ION GNSS 2010 Show Daily

F R I D A Y

September 24, 2010

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Outgoing ION Satellite Division Leadership: L to R: Dr. Christian Tiberius, European Technical Advisor; Dr. Pratap Misra, Satellite Division Chair; Patricia Doherty, Treasurer; Dr. A.J. Van Dierendonck, Immediate Past Chair; and Dr. Mikel Miller, current ION President. Not pictured: Dr. Demoz Gebre-Egziabher, Secretary; Dr. Andrew Dempster, Asian Technical Advisor and Dr. Guenter Hein, Galileo Advisor.

ION Satellite Division

Passing of the Torch

This past summer the Satellite Division held its election for Satellite Division Officers who will take office at the conclusion of ION GNSS 2010.

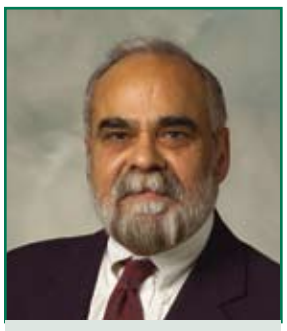
The following individuals were elected and will serve on the Satellite Division Executive Committee for a two-year term of office:

Chair: Dr. John Raquet, *Air Force Institute of Technology*
Vice Chair: Dr. Jade Morton, *Miami University (Ohio)*
Secretary: Mr. Tim Murphy, *Boeing*
Treasurer: Dr. Paul Kline, *Honeywell*

Dr. Pratap Misra, The MITRE Corporation, will continue to serve on the Satellite Division Executive Committee for an additional two years as the Immediate Past Chair. Two International Technical Representatives will also be appointed.

The Satellite Division would like to thank Dr. Demoz Gebre-Egziabher and Patricia Doherty who have served as Satellite Division Secretary & Treasurer for the past two years, Dr. A.J. Van Dierendonck who has served on the Satellite Division Executive Committee for the past six years and Dr. Christian Tiberius, Dr. Andrew Dempster and Dr. Guenter Hein who have served as International Technical Advisors. The Institute also extends our thanks to all other volunteers that have provided counsel and guidance over the past two years. ◆

MISRA IS RECOGNIZED



Dr. Pratap Misra, Satellite Division Chair, 2008-2010

Dr. Pratap Misra, out-going Satellite Division Chair, is to be recognized by the Satellite Division today for his visionary leadership. During the past four years Dr. Misra has served on the Satellite Division Executive Committee (two years each as Chair and Vice Chair) he has been an avid supporter of the Satellite Division's outreach supporting developing technical events such as the ION's Robotic Lawn Mower Competition, ION GNSS Student Awards, the ION's Autonomous Snow Plow Competition and initiatives for the sustainable development of navigation, science and technology in Africa. Additionally, he has participated in the further development of the ION GNSS conference's organization and leadership. The Institute extends its thanks. ◆

ION GNSS 2011: See You in Portland!

Panel Discussion

Deep Indoor Nav – What Technologies Will Prevail?

Thursday morning's panel discussion covered perhaps one of the newest frontiers in PNT technology— navigating deep inside buildings where GNSS signals are typically blocked.

Moderated by Dr. John Betz, of The MITRE Corporation, the panel drew on six industry experts and integrators. Four panelists introduced prospective approaches to solving the indoor positioning challenge: use of existing RF signals other than GNSS, augmentation systems such as pseudolites, and new signal systems such as the indoor messaging (IMES). The integration and business cases for these technologies were considered by two other industry gurus.

Advocating the consideration of pseudolites, Dr. Stewart Cobb, from Novariant, discussed the challenges of indoor usage of pseudolite technology. Multipath, signal blockage, and convergence problems must be overcome, typically by development of appropriate algorithms, all the while meeting the cost of distributing three or four pseudolites throughout each room or hall of a public space.

In 1997, Dr. Cobb noted, "The satellites are weak, and the pseudolite signals can be strong, and no amount of clever engineering can entirely negate this conflict." Still, today the risk of signal interference in the proximity of doorways and windows, known as the "near-far" problem, remains a relevant concern to pseudolite users.

Professor Changdon Kee, from Seoul National University, offered his preferred solution, a pseudolite system of several closely spaced transmitters within a single antenna unit. The transmitters avoid issues such as multipath and cycle ambiguity, by each transmitting asynchronously, an ambiguity-free carrier phase signal on L1 frequency.

