program attracted 587 abstracts. The top four conference themes and some highlights identified by Dr. El-Sheimy are:

- **GNSS Receiver Algorithms** (44 abstracts) with a variety of topics ranging from tracking of weak signals, including “Complex Channel Structure for Generic GNSS Signal Tracking,” and “Combined L1/L5 Kalman Filter-Based Tracking versus Standalone L1/L5 Tracking in Challenging Environments.”
- **Urban & Indoor Navigation Technology** (40 abstracts) with many interesting new topics such as “Efficient Tracking Algorithm Based on FFT for Extremely Weak GPS Signal,” “Navigation in Strong Multipath Environments,” “Multipath Mitigation via Synthetic Aperture Beamforming.”

PSN: Welcome to ION GNSS 2009

Four days, 400 papers, 70 exhibitors and the sights of Savannah!

S avannah, Georgia, the “Hostess City,” serves as the backdrop for the 22nd anniversary of The Institute of Navigation’s (ION) Satellite Division international conference — the best opportunity to meet and learn from the best and brightest thought-leaders in GNSS technology.

This conference is the one time each year where GNSS technical experts and innovators gather to review more than 400 technical papers on a diverse array of topics and network with peers — all in a relaxed and fun environment.

The international nature of the event is reflected in the pre-organizations for ION GNSS 2009 — 41 percent of attendees will come from nations outside the United States.

ION GNSS 2009 also features the world’s largest showcase of GNSS technology, products, and services.

Many attendees will not want to miss this morning’s GPS Program Update Panel Discussion led by The MITRE Corporation’s Dr. John Betz and featuring updates on satellite-based navigation systems by leading experts from the Air Force GPS Wing, the Russian Institute of Space Device Engineering (GLONAS), Europe’s Galileo, China’s COMPASS program, and Japan’s QZSS.

This afternoon’s SVN-49 Review Panel, moderated by Col. David Goldstein with the USAF GPS Wing, will be a comprehensive review of SVN-49 including the background, current status, issues, and options for meeting forward.

These panel sessions promise to be timely and informative. But if you miss any of them, don’t worry. Conference organizers are posting video’s on ION’s website available for all conference attendees.

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**Wednesday Panel on GPS SVN49**

**Considerable interest is expected at a special panel discussion this afternoon that will review the GPS SVN49 signal anomaly and the Air Force’s plans for addressing the problem.**

Col. David Goldstein, chief engineer for the GPS Wing, will chair the session, which will be held from 5:30 to 6:30 p.m. in Room 203/204/205. Panelists include Capt. Steven Dirks, 2nd Space Operations Squadron (2SOPS), Schriever Air Force Base; Chuck Frey, Lockheed Martin satellite division; Tom Powell, The Aerospace Corporation; Tom Stansell, consultant to The Aerospace Corporation; and Chris Hegarty, MITRE Corporation.

First detected April 10, the anomaly is caused by a signal being reflected from a filter into an auxiliary port through which the new L5 demonstration signal travels. The resulting multipath effect is producing higher than normal pseudorange errors, particularly noticeable on L1 signals, that vary with the elevation of the satellite in the sky. Lockheed Martin added the payload to one of its Block IIIR satellites that was launched in March of this year.

As a result, much weaker, delayed, L1 and L2 signals are transmitted from the port. The pattern has a null at moderate angles; so, polarity reverses between low and high elevation angles.

This situation effectively creates a multipath signal with about a 30 nanosecond delay and signal power that is 14 to 38 decibels weaker than the direct signal, depending on the satellite elevation. This delay is smaller than that which can be handled by the correlator spacing in most GPS receivers, causing a code correlation error that in turn creates substantial signal-tracking problems and position errors.

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**PPP and Networked-based RTK (52 abstracts) shows lots of innovative R&D applying precise point positioning in surveying and mapping applications. Some of the papers are,” Precise Point Positioning for Real-time Determination of Co-crustal Motion, “ Real Time Satellite Clock Corrections in Precise Point Positioning, and “New Methods for Evaluation of the Ionospheric Modeling Error in a VRS-based Network RTK Service.”**
**NEW PRODUCT ANNOUNCEMENTS**

**Septentrio Introduces First GNSS/IMU Receiver**

Today at ION GNSS 2009, Septentrio (Booth 723-725) launched AstreXi, the company’s first multi-sensor GNSS receiver. AstreXi processes high-quality GNSS measurements with inertial measurement unit (IMU) data to generate an enhanced position and attitude solution based on the integration of the high-quality micro-electromechanical measurement units (MEMS) IMUs with high-precision AstreXi receivers, the benefits of integrated inertial/GNSS systems become available for a host of new industrial applications. Besides tracking GPS and GLONASS satellites, the integration with IMU measurements allows AstreXi to deliver precise position data in places where conventional GNSS receivers can’t: underground structures, trestles, tunnels, and urban canyons. The AstreXi receiver is designed with a versatile interface that facilitates integration with a variety of IMU sensors, depending on the application requirements. AstreXi is delivered standard with Xsens IMUs.

