

# ION+2014 | SHOW DAILY

WEDNESDAY EDITION

From the editors of



## CHECK IT OUT

### Mobile Conference Site

Access the GNSS program and other conference information on your mobile device. Point your mobile browser to <m.iongnss.org>.

### Customize Your Conference Schedule

Once you are registered for the conference, visit the ION website to build a customized schedule of conference papers you wish to attend. Visit the ION GNSS+ program at <www.ion.org/gnss> for details.

### Self-Service Business Area

The use of computers, a printer, and a copier is being provided 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, sponsored by **NovAtel**, **Inside GNSS**, and **Lockheed Martin**. As a courtesy to others, please limit your time when others are waiting.

### Technical Paper Copies Online

Registered attendees may download copies of technical papers online for FREE. Papers can be accessed by logging into your ION web account at [www.ion.org/gnss](http://www.ion.org/gnss). Only papers provided to the ION by the presenting author will be available. If a desired paper is not available, we recommend you contact the author directly.

### Conference Proceedings

Official conference proceedings are scheduled for distribution in November to all eligible conference participants.

Gen. John E. Hyten

## New AFSPC Commander Takes a Look at the GNSS Future

Dee Ann Divis

As the new commander of Air Force Space Command (AFSPC) Gen. John E. Hyten is responsible for all the service's space programs including the Global Positioning System.

Hyten is no newcomer to GPS. He got hands-on experience during 2006 as commander of the 50th Space Wing, which supports GPS, and was the director of space programs in the Office of the Assistant Secretary of the Air Force for Acquisition from 2010 to 2012.

He served as vice commander of Space Command from May 2012 through August 15 of this year when he took over the top post from Gen. William L. Shelton. Gen. Hyten took time from his first month in his new job to share his perspective with the GPS community. Here are his written answers to questions submitted by *Inside GNSS* with some added background in italics for context and clarifying notes in brackets where needed.



Gen. John E. Hyten, the new AFSPC Commander.

**Inside GNSS:** What are your top three priorities as you take the helm at Space Command? How are those priorities different from those say three to five years ago?

**HYTEN** *continued on page 3*

## ION GNSS 2014

## A Conference with Deep Roots

Launched nearly 30 years ago to create more space for discussions about the then-new GPS constellation, the Institute of Navigation satellite navigation conference has evolved into the world's premier gathering on positioning, navigation, and timing with presentations on the many programs underway around the globe and papers on emerging applications like indoor location technologies.

In 1987, just four years after President Ronald Reagan decided to make GPS more widely available to civil users, the ION's relatively new satellite navigation division organized its first satnav conference.

"We only had a couple hundred people there [at that first meeting]," said Brad Parkinson, the former head of the Air Force's NAVSTAR GPS Joint Program Office who helped establish and lead the ION Satellite Division in its early years. Even so, "it was clear that we were onto something that was really going to work."

**ION's DEEP ROOTS** *continued on page 6*



Colorado Springs' Broadmoor Hotel, site of the first ION GPS conferences.

**HYTEN** continued from page 1

**Gen. Hyten:** My priorities are to Win Today's Fight, to Prepare for Tomorrow's Fight, and to Take Care of our Airmen and Families. AFSPC's mission is to provide resilient and affordable space and cyberspace capabilities for the Joint Force and the Nation. That hasn't changed. Over the past several years what has changed is the fiscal environment; budgets are tighter and we have had to learn to work within that constraint.

We also have a sacred responsibility to deliver space effects to Soldiers, Sailors, Marines and Airmen wherever they are, all the time. Not only that, services like GPS are critically important to people the world over, we must always deliver on that too.

Looking a few years ahead, we will enter a time in space operations in which the United States may have to defend our space capabilities from an increasingly debris cluttered environment and a field of potential adversaries that would seek to deny the Nation and the Joint Force access to the capabilities we provide. The systems we have on orbit today weren't designed for that; so, we have to think differently about our satellites, the systems that support them, and especially Space Situational Awareness.

