

SatMagazine

Maritime Communications, Mobility

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April 2014

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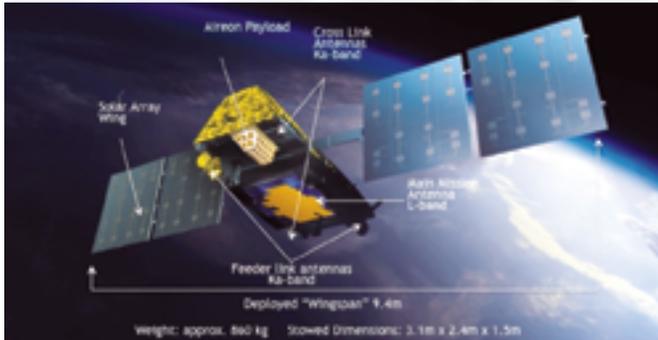
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InfoBeam

Orbital Sciences + Iridium—Financially Speaking, When You Say “Huge,” This Is “Huge.”



Iridium NEXT satellite configuration. Image courtesy of Iridium.

Orbital Sciences Corporation (NYSE: ORB) has started the production of 81 satellites for the Iridium NEXT program, all as part of a contract between Orbital and Iridium’s prime contractor, French-Italian aerospace company Thales Alenia Space.

Orbital will complete the assembly, integration, test and launch support phases for this second-generation global communications satellite constellation at its satellite manufacturing facility in Gilbert, Arizona.

The commencement of production also signifies the opening of a Foreign Trade Zone (FTZ) at the Gilbert facility, which allows Orbital to reduce program costs by importing foreign-sourced hardware from Thales Alenia Space.

“Ten years ago, this factory was created with large scale production in mind,” said Jason Yocum, Orbital’s Senior Program Director for the Iridium NEXT production program. “At the Gilbert facility, we produce cutting-edge satellites that are executed with the highest degree of excellence and professionalism.

“As always, we appreciate the support we have received from the Town of Gilbert as we begin to use this unique facility for its intended purpose—as an international, high-rate, satellite production factory.”

Orbital worked closely with the town of Gilbert to develop the FTZ, enabling the company to develop a highly efficient satellite production line. Orbital will integrate a total of 81 satellites for the constellation, including 66 Low-Earth-Orbit (LEO) operational satellites, six in-orbit spares, and nine ground-backup spacecraft, over the next three years.

Orbital’s responsibilities also include ground support

equipment, primary and hosted payload integration, shipment and launch integration services.

“We thank Orbital for their partnership and cooperation in creating Gilbert’s first Foreign Trade Zone,” said John Lewis, Mayor of Gilbert, Arizona. “It takes a tremendous amount of effort to prepare for a project of this magnitude and we are excited for this international effort to be happening here in Gilbert.”

Scheduled to start launching in 2015, Iridium NEXT will



Orbital’s Gilbert, Arizona, manufacturing facility.

fully replace Iridium’s current satellite constellation of 66, cross-linked, LEO satellites that cover 100 percent of the globe.

The new satellites will dramatically enhance Iridium’s ability to meet the rapidly-expanding demand for truly global mobile communications on land, at sea and in the skies.

“Over the past three years, our teams have been working diligently to produce the best-designed satellite and to validate that design in preparation for production,” said Scott Smith, Chief Operating Officer, Iridium Communications Inc.

“Team members from all over the world have been working together to challenge the processes, build hardware for validation testing and work to make this process as efficient as possible. All of this hard work has paid off and we look forward to a steady production



Artistic rendition of NASA OCO-2 satellite. Image courtesy of Orbital Sciences.

of high quality satellites for our new network from this facility.”

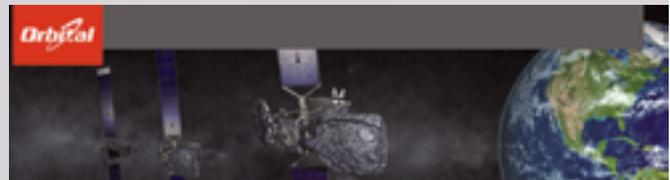
Orbital also engaged in a ribbon cutting ceremony to announce the start of the production of the 81 Iridium NEXT satellites. In addition to viewing the production line, visitors were able to view NASA’s Orbiting Carbon Observatory-2 (OCO-2) satellite, which is currently in its final integration and testing phase—Orbital will provide an update on the program.

Iridium is the only mobile voice and data satellite communications network that spans the entire globe that enables connections between people, organizations and assets to and from anywhere, in real time. Together with its ecosystem of partner

Orbital develops and manufactures small- and medium-class rockets and space systems for commercial, military and civil government customers.

The company’s primary products are satellites and launch vehicles, including LEO, Geosynchronous-Earth-Orbit (GEO) and planetary spacecraft for communications, remote sensing, scientific and defense missions; human-rated space systems for Earth-orbit, lunar and other missions.