The user's receiver then resolves the phase difference, in order to determine its position within 30 centimeters, Professor Kee said. This solution provides a single antenna per room, with a significant cost advantage over the use of pseudolites.

Skyhook Wireless, Inc. offers a product called SpotRank. Dr. Farshid Alizadeh-Shabdiz, of Skyhook Wireless, presented this Wi-Fi-based solution, which stochastically calculates a user's position using dynamic anchor points in both indoor and outdoor environments. The receivers listen for these access points while reporting their presence within a particular point's coverage area.

The interactive method of position determination also generates population-density data within a particular area, supporting other emerging data mining applications.

A lesser-known aspect of the Japan Aerospace Exploration Agency (JAXA) Quasi-Zenith Satellite System (QZSS) program is development of IMES or Indoor Messaging System. IMES is a terrestrial complement of QZSS that uses pseudorandom noise codes (PRNs) and operates near the GPS L1 frequency to provide a location messaging service, according to Kiyoshi Yajima, of Lighthouse Technology and Consulting Co., Ltd., a Japanese company that promotes IMES transmitters.

IMES operates on the 1572.42 MHz frequency (±8.2 KHz), near enough to the GPS signal at 1575.42 MHz, without interfering with it. It uses different PRN code IDs than GPS to maintain signal coherency, but matches the GPS data rate, modulation, and polarization.

This design allows OEMs and their customers to use existing receiver equipment, with only a few inexpensive modifications, to enable them with indoor navigation capability. However, challenges remain in

PANEL DISCUSSION continued on page 3

Exhibitor News

Consortium to Tackle Solar Max Challenges

The European Galileo R&D Framework Program (FP7) and the European GNSS Supervisory Authority (both in **Island Booth L**) recently granted co-funding to the CIGALA Consortium to tackle the challenges posed by the next solar max in 2013.

Belgium-based Septentrio **(Booth 516/518)** will lead the consortium, which also includes the University of Nottingham of the United Kingdom **(Booth 221)**, INGV of Italy, Pildo Labs of Spain and Brazilian partners Petrobras, Universidade Estadual Paulista "Julio de Mesquita Filho" (UNESP), and Consultgel.

CIGALA's mission is to develop and test receiver-level ionospheric scintillation mitigation with the goal of increasing the robustness of professional multi-frequency GNSS based applications in low latitude regions, particularly in Latin America.

The project comprises scintillation climatology research, signal propagation, and tracking R&D as well as a large-scale ionospheric measurement and test campaign that will be conducted in Brazil with the support of several local academic and industrial partners, including Petrobras.

GPS Networking Updates Brand ID

GPS Networking **(Booth 210)** has introduced a new brand identity that includes a redesigned corporate logo.

In announcing the new marketing initiative, GPS Networking President Steve Waite said the rebranding was designed "to reflect the vibrancy of our current business model and to capture greater visibility in the future."

NEW PRODUCT ANNOUNCEMENTS

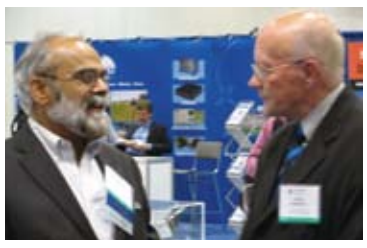
Spirent Unveils Map Matching Tool

Spirent **(Island Booth E)** recently announced a new online tool designed to create a Spirent-formatted User Motion File (*.umt) from a route defined by Google Maps. The generated User Motion File can provide the motion trajectory for the simulated vehicle in one of Spirent's systems running SimGEN or SimREPLAYplus software. Spirent says the SimROUTE tool allows users to visualize real-time motion data from a running Spirent test case in Google Earth and is designed to allow users to create a road-matched trajectory from and to any address that can be geo-coded by the Tele-Atlas/Google Maps database, specify waypoints to allow re-routing or to add additional sections, display the waypoints used to form the route, and generate and download a fully-interpolated ("smoothed") Spirent user motion file and a .KML visualization file to display data in Google Earth. SimROUTE is available free of charge to Spirent customers who own Spirent simulation systems running SimGEN or SimREPLAYplus software with a support contract or warranty. SimROUTE is also available as a stand-alone product on general release.