**Inside GNSS:** Over the last several years the civil GPS community has been unable to contribute to GPS modernization in the amounts planned when the arrangement was first devised. How do you see the GPS program addressing the issues created by the shortfalls?

**(Background)** With an eye toward giving the civil community both greater leverage and more of a stake in decisions affecting the GPS system, the White House decided a number of years ago that non-military users should contribute to the funding of the program. Though budget requests were made for the Federal Aviation Administration, which was to be the financial conduit for the civil contribution, Congress has slashed the requested allocations repeatedly, leaving the GPS program short on its original \$235 million commitment by what *Inside GNSS* estimates to be \$55 million to \$100 million. The Air Force has made up some of that shortfall in the past to keep the program on track. Sources have told *Inside GNSS* previously that, given the

current budget climate, the service may not be able to do that again.

**Gen. Hyten:** Unfortunately, our civil partners have faced the same fiscal scrutiny that we in the military have had to contend with over the past several fiscal years. The result has been a delay in the amount of money the civil community is paying for their share of modernized GPS civil services. The GPS Enterprise impacts result in delays to the Next Generation Operational Control System (OCX) program. This can be avoided if the DOD funds civil funding shortfalls in order to keep the program on its revised schedule. OCX provides civil message generation for legacy signals (C/A, L1, L2C, L5C) and introduces message capability for L1C. OCX also monitors all signals generated by the GPS constellation.

**Inside GNSS:** The number of companies able to provide key services to Space Command has narrowed as have the overall capabilities of the U.S. industrial base. Moreover, as technical experts age and younger engineers and managers are snapped up by other industries, the space community in general and the GPS community in particular, may face shortages of experienced problem solvers. What can Space Command do to keep its contracting options open and the pool of human talent it needs both deep and vibrant?

**Gen. Hyten:** The narrowing of the industrial base and an aging workforce are issues SMC must wrestle with. The Air Force has embraced setting aside more contracts for small business, but those practices have created some instability for promising engineers, technical managers, and functional experts. Larger businesses with multiple programs have enough aggregate demand to justify very highly skilled, specialized subject matter experts, which a company dedicated to a single program often cannot, particularly when we chose to fund them only one option year at a time. To overcome such issues, we must

make smart contracting source decisions and seek stable, albeit reduced, budgets.

To recruit talent into the workforce, SMC engages at the college level through the Air Force Pathways and DoD SMART (Science, Math & Research for Transformation) programs. Recent college graduates and stay-in-school interns join the Air Force civilian corps, bringing fresh ideas and the latest in academic thought. SMC also recruits talented career engineers from across the country from both inside and outside the government. In the last year, SMC has brought in nine engineers from outside the Center and has eight more offers pending now.

One approach to address the importance of a strong industrial base for space is the implementation of the Department's Better Buying Power Initiatives, which promote effective competition while incentivizing productivity and innovation. SMC is continuously looking for opportunities to invest in alternate sources for capabilities, and leveraging the benefits of competition to drive efficient and innovative approaches to reduce costs over the lifecycle of a program. Three recent examples are the approaches we took and are taking on the FAB-T Program, the New Entrant Launch Initiative, and the follow-on production for GPS-III.

**Inside GNSS:** Sequestration and the overall push within the Pentagon to reduce costs, including decisions to reduce staff, creates pressure on the talented military and contract personnel needed to manage programs and execute plans. How do you see Space Command dealing with the human side of the budget squeeze?

**Gen. Hyten:** The Department of Defense and the Air Force continue to work in a very difficult fiscal environment. In July, the Air Force announced significant changes to Headquarters staff manning. This requires a 20% cut in cost and staff levels — a reduction that includes both

**HYTEN** continued on page 6



**HYTEN** *continued from page 3*

civilian and military positions.

Our civilian personnel sections are working diligently to place impacted employees and are using every tool available. Four rounds of Voluntary Early Retirement Authority and Voluntary Separation Incentives have been offered to civilian employees to assist with placement of employees who were displaced by the reduction in positions. Military members whose positions are cut will remain in place for the remainder of their tours, but when they PCS [receive permanent change of station orders] there will be no replacements, and those positions will be removed from the manning document. Some of those positions will transfer to other units as appropriate.