The firm also engages in the manufacture of ground- and air-launched rockets that deliver satellites into orbit as well as missile defense systems that are used as interceptor and target vehicles.



companies, Iridium delivers solutions for markets that require truly global communications.

Thales Alenia Space, a joint venture between Thales (67 percent) and Finmeccanica (33 percent), is a key European player in space telecommunications, navigation, Earth observation, exploration and orbital infrastructures.

Thales Alenia Space and Telespazio form the two parent companies’ “Space Alliance,” which offers a complete range of services and solutions. The firm’s expertise ranges from its dual (civil/military) missions, constellations, flexible payloads, altimetry, meteorology and high-resolution optical and radar instruments. The company posted consolidated revenues in excess of 2 billion euros in 2013, and has 7,500 employees in six countries.

Orbital also provides satellite subsystems and space-related technical services to government agencies and laboratories.

For further information regarding Orbital Sciences, please visit: <http://www.orbital.com/>

InfoBeam

RUAG Space—POD'ing Along

Sentinel-1, the European Copernicus Program's first environmental satellite, is ready for launch.

On April 3, 2014, 23:02 Central European Time, the radar satellite lifted off from the European spaceport in Kourou, French Guiana, aboard a Soyuz launcher en route to its orbit. RUAG Space contributed greatly to the satellite's development and construction.

Sentinel-1, the first in the Copernicus satellite family, will deliver data for a variety of environmental and safety related applications, including detecting oil spills, mapping sea ice, monitoring the movement of land masses and mapping trends in land use.

Additionally, Sentinel-1 will support disaster relief and humanitarian crisis response by providing Earth observation data.

Knowing where the satellite is at any given time is a prerequisite for ensuring its measurements are precise. That's why the satellite uses signals from the United States' GPS (global positioning system) satellite navigation system for attitude control.

The GPS receiver developed by RUAG Space is tailored to meet precise orbit determination (POD) requirements in space. Unlike the GPS receivers commonly used in terrestrial applications, these devices are capable of simultaneously processing signals received at two different frequencies, and thus delivering positioning information of the highest accuracy.

A laser terminal on board of the satellite will make it possible in the future for satellites to send data over an optical connection to the European Data Relay System (EDRS) satellites that ESA will launch by the end of 2014. This new technology lets satellites send substantially more data than is possible with a standard direct radio link with the Earth.



A RUAG technician at work on the RUAG Space Sentinel-1 project.

RUAG Space supplied the telescope assembly for Sentinel-1's laser communication terminal.

RUAG Space was also responsible for producing the satellite's aluminum and carbon fiber structure.

Comparable to the chassis of a car, this structure forms the "backbone" of the satellite onto which all other components are mounted. RUAG Space also provided the thermal insulation for the Sentinel-1 satellite.

In addition RUAG Space manufactured a number of electronic modules for controlling and tracking the satellite in orbit.

The radar antenna features another 28 RUAG electronics modules, which are used to direct the radar beam. The electronics modules that generate the radar signal were also supplied by RUAG Space.

For further information, access <http://www.ruag.com/>



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ETL Systems + Boeing—Maritime Moves For GX



ETL Systems has been selected by Boeing to support Inmarsat's GX services for high speed maritime communications.

A range of ETL's RF systems will support the first of three Global Xpress® (GX) satellites. The Inmarsat-5 F1 has launched and successfully completed its orbital deployment stages on schedule.

The first teleport, in Fucino, Italy, where ETL's equipment is installed, is being commissioned next month. Inmarsat-5 F1 is on course to commence commercial service of its high-speed broadband GX connectivity service by mid-year 2014.

From its geostationary orbital location at 62.6 degrees East, the I-5 F1 will offer high-throughput broadband services. The satellite, manufactured by Boeing, features 89 beams and six steerable high-power spot beams, which will enable Inmarsat to increase capacity based on customer demand.

ETL Systems was selected to supply its new Alto range of line amplifiers as well as RF splitters and combiners for the ground segment of the project. These offer signal optimization and signal distribution over L-band, and provide remote control and monitoring for 24 hour operations.

As ETL systems recently launched its North American operations, headed by Susan Saadat, Vice President of ETL's North American Sales and Operations, this is an excellent example of the expansion that is being achieved in the U.S.

"This new project with Boeing is another example of our growing international trade," said Ms. Saadat. "More than 40 per cent of our turnover is coming from U.S. sales and we are encouraged to see those numbers rise. We strive to continue to produce the most resilient RF distribution products and maintain ourselves as a key player in the satellite market."

For further information about ETL Systems, please visit <http://www.etlsystems.com/>

Rockwell Collins—The First From Brazil



Rockwell Collins recently delivered its HF-9087D radio to Helibras, marking the first radio manufactured and delivered by the company's Brazil facility.

Rockwell Collins is under contract with Helibras to deliver avionics and communications for the Panther, Fennec, Cougar and EC-725 platforms.

The Rockwell Collins HF-9087D High Frequency (HF) communication system is part of the company's family of HF airborne radios that enable long range, high altitude communications including the

transmission and receipt of text and graphics while providing HF voice communications to and from remote locations.