Spectracom Launches GSG-54 8-Channel Simulator

Spectracom **(Booth 520)** has introduced a new eight-channel GPS constellation simulator, the Pendulum GSG-54. Designed to provide a wide-range of capabilities for in-line production testing of devices integrating GPS receivers, according to the company, the simulator features ease-of-operation, fast test cycles, and versatility in supporting the integration of GPS receivers into devices under development. The unit's bench-top chassis is compact, portable, and easy to set up. The Pendulum GSG-54 simulates the satellite signals detected by a GPS receiver. Built-in standards-based test scenarios can be initiated or modified on the fly from the front panel interface. It also supports a variety of connectivity options to control and reconfigure test parameters.

Inside the 2010 ION GNSS Exhibitor Hosted Reception



ION GNSS

Best Presentation Award Winners

Best Presentation Award winners are selected by their respective session co-chairs. Seventy percent of the selection criteria is based on technical content and innovation, 20 percent is based on the quality of the presentation materials and their applicability to the topic, and 10 percent is based on the quality of the delivery. All winners will be mailed certificates and their papers will be highlighted in the ION GNSS 2010 proceedings CD-ROM. Those winners not yet named will appear on the ION website and in the next issue of the ION Newsletter.

Session B1: GNSS Algorithms & Methods 1
Paper #1: Novel Multipath Mitigation Methods Using a Dual-polarization Antenna: P.D. Groves, Z. Jiang, B. Skelton, P.A Cross, *University College London, UK;* L. Lau, *Institut De Geomatica, Barcelona, Spain;* Y. Adane, I. Kale, *University of Westminster, London, United Kingdom*

Session C1a: Autonomous Vehicles
Paper #3: Integrity Monitoring of Vision-Based Automotive Lane Detection Methods: C. Mario, J. Rife, *Tufts University*

Session C1b: RAIM and/or Multi-Constellation RAIM
Paper #1: Analysis of RAIM using Multi-Constellation to Provide LPV-200 Service Worldwide; Y.C. Lee, T. Cashin, *The MITRE Corporation/CAASD*

Session D1: Atmospheric Sciences
Paper #2: Observing Traveling Ionospheric Disturbances Caused by Tsunamis Using GPS TEC Measurements: D. Galvan, A. Komjathy, *NASA Jet Propulsion Laboratory, California Institute of Technology;* M. Hickey, *Embry Riddle Aeronautical University;* J. Foster, *University of Hawaii;* A.J. Mannucci, *NASA Jet Propulsion Laboratory, California Institute of Technology*

Session E1: Urban & Indoor Navigation Technology 1
Paper #4: GNSS Signal Simulations in Urban Environments: A. Steingass, B. Krach, F. Schubert, *German Aerospace Center, Germany;* M. Crisci, R. Prieto-Cerdeira, *European Space Agency, The Netherlands*

Session F1: Pedestrian Navigation
Paper# 4: Vision-aided IMU for Pedestrian Navigation: C. Hide, *University of Nottingham, UK;* T. Botterill, M. Andreotti, *University of Cantenbury, New Zealand*

Session A2: GPSIIF: From Inception to Launch
Paper #8: GPS Block IIF Rubidium Atomic Frequency Standard Life Test: F. Vannicola, R. Beard, J. White, K. Senior, A. Kubik, D. Wilson, *U.S. Naval Research Laboratory*

Session B2: GNSS Simulation and Testing
Paper# 5: Modifications to GPS Reference Station Antennas to Reduce Multipath: A. Kerkhoff, C.P. Petersen, R.B. Harris, A. Pickard, *Applied Research Laboratories, The University of Texas*

Session C2: Enhanced and Developing Systems
Paper #1: Alternative Positioning, Navigation, and Timing (APNT) Services Research Development Program: L. Eldredge, Federal Aviation Administration; M. Harrison, R. Kennagy, R. Lilly, *Aviation Management Associates;* M. Narins, *Federal Aviation Administration;* D. Chapman, R. Loh, *Innovative Solutions International;* V. Massimini, R. Niles, *The MITRE Corporation;* P. Enge, S. Lo, *Stanford University*

Session D2: Remote Sensing with GNSS & Integrated Sensors
Paper #8: The SGR-ReSI – A New Generation of Space GNSS Receiver for Remote Sensing: M. Unwin, R. de Vos Van Steenwijk, *Surrey Satellite Technology Limited, UK;* C. Gommenginger, *National Oceanography Centre, Southampton,* C. Mitchell, *University of Bath;* S. Gao, *Surrey Space Centre, UK*