**Inside GNSS:** The possible reopening of the GPS III contract this fall is an opportu-

nity to not only tweak the GPS program but to make significant changes. Can you describe three or four challenges you hope to address as you weigh the options?

**Background:** In June Air Force Space Command released a "sources sought" announcement, looking for firms able to produce up to 22 GPS III spacecraft. The effort is aimed at determining if there are suppliers able to replace Lockheed Martin, the current GPS III prime contractor, and Exelis, the subcontractor responsible for the navigation payload. That payload, and consequently the GPS III satellites themselves, has been significantly delayed.

*Inside GNSS* has since reported that the Air Force is very interested in using this opportunity to shift to a digital navigation payload, which offers greater capability and potential cost savings. If military managers decide to seek new contractors, up to two Phase 1 contacts could be awarded in fiscal year 2015 followed by a final contest between Lockheed Martin and the selected contractor or contractors for up to 22 GPS III production spacecraft. An award for those satellites is anticipated in the FY17/18 timeframe to support completion of the first space vehicle by the first quarter of FY23.

**Gen. Hyten:** Nothing is ever official until our acquisition arm at Space and Missile Systems Center (SMC) garners Milestone Decision Authority approval, but SMC is conducting market research to see if competition is viable starting at Space Vehicle 11. SMC released the Sources Sought on June 4 in order to inform the GPS III SV 11+ acquisition strategy and determine whether viable alternate sources exist to produce GPS III space vehicles. By reopening competition for the GPS III contract we hope to explore alternate navigation payload providers and investigate more efficient bus designs that leverage new materials and technologies. A further benefit to injecting competition is the expansion in the industrial base, which will lead to increased product quality, while decreasing overall cost. ■

**ION's DEEP ROOTS** *continued from page 1*

Staked with \$1,000 each from ION, Trimble, and NavtechGPS (then known more simply as Navtech), the "Satellite Division First Technical Meeting" was held Sept 21-25, 1987 at the Broadmoor Hotel in Colorado Springs, Colorado, with tutorials offered by Navtech Seminars at the nearby Antlers Hotel.

"It started out as a small, very much United States-focused conference," said Parkinson, conference chairman and the then-president of the satellite division. "By the second year we had expanded it to be an international conference."

**Out of the Cave**

By all accounts the early conferences owe much of their success to Alison Brown, the founder of NAVSYS Corporation based in Colorado Springs, who poured her energy into organizing the program, the meeting spaces and some very memorable networking events. One year the conference rented an entire shopping mall with a skating rink, another year they went to the Flying W Ranch for a cowboy-inspired evening.

"There is a cave in Colorado Springs — we booked the whole cave and had a party in the cave. It was called the Cave of the Winds," Brown told *Inside GNSS*.

In 1989 the conference added its first international technical chairs from other countries and, in 1991, having outgrown the Broadmoor, moved to Albuquerque. Even bigger spaces would soon be needed.

"In the 1990s there was exponential growth. We went from about 700 people to over 2,000 people in a 10-year span," said ION's Executive Director Lisa Beaty. She said attendees were drawn by the GPS research and development activity underway and the opportunity to glean details about potential future contracts. New technology, including the first hand-held navigation devices, was being demonstrated in the exhibit area and there were presentations about ongoing policy debates — particularly those taking place within

and between the United States and Europe. The number of people coming to ION GNSS surged when the Europeans started Galileo, Beaty said. "We covered Galileo as one of the GNSS systems as part of the



Alison Brown



Lisa Beaty



Brad Parkinson

conference. The Europeans would come to us to hear about their own system, and there are actually more Europeans that attend ION GNSS than attend the European satellite navigation conference."

**And into the World**

All of that activity helped make the ION GNSS audience much more international.

"We saw a huge rise in international attendance beginning in the mid-to-late '90s, which is where a lot of our growth was coming to us," said Beaty.

That growth stalled after the terrorist attacks of 2001.