Applications for the radio include air traffic control contact, weather and marine storm warnings, security threat warnings and personal radiotelephone service.

For further information regarding Rockwell Collins, please access <http://www.rockwellcollins.com/>

KVH + RHL Hamburger Lloyd—Bringing VSAT Aboard



KVH's V7-IP antenna, interior view.

To meet growing bandwidth usage and Internet demand onboard its tanker fleet, RHL Hamburger Lloyd Tanker GmbH & Co. KG, of Hamburg, Germany, an international shipping company known for managing sophisticated, innovative tankers, has selected KVH Industries, Inc., (Nasdaq: KVHI) for its mini-VSAT Broadband satellite communications solution.

Twelve oil and chemical tankers will be outfitted with KVH's TracPhone V7-IP satellite antenna systems in the next month, with a potential for 16 additional container vessels to receive KVH systems

The KVH systems will be installed on sophisticated tankers known as Safety Chemical Oil Tanker (SCOT) 8000s, which are considered environmentally friendly because their advanced design is intended to minimize the risk of a spill.

RHL Hamburger Lloyd Tanker was heavily involved in the design and construction of the SCOT 8000 tankers, which are propelled and maneuvered by two separate drive systems and are built with a double hull; the tankers have a capacity of 8,000 tons.

KVH's TracPhone V7-IP is a 60cm (24 inch) diameter, enterprise-grade, 3-axis, gyro-stabilized antenna for Ku-band service worldwide.

The system provides data rates as fast as 2 Mbps shore-to-ship, and 1 Mbps ship-to-shore, and high-quality VoIP phone service.

TracPhone V7-IP is designed and optimized for mini-VSAT Broadband service, which is the market share leader in maritime VSAT, according to independent industry reports published in 2012.

TracPhone V7-IP includes the Integrated CommBox Modem (ICM), a streamlined below decks unit that replaces the need for a rack full of components and integrates all antenna control, onboard network management, and modem functions in one small box. This makes installation fast and easy, significantly reducing deployment costs.

Onboard network management is increasingly important for commercial vessels, where there is a need to manage demand for broadband and ensure that operational data usage is prioritized.

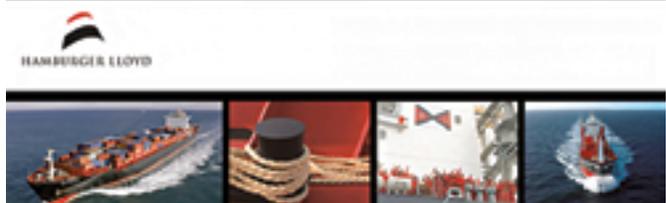
Maritime operators also face the challenge of complying with industry regulations such as MLC-2006, which was implemented last year and requires operators to provide crew welfare in the form of access to satellite phone and Internet services.

KVH's end-to-end solution is designed to address those needs, and is unique in the maritime industry in that KVH designs and manufactures the TracPhone antenna hardware, operates the mini-VSAT Broadband network, manages the airtime service, and provides 24/7 global support.

In addition, KVH is introducing a content delivery service, IP-MobileCast, for multicasting delivery of entertainment and operations content directly to subscribing vessels.

The KVH infosite is located at <http://www.kvh.com/>

The Hamburger Lloyd infosite may be visited at <http://www.hamburger-lloyd.de/>



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Johns Hopkins University Applied Physics Laboratory—Solar Probe Plus... Testing Initiated

NASA's ambitious mission to fly through and examine the sun's atmosphere—has reached a key stage of development.

Solar Probe Plus will begin advanced design, development and testing—a step NASA designates as Phase C—following a successful design review in which an independent assessment board deemed that the mission team, led by the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland, was ready to move ahead with full-scale spacecraft fabrication, assembly, integration and testing.

“Solar Probe Plus will fly closer to the sun than any spacecraft before it—almost 10 times closer to the sun than the planet Mercury—and this presents unprecedented technical challenges,” said Andrew Driesman, Solar Probe Plus project manager at APL. “Whether it was devising ways for a spacecraft to survive so close to the sun, or to collect data in such an extreme environment, the concept of an operational solar probe had challenged engineers and scientists for decades, and now we’re another step closer to making it happen.”