Session E2a: Consumer Applications
Paper #2: Multi-Sensor GNSS Tight Hybridisation for Indoor Positioning: J.M. Lorga, P.F. Silva, J.S. Silva, *DEIMOS Engenharia, Portugal;* T.F.R. Silva, J.M. Goncalves, *INOV-INESC Inovacao, Portugal*

Session F2: LBS Technology and Applications
Paper #5: Demonstration of Inter-Vehicle UWB Ranging to Augment DGPS for Improved Relative Positioning: M.G. Petovello, K. O'Keefe, B. Chan, *University of Calgary, Canada*

Session A3: Integrating System Capabilities at the GPS Wing (Invited Papers Only)
Paper #4: GPS Capability Delivery Planning and Analysis: J. Silvas, J. McCanless, *Booz Allen Hamilton;* C. Williams, *U.S. Air Force GPS Wing*

Session B3: New Products Announcements
Paper #2: GNSS Absolute Antenna Calibration at the National Geodetic Survey: A. Bilich, G. Mader, *National Geodetic Survey*

Session C3: Aviation Applications
Paper #2: Operational Implementation of EGNOS and LPV Approaches in Aviation in Europe: J. Murcia, L. Chocano, *INECO;* P. Haro, Aena: R. Farnworth, *Eurocontrol;* H. de With, *GSA*

Session D3: Surveying & Geodesy
Paper #2: Operational Performance RTK Positioning when Accounting for the Time Correlated Nature of GNSS Phase Errors: C. Miller, K. O'Keefe, Y. Gao, *University of Calgary, Canada*

Session E3: GPS and GLONASS Modernization and Other Emerging GNSS (Galileo, QZSS, IRNSS, COMPASS)
Paper #7: First GPS IIF Satellite in the Air: Observation and Performance Analysis: G.X. Gao, J. Blanch, T. Walter, P. Enge, *Stanford University*

Session F3: Land Based Applications
Paper #5: Application of Particle Filters for Vehicle Positioning Using Road Maps: P. Davidson, J. Collin, *Tampere University of Technology, Finland;* J. Raquet, *Air Force Institute of Technology, USA;* J. Takala, *Tampere University of Technology, Finland*

Session A4a: NATO Military PNT & NAVWAR (Invited Papers Only)
Paper #2: PS Precise Positioning Service Equipment Certification Office (PECO) and Military Standard Order (MSO) Authorization: K. Kovach, X. Tran, *The Aerospace Corporation;* J. Tomaszewski, *U.S. Air Force GPS Wing;* J. Stripling, *Epsilon Systems:*

Session A4b: Results of the ION's 2010 Robotic Lawn Mower Competition
Paper #2: CWRU-Cutter C: Case Western Reserved University's Autonomous Lawn Mower Design and Performance Review: B. Hughes, A. Smith, A. Schepelmann, D. Bennett, H. Snow, *Case Western University Mechanical Engineering Department*

Session D4a: Marine Navigation
Paper #1: Seabed Mapping on an Earth Centered Earth Fixed (ECEF) Geocentric Reference Frame. Cooperative Validation with the US Navy and Brazilian Navy in Guanabara Bay, Rio de Janeiro: E.N. Arroyo-Suarez, *U.S. Naval Oceanographic Office;* A.M. de Oliveira, Jr., A. Moreira Ramos, *Brazilian Directorate of Hydrography and Navigation, Brazil*

Who will be next?

Previous Kepler Award Winners at ION GNSS 2009 (L to R): Dr. Per Enge (00); Patrick Fenton ('06); Dr. Rudy Kalafus ('92); Dr. Elizabeth Cannon (01); Thomas Stansell, Jr. ('03); Dr. Bradford Parkinson (91); Dr. Penina Axelrad (09); Mr. Phillip W. Ward (08); Dr. Gerard Lachapelle (97); Dr. Chris Hegarty ('05); Dr. Richard Langley (07); A. J. Van Dierendonck ('93); Ron Hatch ('94).

PANEL DISCUSSION, continued from page 1

the management of the transmitter frequency, and in the regulation of the market –especially so that they do not jam GPS receivers.

Two integrators on the panel presented consumer models for the indoor positioning services, including business cases for advertising, shopping, entertainment, and emergency services. They evaluated the four options presented by the technologists, using the criteria of profit and marketability.

Dr. Frank van Diggelen, of Broadcom, presented a compelling case for the "practically perfect" products and services provided by GPS . . . when used outdoors. Although no perfect option exists among indoor positioning solutions, his favorite approach was the IMES system, due to the practical information it provides, such as the floor number of a building rather than a precise height above sea level.