"The conference was supposed to open the evening of September 11, 2001. We were in Salt Lake [City, Utah]. The terrorists attacked in the morning, the plenary session was supposed to be that afternoon."

"The 2001 conference had started but nobody could make themselves leave the convention center because they had put televisions all over," said Carolyn McDonald, president and CEO of NavtechGPS. "They rolled out coffee stations so that people could keep tabs."

Many of those planning to attend the conference had already arrived in Salt Lake City because the tutorials had started that morning.

Growth stalled after 9/11, then recovered only to be hit again a decade later when the budget fight in Washington shut

down the government and slashed federal spending. With some of the budget woes now settled attendance has been rebounding and is expected to be up 7 percent this year as compared to last year, said Beaty.

That rise in the number of conference goers has been bolstered by the continuing strong program for navigation students and more presentations for professionals focused on commercial applications.

"If you are an applications program person you can see an entire track of sessions for all three days that are application-oriented just for you," said Beaty. "If you are a commercial person you can see a commercial track of sessions designed specifically for you."

The Indoor Location Alliance (ILA) is managing a session this year and some ILA companies will be doing live indoor wireless demonstrations.

Even so, today's ION GNSS+ is still very much a technical meeting. There are two tracks of very intense, academic sessions, said Beaty, and ION is now offering technical presenters the opportunity to have their papers reviewed by peers.

"This is the first year we've done that," she told *Inside GNSS*.

The technical acumen of those who come to the conference and their willingness to share information and knowledge make it such a singular event, Beaty suggested.

"I think the thing that's unique about us is that, while we have policy sessions, we fundamentally are a group of fixers. People who are trying to make their systems work," Beaty said.

"There are only so many people in the world that really have an understanding, a technical understanding, of these systems down to the level of the people who attend ION GNSS," Beaty said. "When you're the people who write the textbooks, the only place you can learn is from each other. ■"

GNSS+ 2014

ION  
ATTENDEE  
Company Name



FULL REGISTRATION

## ION MEMBERSHIP SPECIAL

Join ION or Renew Your Membership  
and Play the ION Plinko Game!

This is your chance to JOIN The Institute of Navigation at a reduced rate and join the Plinko party, too!

If you have a **YELLOW** ION GNSS+ 2014 registration badge, you're probably not currently a member of The Institute of Navigation (ION), but you are eligible for a **special limited-time membership offer**. During the conference, you can join the Institute of Navigation for just \$15 (\$35 outside the U.S.)

We want *all* GNSS+ 2014 attendees to enjoy the benefits of ION membership. So, trade in your **YELLOW** badge for a **GREEN** badge by joining the Institute of Navigation during ION GNSS+ 2014.

It's easy *and* fun.

Plus, if you join or renew your ION membership during ION GNSS+ 2014, you will get to play the new ION Plinko game.

**Two easy ways to JOIN OR RENEW:** 1) Go to the ION GNSS 2014+ registration desk and complete the membership or renewal form, or, 2) go to the ION Membership Booth (#603) in the Exhibit Hall.

Join and play Plinko for a free prize. Just don't land on "Lose a Turn"! Prizes include Starbucks gift certificates, ION lapel pins, ION Coins, ION ear buds, and other fun prizes.

This is the best opportunity to join ION at a great price.

## New Products @ ION GNSS+

### KVH Introduces Two New FOG-Based IMUs

KVH Industries, Inc., (Island Booth A) has introduced the 1725 Inertial Measurement Unit (IMU) and the 1775 IMU, advanced sensors designed to be integrated into a range of stabilization, pointing, and navigation applications.

The new products complement KVH's 1750 IMU and create a range of choices for advanced six-degrees-of-freedom sensors with enhanced performance. All three products utilize the E•Core ThinFiber technology of KVH's DSP-1750 fiber optic gyro (FOG).

According to KVH, the 1725 IMU features a flexible user interface, with user programmable data output rates from 1 to 1,000 hertz and is designed for all types of platforms and navigation or stabilization systems where low cost, high-performance, and high bandwidth are critical for success. The 1775 IMU is a premium sensor that offers user-programmable data output rates from 1 to 5,000 hertz and includes three axes of magnetometers for automatic gyro bias compensation even in the presence of strong magnetic fields. The 1775 IMU is designed for sophisticated systems and applications where very high bandwidth, low latency, and extreme stability are critical.