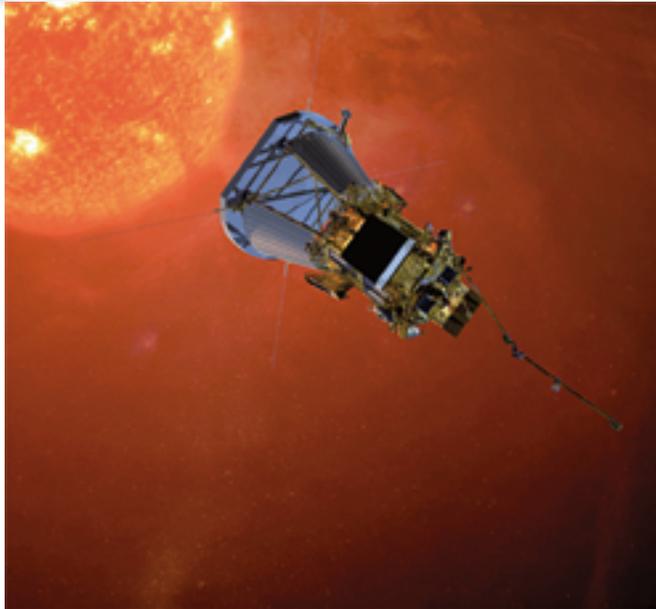
The spacecraft will carry 10 science instruments specifically designed to solve two key puzzles of solar physics: why the sun's outer atmosphere is so much hotter than the sun's visible surface, and what accelerates the solar wind that affects Earth and our solar system.

The Johns Hopkins University Applied Physics Laboratory manages the Solar Probe Plus mission for NASA and leads the spacecraft fabrication, integration and testing effort.

Set to launch in 2018, Solar Probe Plus will orbit the sun 24 times, closing in with the help of seven Venus flybys.

At its closest passes the probe will speed 118 miles per second through the sun's outer atmosphere, or corona, coming about 3.8 million miles (about 6.2 million kilometers) from the surface to explore a region—and face hazards—no other spacecraft has encountered.

Solar Probe Plus will carry ten science instruments specifically designed to help solve two key puzzles of solar physics: Why the sun's outer atmosphere is so much hotter than the sun's visible surface, and what accelerates the solar wind that affects Earth and our solar system.



Artist's impression of NASA's Solar Probe Plus spacecraft on approach to the sun. Credit: NASA/Johns Hopkins University Applied Physics Laboratory

“The answers to these questions can be obtained only through in-situ measurements of the solar wind down in the corona,” said APL's Nicky Fox, Solar Probe Plus project scientist.

“Solar Probe Plus gets close enough to provide the missing links, with the right complement of instruments to make the measurements. For the first time, we will be able to go up and touch our star.”

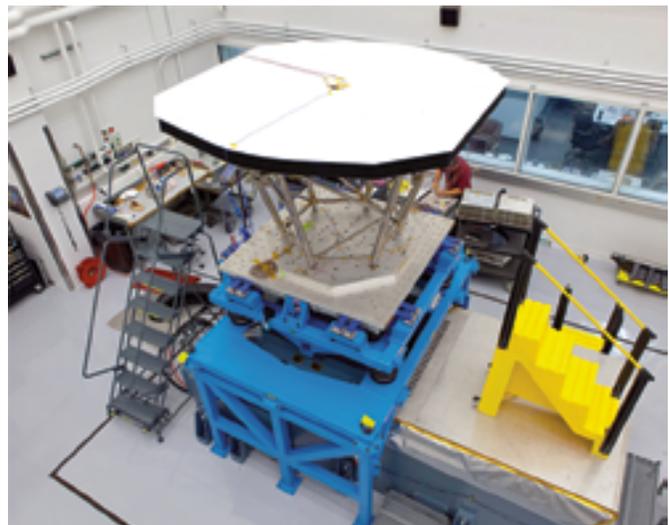
The main feature of the TPS is an 8-foot-diameter, 4.5-inch-thick, carbon-carbon, carbon foam shield that will sit atop the Solar Probe Plus spacecraft body.

The system will protect Solar Probe Plus from temperatures exceeding 2,500 degrees Fahrenheit and impacts from hypervelocity dust particles as it flies through the sun's outer atmosphere.

The vibration tests simulate the shaking the spacecraft will undergo during launch; Solar Probe Plus is scheduled to launch in 2018.

APL manages the mission and leads the spacecraft fabrication and integration effort and has made significant progress on several enabling technologies.

These include such technologies as the carbon-carbon composite heat shield that will protect Solar Probe Plus from temperatures exceeding 2,500 degrees Fahrenheit and impacts from hypervelocity dust particles.



Technicians at the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, prepare an engineering model of the Solar Probe Plus Thermal Protection System, or TPS, for vibration tests in October 2013. The main feature of the TPS is an 8-foot-diameter, 4.5-inch-thick, carbon-carbon, carbon foam shield that will sit atop the Solar Probe Plus spacecraft body. The system will protect Solar Probe Plus from temperatures exceeding 2,500 degrees Fahrenheit and impacts from hypervelocity dust particles as it flies through the sun's outer atmosphere. The vibration tests simulate the shaking the spacecraft will undergo during launch; Solar Probe Plus is scheduled to launch in 2018.

Credit: Johns Hopkins University Applied Physics Laboratory

Engineers have also built and tested a liquid-cooling system to keep the spacecraft's solar arrays at safe operating temperature throughout the voyage, and spacecraft parts are undergoing high-velocity dust tests that simulate flights through swarms of high-energy particles near the sun.