**Hemisphere GPS Announces Smart GPS Antennas**

On the first day of ION GNSS 2009, Hemisphere GPS (Booth 632-642) introduced its new A220 and A221 smart antennas. In rugged, portable all-in-one enclosures, the A220 and A221 deliver centimeter-level positioning accuracy for precise guidance, machine control and survey applications. Combining Hemisphere GPS Eclipse dual frequency receiver and antenna technology with optional radio modem, the A220 and A221 are capable of supporting RTK (space-based augmentation system (SBAS), and OmnSTAR HPPX corrections; The A220 features L1/L2 C/A GPS and L1 L5 L2C L5C GNSS signals; and the A221 features a built-in menu system and four-line LCD display- making it easy to monitor and configure as an RTK base station. Dual-segment, USB, CAN, and pulse output options enable the A220 and A221 smart antennas to interface with many external devices.

**Topcon Positioning Systems (TPS) Introduces NET-G3A Geodetic Receiver**

Featuring the Paradigm G3 chip from Topcon (Booth Island), the NET-G3A channel-geodetic delivers tracking of all currently available satellite signals and is fully configurable through a new Internet user interface (Internet Explorer, Firefox, Opera) to allow remote configuration. It offers 25-hour internal battery, advanced memory storage capabilities, and a selectable data rate up to 100-hertz. Although primarily designed to operate as part of a network solution delivering real-time corrections and providing data for post-processing applications, the NET-G3A is fully capable of playing the role of a fully featured “field” (canned) configuration or stand-alone RTK base station. Key features of the NET-G3A include GPS, L1, L2, L5, GLONASS, and Galileo support; removable CF memory card up to 2GB, USB host that allows use of a plug-in USB memory stick or a USB mass storage device, two lithium-ion batteries, and multiple communications ports for serial, USB, Ethernet and which TCP/IP addresses and NTRIP client and server functionality.

**IFEN Displays Anritsu A-GPS Test System, Announces SW Receiver Workshop**

Having recently announced Anritsu Corporation’s selection of IFEN’s NavX-NCS RF simulator for use together with their assisted-GPS test system, IFEN will display the A-GPS test system at its exhibit (Booth Island B). With the NavX-NCS as the system’s GNSS signal source, IFEN is also announcing the first NavX-NSR software receiver workshop to be held in the U.S. May 20, 2010. The next year will see NAV-2011, 2012, and beyond, with IFEN continuing to be accepted at the company’s Ion Boom. A prototype of IFEN’s next-generation NSR software receiver (V2.0) will also be showcased at the booth.

**Simulator Scenario-Generation Software from Racelogic**

Racelogic (Booth 627) has released new scenario-generation software, SatGen, intended to simplify creating custom scenarios for the company’s LabSat GPS Simulator. According to the company, the software can simulate user-defined dynamic GPS scenarios from scratch anywhere in the world. The SatGen software is designed to use with Racelogic’s LabSat GPS RF simulator which can replicate real-world data reproducing common conditions such as satellite obstructions and atmospheric effects. SatGen enables users to generate customized scenarios early in GPS device development to cover specific testing requirements. The new software allows receiver designers and developers to assess specific testing requirements. The new software allows receiver designers and developers to cover specific testing requirements. The new software allows receiver designers and developers to assess specific testing requirements.

**ION GNSS 2009 SHOW DAILY**

**GNSS Receivers Produce Triple Constellation Solutions, Track GPS SVN49 Signal**

Located at Island Booth F, Javad GNSS offers a variety of multi-constellation GNSS OEM and survey receivers and antennas, covering the entire spectrum of precision applications and budgets. The receivers are based on the company’s TRUERECEIVE technology implemented in their highly reliable SVN49 chip with position update rates of up to 100 Hz. RTK. In recent tests conducted jointly with Spiriten Communications, JAVAD GNSS receivers successfully tracked all Galileo satellites from a Spiriten simulator and produced Galileo-only and triple-satellite (GPS+GLONASS+Galileo) positions. Up to 27 satellites were tracked simultaneously. The anomalies in the recently launched GPS satellite (SVN40/PRN1) also provided a chance to demonstrate the advanced multipath reduction feature of Javad’s Triunmph technologies. The same multipath reduction capabilities that removed the SVN40 multipath anomalies can also remove environment-caused multipath effects, which are a major source of error in precision positioning.