### Spirent Offers Multi-GNSS Record & Playback System

Designed to capture and replay complex signal conditions, the new GSS6425 Record and Playback System (RPS) from Spirent (**Booth F**) expands on its L1-only GSS6400 by providing RF recordings for more constellations (GPS, GLONASS, Galileo, BeiDou, QZSS), more frequencies (L1, L2, L5), wider bandwidth (50 megahertz) and more features, to support a wide range of positioning, automotive, survey and military test applications.

The test system is self-contained and portable, enabling users to record and play back data in the field without the need for an additional PC or external power. The GSS6425 is designed for use in such environments as urban canyons, indoor spaces (for example, airport terminals), and dense forests.

### EMI Shielding Available on GPS Networking Splitters

GPS Networking (**Booth 526**) now offers electro-magnetic interference (EMI) shielding on its GPS/GNSS splitters. Interference between electronic components is an increasing issue as more wireless components are used to complete broadband systems. Reducing disturbance between separate frequencies through EMI shielding is a critical deliverable for Project Managers.

According to the company, the new GPS Networking EMI Shielded splitter meets the requirements set forth in MIL-STD 461F.

### IFEN Launches SX3 Software Receiver at ION GNSS+

On Wednesday, IFEN (**Island booth E**) introduces its new SX3 GNSS software receiver, a major upgrade of the company's SX-NSR. Redesigned hardware-frontends feature four wideband RF frequency bands that can be split into a maximum of eight sub-bands per unit. At the same time the bandwidth has been expanded to a full 55 megahertz, offering additional signal power especially in the Galileo E5 band.

A new USB 3.0 port of the frontend supports a data transfer rate that makes possible a maximal bit-quantization of up to eight bits for every stream. The additional power is compressed into a significantly smaller and lighter hardware chassis than before, according to IFEN. Among other options, a dual antenna-input feature can be ordered as well as an OCXO-clock.

The newly released software version offers following new features: interference mitigation algorithms (continuous wave mitigation, pulse blanking), new module controlled data recorder, new configurations (e.g., "Monitoring Receivers," "AntiJam," "ControlledRecorder"), and new



application programming interface (API) examples. As with its predecessor, the SX3 is also able to act as a framework for customers' own signal processing algorithms and serves as a powerful tool for research and development. ■

## Meeting on GPS Specs

An open meeting will be held today in Tampa during ION GNSS+ 2014 to discuss three topics relating to GPS interface specifications: (1) definition of the term outage as used in ICD-GPS-240; (2) implementation in ICD-GPS-240 of a machine readable satellite outage file (SOF) to report NANU messages, and (3) implementation of p-coder algorithms in IS-GPS-200.

This meeting is a follow up on action items from the Public Open Forum held by the GPS Directorate on August 22. If you have input into any of these topics, you are welcome to come and participate. The meeting will be held in Room 4 of the Tampa Convention Center on Wednesday at 12:15 pm.

For more information contact John Lavrakas <jlavrakas@oregonarc.com> or Frank Czopek <frankc@smad.com>. ■