“Solar Probe Plus is a pathfinder for voyages to other stars and will explore one of the last unexplored regions of the solar system, the solar corona, where space weather is born,” said Lika Guhathakurta, Solar Probe Plus program scientist at NASA Headquarters in Washington.

The mission is part of NASA's Living With a Star program, designed to learn more about the sun and its effects on planetary systems and human activities.

NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the program for the Science Mission Directorate at NASA Headquarters.

For more information, please visit <http://solarprobe.jhuapl.edu/>.

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DeLorme + FAA—North To Alaska, With InReach Approval

The Federal Aviation Administration (FAA) Alaska Flight Services has announced that the DeLorme inReach satellite communicator has been approved for the Enhanced Special Reporting Service (ESRS) program.

The inReach is a small satellite communication device that provides automatic GPS flight following, SOS alerting and two-way text messaging from the air.

The inReach device has a dedicated SOS button that, when pressed, immediately sends a distress message.

The two-way communication feature of the inReach allows the search-and-rescue (SAR) authorities to send and receive text messages with the people in distress to ascertain the nature of the emergency and reassure them that help is on the way.

"Pilots and aircraft owners are encouraged to participate in this program while operating within the state of Alaska," said James M. Miller, manager, Alaska Flight Services.

"Once an alert is generated, the position of the aircraft is transmitted to Flight Service either directly or through the International Emergency Response Coordination Center (IERCC).

This allows rescue to go directly to the aircraft location, instead of searching along an entire route when a flight becomes overdue."

The inReach device uses the Iridium satellite network to send and receive messages, ensuring connectivity anywhere in the world, including the most remote regions of Alaska, which are not covered by VHF radio service.

"While SOS alerting is a very important function of inReach, it's much more than just an emergency transmitter," said Jim Skillings, vice president of commercial products for DeLorme.

"With inReach, you can send and receive text messages in flight with any email address or mobile phone number, even when flying in places far beyond the reach of cellular phone carriers.

You can use it to update your Facebook page and post to other social media.

"It also allows you to share your flight with family and friends on the ground by displaying your GPS position and tracks for viewing on a password-protected web-based map display."

DeLorme has also announced the launch of its Freedom Plans, providing contract-free month-by-month usage plans eliminating the need for an annual service fee.

"Our Freedom Plans allow you to pay for satellite airtime service only when you need it on a rolling basis," said Skillings. "You can change plans, up or down, or suspend your service at no charge.

While the account is suspended, all your account data, tracks and details are automatically saved for instant availability when you restore service."

For additional information, access <http://www.delorme.com/>

InfoBeam

Euroconsult—The First Industry Report On Trends + Strategies For EO

Data distributors and services providers have established themselves as a key component of the EO value-chain and an important partner of the EO satellite operators in order to disseminate data to the largest number of end-users possible.

This is particularly apparent in accessing major fast growing regional markets and being able to do business with government and private end-users locally.

According to Euroconsult's new research report, *Earth Observation: Data Distribution*, an estimated 12 to 17 percent of the \$1.5 billion* commercial data market flows through the distributors. It is considered that all major vertical market sectors are procuring from the data distributors to varying degrees.

"While this percentage may seem low, it should be recalled that the majority of the total market is to defense end-users [65 percent] who prefer a more direct approach to receive imagery, such as through direct receiving stations. Business for the data distributor reflects this, with a far greater emphasis on enterprise markets," said Philippe Campenon, Deputy Director, Space and Earth Observation at Euroconsult.

Revenue through data services from the distributors is first from civil governments, totaling 47 percent of distributor data business. This highlights the need to be local in accessing civil contracts, an important consideration given the growing demand globally for EO solutions.

Data provision to the private sector through distribution is also disproportionality higher than the total data market, representing 37 percent of the distributors business. The relatively small figure of 16 percent data revenues associated to defense users demonstrates the more direct approach preferred by this user community.

Most operating companies with very high resolution satellites offer direct receiving stations solutions to defense end-users in order to meet their requirements of secure, continuous data supply with degrees of autonomy in satellite tasking and data acquisition, and short delivery time.

In order to reach out to all user sectors it is therefore considered a necessity to have a diverse approach in mechanisms for data distribution.

This is reflected in the type of distribution offering. In total, there are more than 550 active data distribution agreements signed globally with local companies.

These contracts are classified in five categories within the report, addressing the rationale, contract conditions and key metrics for the following:

- Data Resellers
- Value-Added Resellers (VARs)
- Exclusive Distributors (or Channel Partners)
- Business Partners
- Direct Receiving Station Partners
- Exclusive Interview Results On Distributors' Sales + Growth Strategies

Interviews were conducted with 15 data distributors with a mean presence in the sector of 19 years.