IMES would be a "real game changer if deployed on a mass scale," van Diggelen said and called it the "wild card Joker" solution to indoor positioning.

The business case for deep indoor positioning, highlighted by Dr. Greg Turetsky of CSR/ SiRF, follows the revenue trail back to the users' pockets, while not increasing the cost for consumers' phones. Using existing hardware, while providing fee-based services for applications, would be one strategy that is also compatible with the IMES approach.

The panelists and audience proceeded to address some of the associated questions that this technology seeks to solve. *Should GNSS be considered a public good? Should pseudolites or IMES transmitters be considered part of a society's infrastructure and, thus, to be regulated? How should individual transmitters be managed, for installation, broadcasting, and power and frequency management?*

Dr. van Diggelen summarized, "By virtue of GPS's success, it has become more widely adopted, and thus more challenged. So, people have found places where it doesn't work, and these are the new problems." ◆

FRIDAY AT-A-GLANCE

8:30 a.m.
MORNING SESSIONS BEGIN

PANEL DISCUSSIONS — COMMON FREQUENCIES VS. FREQUENCY DIVERSITY IN CIVIL SIGNALS – WHAT IS THE RIGHT CHOICE?
Room C123-124

9:00 a.m.
EXHIBIT HALL OPENS

12:00 noon
EXHIBIT HALL CLOSES

12:15 p.m – 1:45 p.m.
THE JOHANNES KEPLER AND BRADFORD W. PARKINSON AWARDS LUNCHEON
Oregon Ballroom
The winner of the coveted Kepler Award will be announced along with the *seventh* Parkinson award winner. This event is included in a full conference registration. Tickets for partial registrants and guests may be purchased at the ION registration desk.

1:45 p.m.
AFTERNOON SESSIONS BEGIN

PANEL DISCUSSIONS — THE USE OF GNSS IN EMERGENCY SERVICES
Room C123-124

PROGRAM CHANGES

Session A5: Paper #3 by Woodward, cancelled. Replaced with alternate #1 by O'Brien. Paper #5 by Chandrasekhar, cancelled. Replaced with alternate #1 by Ishikawa.

Session C5: Alternate #3 by Dautermann, cancelled.

THANK YOU!

The ION wishes to express its sincere appreciation for the support of its Show Daily advertisers, **Javad GNSS** and **NovAtel**, and to **Inside GNSS** *magazine* for its editorial contribution to the Show Daily.

Also, our thanks to the sponsors of the Internet kiosks — **Inside GNSS** magazine, **Lockheed Martin** and **NovAtel, Inc.,** and to **RX Networks** for sponsorship of the Business Center.

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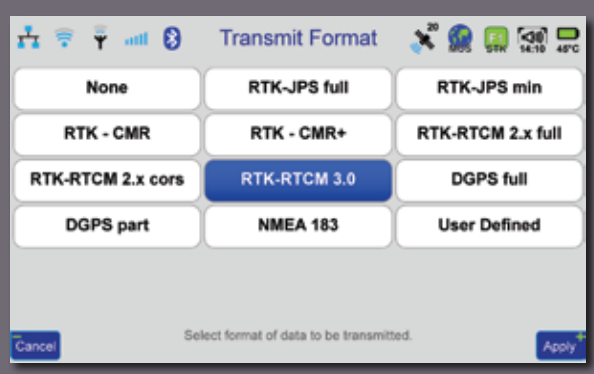