## Sensor Upgrades MEMS IMU Featured in NovAtel, Norbit Units

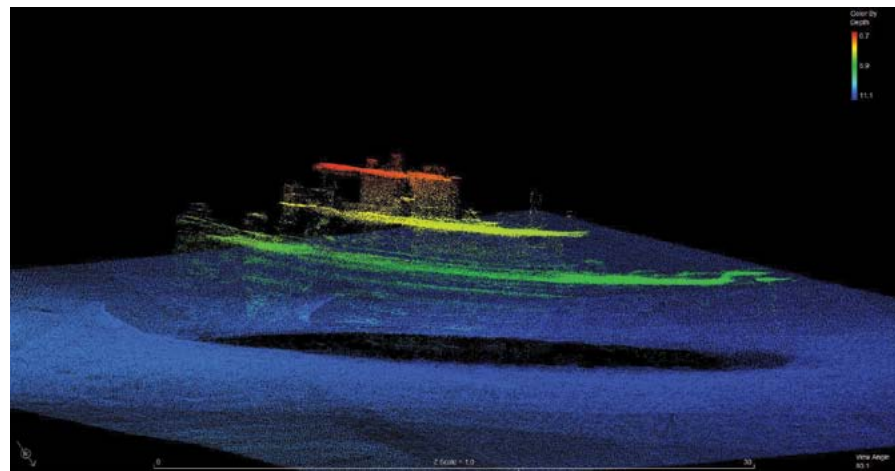
**S**ensor (**Booth 102**) has announced new features for its STIM300, a small, light-weight micro-electro-mechanical system (MEMS) inertial measurement unit (IMU) that provides non-GPS-aided positioning in multiple domains.

The STIM300 — which can be used underwater, on land and sea, and in aeronautic and astronautic applications — now has real-time g-compensation in all axes and supports rates of up to 2000 degrees/second.

According to the company, the MEMS IMU is free of ITAR export restrictions and can provide performance for applications that previously only had fiber-optic gyros as an alternative.

The STIM300 also is part of the NovAtel Synchronized Position Attitude Navigation (SPAN) GNSS/inertial navigation solution that has been incorporated into the Subsea Norbit US Ltd. iWBMS multibeam sonar system used for bathymetric mapping projects. The use of these systems in mapping projects is highlighted in a feature article in the 2014 edition of NovAtel's *Velocity* magazine, available at the company's exhibit (**Island Booth J**) in the ION GNSS+ 2014 exhibition hall.

A key collaborator for both Norbit and NovAtel has been Seahorse Geomatics, a leading hydrographic support company based



in Portland, Oregon, and headed by Mike Mutschler.

Multibeam sonar systems are most often mounted on floating or submerged survey vessels that are heading, pitching, rolling, heaving in different directions, with varying dynamics at play on or under water surfaces. The Norbit multibeam sonar measures several hundred beams, each having a unique two-way travel time and across-track pointing angle from nadir, which must be combined with accurate survey platform positioning, attitude—roll, pitch and heading—and sound speed to derive a final and repeatable XYZ location on a common projection.

When the different sensors are separated, vertical and horizontal uncertainties are increased due to offset measurement errors, sensor misalignments and platform flexing,” Mutschler explains. To solve this, Norbit puts the NovAtel GNSS+INS deep within the sonar hardware. ■

## NovAtel's Purves to Head Hexagon's Veripos Operations

**I**n his role as president of Hexagon Positioning Intelligence, Michael Ritter has announced the appointment Graham Purves as president & CEO of Veripos, effective September 9.



Graham Purves

“Graham has amassed a tremendous level of experience in all aspects of our industry during his over 25 years at NovAtel,” said Ritter, who also serves as president and CEO of the Calgary, Canada-based NovAtel Inc. “This experience and especially his dexterity for sales, marketing, and business development are ideal prerequisites for this next step in his career.”

Purves, who until his new appointment, had served as NovAtel's executive vice-president, will be based in Veripos's Aberdeen, Scotland, office.

Hexagon recently acquired Veripos, a long-established offshore positioning company. ■

## Martin to Head PNT NCO

**H**arold W. "Stormy" Martin III will serve as the new director of the National Coordination Office (NCO) for Space-Based Positioning, Navigation, and Timing (PNT) in Washington, D.C.

A former Air Force colonel, Martin had previously served as NCO deputy director and commanded the 50th Operations Support Squadron at Schriever AFB, Colorado, and served as director of GPS operations. He also has served as chief of the Military Satellite Communications Operations Division and Chief, Position, Navigation & Timing Operations Division for Headquarters Air Force Space Command.



Harold Martin

The NCO was established by presidential policy in 2004 to facilitate information sharing, coordination and issue resolution of space-based PNT programs, requirements, budgets, and policies across the Department of Defense, the Department of Transportation and all other U.S. agencies. ■