Companies ranged from data distribution being their primary business to organizations active in other parts of the EO value-chain. The following topics are reviewed in detail:

- Motivation for setting up a data distribution business line

- The distributors' offer to the satellite operators
- The relationship between satellites operators and the distributors
- Data distributor customer mix
- Importance of key client requirements
- Technology as a market driver/inhibitor
- Ranking the vertical markets driving data sales and services

For details regarding this report, access this direct link: <http://www.euroconsult-ec.com/research-reports/space-industry-reports/earth-observation-data-distribution-38-56.html>

* Euroconsult: *Satellite-based Earth Observation, Market Prospects, 6th edition*

Sea Launch—Re-Enactment Of Maiden Launch 15 Years Ago



The Zenit 3SL launch vehicle. Photo courtesy of Sea Launch.

Sea Launch has celebrated the 15 year anniversary of the successful maiden launch of the Zenit-3SL ocean-based launch system with the DemoSat spacecraft, that occurred on March 27, 1999.

This was an impressive accomplishment given that, at the time, DemoSat was the largest commercial satellite ever launched into

geosynchronous transfer orbit. Sea Launch's inaugural launch validated the overall program concept and demonstrated system capability.

The payload for the first mission was designed to mimic the mass properties of a 4,500 kilogram spacecraft, with an optimized mission injection profile actually providing 4,900 kilograms of equivalent performance.

It was the culmination of four years (starting in 1995) of intense development work performed by thousands of aerospace and marine professionals throughout the world.

Since then, Sea Launch has managed 35 launches, with its 36th mission (EUTELSAT 3B) scheduled for launch mid-April.

Approximately 200 guests were on hand at the Home Port facility in Long Beach, California, to participate in the celebrations, including customers, dignitaries, suppliers, Sea Launch employees, Energia Logistics U.S. (ELUS) employees as well representatives from RSC Energia.

Dr. Valery Aliev, Executive Vice President Launch Operations for ELUS, said, "Fifteen years ago the entire world witnessed a remarkable event in 20th century global space launch technology—the inaugural launch of the Sea Launch rocket."

Dr. Vitaly Lopota, President and General Designer of RSC Energia, added, "Sea Launch is the first international commercial project that included developing, creating and operating launch vehicle aerospace technology. The initial concept of the project remains viable and unrivaled, and that is—to achieve maximum performance and cost efficiency for launching rockets by choosing the ideal launch site in the Pacific Ocean. This choice avoids limitations of safety exclusion areas of national economic zones from being in the impact zone of jettisoned rocket elements, minimizes the required infrastructure while unequivocally increasing global sustainability of rocket launches and minimizing the impact on environmental conditions and safety of populated areas."

These services include the provision of all-inclusive launch services incorporating schedule assurance, financing, risk management; insurance and creative contracting solutions to meet the changing demands of the commercial launch market.

Sea Launch owns or manages, through affiliate agreements, the primary technology, patent and other intellectual property and tangible assets required to perform its launch services business. These include the highly specialized vessels Odyssey Launch Platform and the Sea Launch Commander each located in the Home Port facility in Long Beach, California, as well as the unique know-how associated with launching satellites from an ocean-based launch platform located directly on the equator.

For more information, visit <http://www.sea-launch.com/>

InfoBeam

MTN—A SEAsoned Event Streaming Solution



MTN Communications (MTN) has launched "MTN OceanCast," a system for the live streaming of events from any maritime vessel, offering simple, cost effective and potentially profitable end-to-end program management.

MTN OceanCast enables concerts, sports tournaments, celebrity interviews, educational sessions, charter voyage events, or even unplanned emergencies to be broadcast live to any smartphone, tablet, TV or other device anywhere in the world from a maritime vessel.

Vessel operators can now deliver a high-definition broadcast from their fleet, creating new revenue-

generating events or simply sharing content, such as educational explorations, with minimal impact to the overall bandwidth or leverage on their existing communications service.

"MTN OceanCast is the ultimate social media avenue and event broadcasting tool in maritime," said Chris Leber, executive vice president, commercial business development, MTN.

"It eliminates the complexity of live broadcasting from the middle of the ocean. This turnkey web solution can be set up to stream in as little as 15 minutes with a simple touch-screen device on the ship connected through a

modem to the MTN network. Our Production Services Team can customize the streaming to the customer's specific needs. This is one more MTN value-add that, aligned with our service excellence and industry innovation, demonstrates our ability to anticipate and exceed our partners' ever-expanding needs."

"We have conducted our first OceanCast for Lindblad Expeditions, when they produced their first TV broadcast from their ship National Geographic Explorer in South Georgia," said Arthur Theodorou, network and fleet IT manager, Lindblad Expeditions.

"James Balog, the founder of the Extreme Ice Survey, whose work was featured in the highly acclaimed documentary 'Chasing Ice,' did four live to tape interviews to North American network and affiliate news programs. The HD content from the remote locale provided a dramatic backdrop to Balog's comments on his expansion of

his Extreme Ice Survey to the southern hemisphere."

With MTN OceanCast, the vessel operator can select who views the broadcast, who gets security access, and ways to generate new revenues through live event streaming.

Live chat boxes can be available during a broadcast event, making it truly interactive with the viewing audience.