**Launches Low-Cost GPS/GLONASS L1 Precision Receiver**

Today at ION GNSS 2009, NovAtel Inc. (Booth Island B) announced the launch of their new single-frequency GPS receiver, OEMStar. The low-cost, 14-channel OEMStar receiver measures 46 x 71 millimeters and consumes just 750 milliwatts of power when tracking both GPS and GLONASS signals. The company also announced the release of Version 3.740 firmware for their OEMVP family of GNSS precision receivers, which includes enhancements to NovAtel’s single frequency RTK positioning solution, RT2-L1T1E, and to the company’s ALIGN heading technology. Speaking about the OEMStar, Graham Purves, NovAtel’s vice-president of sales and marketing, said, “There is definitely a void in the marketplace at this price/performance level. We believe this is the lowest cost GLONASS-capable receiver out there.” The OEMStar is form-factor compatible with NovAtel’s previous SUPERSTAR II and current OEM1 and OEM1-V1 receivers. The company plans to start shipping the OEMStar to customers in November, 2009.

**Simulators and GNSS Commemorative Pins at Show Exibit**

To commemorate Spiriten’s support all GNSS-system engineers worldwide, the simulator developer is giving away gnss pins, to be distributed exclusively at ION GNSS 2009. Stop by Spiriten’s exhibit at Island Booth D to guess the correct number of pins, and win a Garmin Forerunner GPS-enabled sport watch.

**Also at the booth, for the first time ever, ION GNSS attendees will have access to live demonstrations of Spiriten’s full range of GNSS modernization and new multi-GNSS simulators. The GSS8800 Multi-GNSS Constellation Simulator supports SAASM, AES M-code and SDS M-code testing, as well as anti-interference testing. CPDAs testing can be used for simulating numerous inertial interfaces. It provides up to three constellations (GPS/ SBAS, GLONASS, and Galileo) in a single channel, and GPS configurations can also support QZSS. The GSS7600 Multi-GNSS Simulator offers multiple channels of coherent GPS/SBAS, GLONASS and/or Galileo L1 signals from a single- channel. The GSS8900 Multi-GNSS Simulator Generator provides a single channel of GPS/SBAS, GLONASS and/or Galileo L1 signals for production testing commercial GNSS receivers.

**GPS World Challenge: Beat My Wii Bowling Score or Go Bust Trying**

On behalf of marketing departments for GNSS companies around the world, GPS World magazine’s Kyle in marketing coordinator Sarah Joyce Obama Lagunzad, issues a Wii Bowling Challenge to all engineers and technical attendees at the ION GNSS 2009 conference and exhibition. Lagunzad has posted a bowling score of 227 on the Wii apparatus and would like to see anyone do better. Contestants are welcome to try their hand on the Wii machine and screen displayed in Booth #120, 10 a.m. – 4 p.m. and 7-9 p.m. Wednesday, and from 9 a.m. – 3 p.m. Thursday. First, second, and third place winners will be determined and declared during the Thursday afternoon coffee break. 3:35-5:35 p.m. (A special scoring division and separate but hardly equal prizes are offered for marketing and other non-technical staff of GNSS companies, sponsored by the magazine’s editorial department.)

**Galileo Services PND Raffles**

Galileo Services, the international association of GNSS downstream industries focused on the Galileo program, invites ION GNSS 2009 attendees to participate in a raffle to win navigation receivers on Wednesday and Thursday. Visit Booth 204, leave your business card, and try your luck.
The Satellite Division of The Institute of Navigation
22nd International Technical Meeting

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• Algorithms for Multi-sensor Fusion and Land Based applications (29 and 27 abstracts, respectively) with clear emphasis on the emerging MEMS technologies and their applications in pedestrian and indoor navigation.