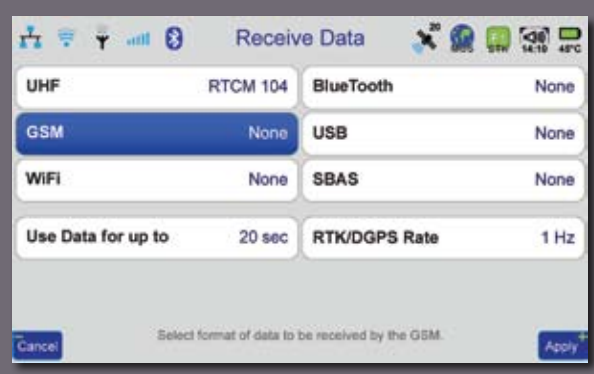

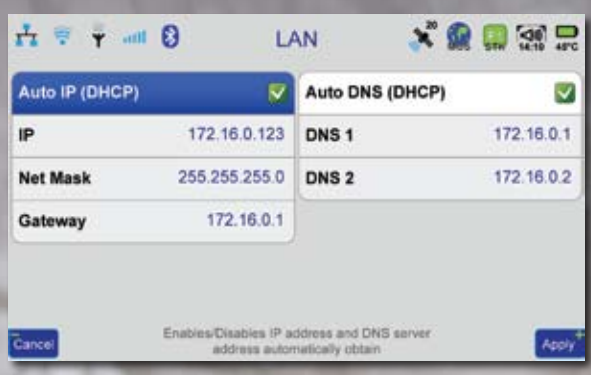

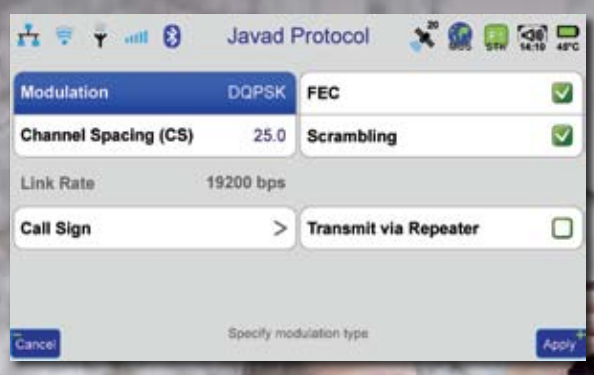

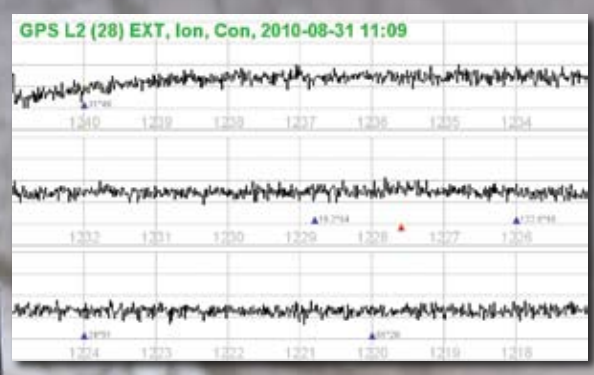

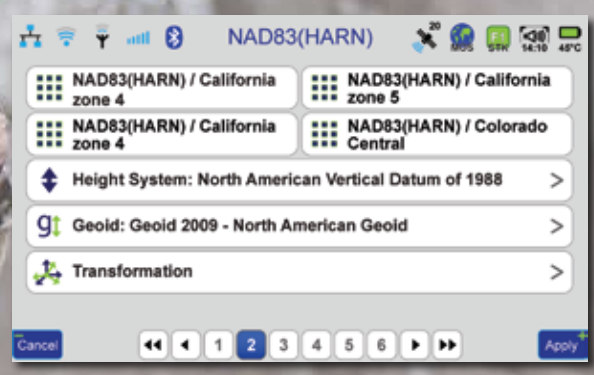

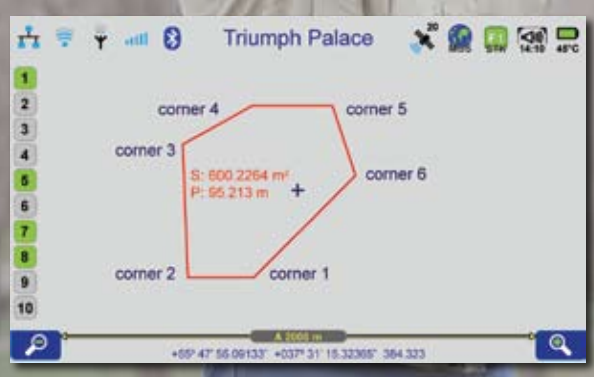

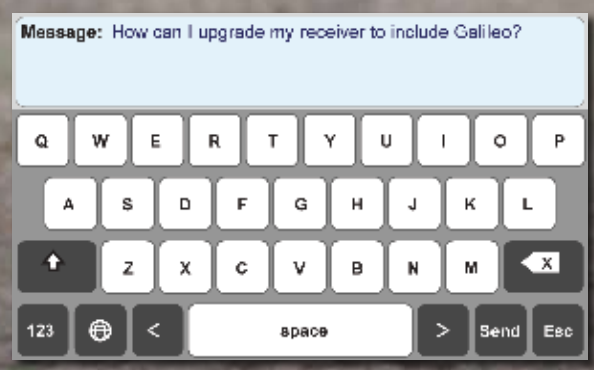

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