MTN OceanCast is a new service delivered through the company's TV and Broadcast Group. MTN introduced MTN Worldwide TV (MTN TV) as the only live, worldwide maritime television service for the enjoyment of passengers and crew on vessels around the world.

MTN TV is a turnkey solution, including equipment installation and service provisioning, for MTN partners as well as for vessel operators just using this particular MTN service.

For more information, visit <http://www.mtnsat.com/>.

Orolia + Transas—Partnership To Provide Seafaring Safety Solutions



Orolia, a specialist in critical Global Navigation Satellite System solutions, and Transas Group, provider maritime simulation, navigation and surveillance systems, have signed a Memorandum of Understanding whereby they will jointly develop new solutions to address the maritime industry's need for high-end e-maritime systems that integrate the latest in Maritime Domain Awareness (MDA) and Search and Rescue (SAR) functionality.

The new joint solutions will also further protect our waterways and strengthen homeland security by advancing Coastal Surveillance Systems to better protect and leverage assets

Coastal surveillance is demanding in terms of sensor fusion, automatic threat detection and business analytics capabilities, and tends to be controlled by large defense and security integrators. Most of them still need to rely on specialized, established technology providers such as Transas to provide turn-key systems to government customers, and McMurdo Group will add these vital coastal surveillance capabilities to Transas' simulation and training solutions.

Under the terms of the agreement, the two groups will leverage complementary products, state-of-the-art technologies and in-depth expertise in vessel management, asset protection and emergency response to create innovative solutions that continue to save lives and improve operations.

Orolia, through its McMurdo Group, provides one of the industry's most comprehensive ecosystems of SAR and MDA technologies including distress beacons, satellite communications infrastructure, emergency and surveillance

operations control centers and fleet management software.

Transas has established itself as one of the world's leading e-maritime innovators covering the design and implementation of integrated navigational solutions, virtual modeling and augmented reality.

"The maritime industry is in need of leadership to help unite a highly fragmented market that today consists of several custom-built, minimally interoperable systems," said Jean-Yves Courtois, CEO of Orolia.

"This collaboration between two established global leaders will contribute to creating a more unified industry, one that is focused on convergence, interoperability and standardization to further improve operations. As part of our overall partner strategy, we are committed to working with leaders such as Transas to pioneer advanced solutions, influence new standards and drive technological innovation for the benefit of the entire maritime community."

While the partnership includes short-term business cooperation initiatives such as sharing product portfolios for broader solution offerings and leveraging sales channels for wider global reach, the primary focus of the agreement is on joint market and solution development for the maritime industry including:

- Creating Advanced SAR-enhanced MDA Systems. Adding McMurdo Group's proven beacon technology and COSPAS-SARSAT/MESOAR satellite-based solutions (including mission control and rescue coordination centers) to Transas' world-leading vessel traffic management, training and 3D



simulation systems can result in higher levels of navigational and safety proficiency. These new offerings will fully integrate emergency preparedness, risk detection, crisis response and emergency operations for activities such as commercial fishing, illegal immigration control and arctic navigation.

- Developing Innovative Coastal Surveillance and Port Management Systems. Augmenting Transas' widely-deployed coastal surveillance and port management offerings with McMurdo Group's advanced threat detection and web-based fleet management technologies can deliver safer, more secure and efficient solutions for sectors such as port operations, inland waterways, oil and gas, renewable energy and border security.

"The joint initiatives and solutions we have identified thus far are just the start of many collaboration projects between our two groups," said Valery Ermakov, CEO, Transas Group. "As our relationship with Orolia expands, we will continue to serve our existing and prospective customers with offerings that remain on the cutting edge of innovation, functionality and performance. We look forward to jointly educating the market, strengthening our global influence and delivering more value not just in the maritime industry but also in new markets such as immigration control, renewable energy, environmental protection and beyond."

Orolia is a technology group that improves the safety, compliance and efficiency of remote operations by providing business solutions and services based on the most advanced positioning, navigation, timing,

sensing, information and communications technologies.

Since 2006, the Orolia group has established itself as a leader in Global Navigation Satellite System solutions. In 2014, Orolia announced the creation of McMurdo Group to unite its Positioning, Tracking and Monitoring Division and its Boatracs, Kannad, McMurdo, SARBE and Techno-Sciences, Inc. brands.

Orolia's headquarters are located in Les Ulis (France). The company also has main offices in Neuchâtel (Switzerland), Rochester (New York), San Diego (USA), Basingstoke (UK), Portsmouth (UK), Guidel and Sophia-Antipolis (France).

Orolia has OSEO "Innovative Company" & "OSEO Excellence" Labels and has won the French Prime Minister's Bold Creativity Prize (2010) and for two years in a row—the group was also awarded third place in the Deloitte Technology Fast 5 (2011 and 2012).

Transas is a developer and supplier of a wide range of advanced software and hardware solutions for transport, oil-and-gas, security, defense and edutainment industries.