General Chair:
Dr. John Raquet is the Director of the Advanced Navigation Technology (ANT) Center at the Air Force Institute of Technology, where he is also an associate professor of electrical engineering. He has been involved in navigation-related research for over 18 years, and he was the recipient of the 2002 ION Early Achievement Award. Dr. Raquet has served in a session chair, program chair, track chair, and general chair of ION conferences; on ION Council as Central Region Vice President, Eastern Region Vice President, and Outreach Chair; and as Secretary and Vice Chair of the Satellite Division of the ION. He received his Ph.D. in Geomatics Engineering from The University of Calgary, an M.S. in Aeronautical/Astronautical Engineering from M.I.T., and a B.S. in Astronautical Engineering from the U.S. Air Force Academy.

Program Chair:
Dr. Naser El-Sheimy is a professor in the Department of Geomatics Engineering, at the University of Calgary. He holds a Canada Research Chair (CRC) in Mobile Multisensor Systems and is the scientific director of Teccresa Research Centre. His research expertise includes GPS/ INS integration, multisensor systems, and mobile mapping systems. Dr. El-Sheimy has authored a book and more than 350 papers in academic journals, conferences and workshop proceedings. He is also currently the president of Commission 1 on “Sensors and Platforms” of the International Society for Photogrammetry and Remote Sensing (ISPRS).

This year’s technical program has been organized into seven parallel tracks chaired by Dr. John Bietz, The Mitre Corporation; Lt. Col. Jon Anderson, USAF GPS Control Segment Squadron; Dr. Hermann Ebner, European Commission; Belgium; Dr. Allison Kraly, University of Melbourne, Australia; Timothy Murphy, Boeing; Mr. Eric Chatre, Spirent Communications PLC, UK; and Dr. Jayon Lee, AMTI/FAA. In addition to the rich technical content of the conference, we hope you can take time to enjoy the sights and sounds of Savannah with its rich traditions, beautifully restored historic homes, Spanish moss hanging off towering live oaks and a cuisine that defines “The South.”

Make the most of the next few days.

Who Organizes this Conference?
Since its founding at the time of the first ION GPS meeting in Colorado Springs, Colorado, in 1987, the Satellite Division has grown into the ION’s most active division.

ION GPS (now GNSS) was the first, and still the largest, technical meeting and showcase for GNSS technology, products and services. The ION GPS/GNSS conference series have drawn worldwide attention, attendance, and recognition as the forum for announcing new policy and technology developments and applications of global navigation satellite systems. No other conference so aptly illustrates the breadth and depth of GNSS technology or the growth and vitality of the marketplace.

Your official hosts for these four days are: Dr. Pratap Misra, Chair; Dr. John Raquet, Vice Chair; Dr. Demis Gehr-Egelhauf, Secretary; Ms. Patricia Doherty, Treasurer; Dr. A. J. Van Derenrondiek, Immediate Past Chair; Professor Andrew Deuenijer, Asian Technical Advisor; and Dr. Christian Tiberius, European Technical Advisor.

What’s Green, Costs $15, and Wins a Prize?
Join the Institute of Navigation during the conference and we’ll promise to make it fun.

During ION GNSS 2009 only, you’ll pay only $15 for full U.S. membership ($35 for international members).

Plus, you’ll get a free spin of the prize wheel for Paula Deen cookbooks, Midnight in the Garden of Good and Evil books and DVDs, Savannah honey, ION lapel pins, shirts, travel clocks, chocolate M&M’s and other Savannah prizes.

If you’re wearing a yellow badge this year, it means you haven’t yet discovered the advantages of ION membership.

Hurry over to the ION GNSS 2009 Registration Desk or Booth 801 in the exhibit hall and join now!

That will qualitify you for a spin for one of the great prizes. Everyone wins.

And then . . . you’ll get to trade in that yellow badge for a GREEN one. How cool is that?

ION Council members are also getting in on the fun! If an ION Council member presents you with an invitation to join, bring that invitation with you. The Council member who recruits the most people to join ION also becomes eligible for a prize.

So, take advantage of the best opportunity to join ION at a great price.

Program Changes
Session A1: Alternate #1 by J.P. Bickstaff, cancelled.
Session D1: Dr. David De Lorenzo is replacing Prof. Fabio DiBona as session chair. Paper #09-27 presented in conjunction with alternate #1 by Storms. Alternate #2 provided by J.P. Bickstaff, cancelled.
Session F1: Dr. Hermann Ebner is replacing Mr. Jérémie Godet as session chair.
Session F2: Dr. Hermann Ebner is replacing Mr. Jérémie Godet as session chair. Paper #09-20 presented in conjunction with alternate #1 by Storms. Alternate #2 provided by J.P. Bickstaff.
Session H3: Dr. John Raquet is replacing Prof. Werner Endler and Dr. Sherman Lee in replacing Dr. Todd Wabler as session chair.
Session P2: Dr. Hermann Ebner is replacing Mr. Jérémie Godet as session chair. Paper #09-07 presented in conjunction with alternate #1 by Storms. Alternate #2 provided by J.P. Bickstaff, cancelled.

Plenary, continued from page 1
New and Miller reported on the results of the initial year of activity that culminated in the first national Mini-Urban Challenge competition, co-sponsored by the Air Force Research Lab and The ION, last May. Introduced at ION GNSS 2008, the competition challenges high school students to design and operate a robotic unmanned car built from a LEGO Mindstorms kit that can accurately navigate through a LEGO city.

An article focusing on the Mini Urban Challenge will appear in the Thursday edition of the ION GNSS 2009 Show Daily. Attendees can few a display from the event in the Exhibit Hall.

Self-Service Business Area. The use of computers, a printer and a copier is being provided by ION Networks on a self-service basis in the ION registration lobby. Internet access is not available on these computers. For Internet access, please use the computers in the Internet Access Center. As a courtesy to others, please limit your time when others are waiting.

Copies of Technical Papers Online. Author submitted technical papers will be available for download at www.ion.org to technical conference registrants. The registration number on the back of your badge is your user ID. If a paper is not available online, we recommend you contact the author directly. After the official conference proceedings are distributed in December, regular download policies and prices will apply.

Messages via Fax. If your office needs to contact you, they can fax a message to 912-447-7301. You will be notified of any received faxes by the posting of your name on the message board asking you to retrieve your fax. We also recommend that you leave your hotel’s phone number with your office and have messages sent there as well.

ION GNSS Internet Access Center. Use of the computers is FREE in the Internet Access Center. The computers are waiting. Special thanks to NovAtel, Lockheed Martin, Northrop Grumman and ION who sponsored this year’s ION Internet Access Center.

Job Board. Use the job board in the business area to post openings.
That is what your customers demand. That is what NovAtel delivers.

We have built our reputation as the industry’s trusted source of high quality precision OEM GNSS technology by doing it right, day in and day out. Right in how we listen to our customers and deliver on our promises. Right in our significant ongoing investment in R&D, ensuring we produce leading-edge solutions. And right in how we develop products that provide the ROI our customers are looking for. Come visit us at Booth I to see our latest innovations:

**The New OEMStar™**

This is what the market has been waiting for! A compact, low cost L1 GNSS receiver that tracks GLONASS satellite signals. Delivering unmatched performance at this price point, the OEMStar features:

- 14 channels
- Low power consumption
- USB connectivity
- Small 46 x 71 x 13 mm form factor

The OEMStar supports NovAtel’s Pulse Aperture Correlator (PAC) multipath mitigation technology, and offers our GL1DE™ relative positioning algorithm as an option. Whether for survey, GIS, agriculture or vehicle tracking applications, the economical OEMStar will put you ahead of the competition!

**Introducing FlexPak-G2**

Building on the success of our legacy FlexPak™ enclosure, the FlexPak-G2 delivers enhanced connectivity options making it easier than ever to integrate. Scalable and flexible, the G2 supports three NovAtel industry-leading OEMV™ receivers: the OEMV-1, the OEMV-1G or the OEMV-2. Field upgradeable and capable of base station or rover operation, the FlexPak-G2 offers:

- Metre to centimeter level accuracy
- Rugged DB-9 connectors with power in/out
- Auxiliary strobe signals with configurable PPS output
- USB connectivity
- Active antenna support

Compact and light-weight, the FlexPak-G2 is ideal for low-payload UAV and other robotic applications.

**SPAN-CPT**

The SPAN-CPT is a single-enclosure GPS/INS navigation system that provides positioning even in challenging environments where satellite signals may be blocked. The SPAN-CPT features:

- Superior navigation with position, velocity and attitude
- NovAtel’s OEMV-3 receiver
- IMU comprising of fiber-optic gyros and MEMS accelerometers
- Compact form factor for easy integration
- Commercially available parts, reducing cross-border shipping difficulties

Come to Booth I and try our fun SPAN-CPT aviation demo and compete to WIN an iPod touch.

For more information on all our SPAN products, go to: improveyourgps.com

www.novatel.com