Transas Group is headquartered in St. Petersburg, Russia, where the company was founded in 1990. Since then, the Group's global presence has grown to include 23 locations worldwide, which successfully supply Transas' products and solutions to over 130 countries. Transas' production facilities are certified under ISO 9001.

For further information, access <http://www.orolia.com/en/>

InfoBeam

KVH Industries—Crewtoo For You



KVH Media Group
Commercially Licensed News, Entertainment
& Training Content

Services for the Maritime Industry



Commercial Ships and Oil Rigs

Content for crew welfare, entertainment, and training

- News
- Movies, Sports, and TV
- Social Media
- Safety and Training



Ocean and River Cruise Ships

Daily news and other digital content for guests

- News
- Passenger Information
- Music Services



Mega Yachts and Charter Boats

Daily news and other digital content for guests and crew

- News
- Passenger Information
- Music Services
- Safety and Training

Crewtoo, the world's largest online network dedicated to seafarers, has launched an online maritime jobs board as a direct response to requests from its members, who have continuously pinpointed recruitment as one of their main priorities.

Crewtoo, which has more than 100,000 members and was founded by KVH Media Group, part of KVH Industries, Inc., (Nasdaq: KVHI), premiered the service at Shipping 2014, the annual shipping conference and exhibition of the Connecticut Maritime Association.

The Crewtoo jobs board is integrated into the Crewtoo site and enables seafarers to simply change a setting on their profile to state that they are available for work; they are

then prompted to fill in their full employment details on the site and upload their current CV/resumé.

For the seafarer, membership to the popular social network remains free of charge and, even before the jobs board launch, thousands of seafarers had already taken the opportunity to complete their jobs profile.

Maritime recruiters using Crewtoo can choose from three advertising packages: A single vacancy post, a monthly plan, or an unlimited annual service that includes social media posts and a featured company profile service.

Crewtoo members represent a wide range of nationalities, with 55 percent from Europe, 34 percent from Asia and the Middle East, 9 percent from



Thousands Of Seafarers Use Crewtoo To Apply For Jobs!

Want to know why?



Join Now, It's fast & free!

Username

Email

First Name

Last Name

Enter number



It's Free, Join To Add Your CV And Apply For Jobs Now!

Africa, and the rest from North America, Latin America, and Australasia. Likewise, the membership encompasses a broad range of ranks, including masters, ordinary seamen, chief officers, chief engineers, electrical engineers, deck cadets, engine cadets, and cooks.

In addition to Crewtoo, KVH Media Group has a number of other services aimed at improving crew welfare.

NEWSlink is a daily news and information service customized for seafarers, with more than 75 publications in 17 languages delivered by email to vessels

around the world. MOVIElink, TVlink, and TRAININGlink provide commercially licensed movies, television programs, and training films for onboard viewing by seafarers, delivered in a range of formats from hard-copy DVDs delivered directly to ship agents anywhere in the world to fully digital services. SPORTSlink provides daily video clips of sporting events.

The KVH infosite may be accessed at <http://www.kvh.com/>

The Crewtoo recruiting/jobs site is located at <https://www.crewtoo.com/>

KNS—A Maritime Connection



KNS arrived at a D.C. satellite event from South Korea with a busy schedule that started with the firm taking on the responsibility of being the primary sponsor of MSUA-11.

For the first time, KNS displayed their full range of Ka- and Ku-band antennas.

The MSUA-11 Conference, produced by the Mobile Satellite Users Association (MSUA), focused in on the mobile satellite marketplace—challenges, opportunities and what lies in the road ahead.

From Communications-On-The-Move (COTM), maritime broadband and in-flight connectivity, to the future of MSS and FSS, panels of experts discussed all of the mobile satellite's sectors needs.

As a longstanding partner of maritime industry, a field where connection is of vital importance, KNS develops all its maritime antennas according to the highest stands of sturdiness and functionality.

In 2012, they introduced all new SuperTrack Series for marine stabilized antenna systems for satellite communications, satellite television-at-sea (TVRO), broadband at Sea, voice and data services with upgraded performance.

Located in DaeJeon, the Research and Development capital of South Korea, KNS Inc. is a worldwide designer, manufacturer, and integrator of products for the marine communications industry.

KNS has been serving customers worldwide providing high quality service, VSAT antennas, equipment and parts for the marine communications industry. The company also holds ISO 9001:2008, ISO 14001:2004, and CE 0678.

KNS products are used and challenged in the roughest of seas all over the world.

The global network KNS SuperTrack S / Z / A Series are also available across the globe.

For further information, access <http://kns-kr.com/test/index.html>



A satellite doesn't run by itself.

It needs the right telemetry, tracking, and control system to do its job, and the right team of professionals to manage that system. With Harris Corporation's OS/COMET®, your mission gets a COTS scalable, customizable, and extensible TT&C solution and Harris people with unparalleled technical expertise to support you.

The OS/COMET® team has more than 30 years' experience in the satellite TT&C business. Put that experience and know-how to work for you, no matter what your satellite mission is.

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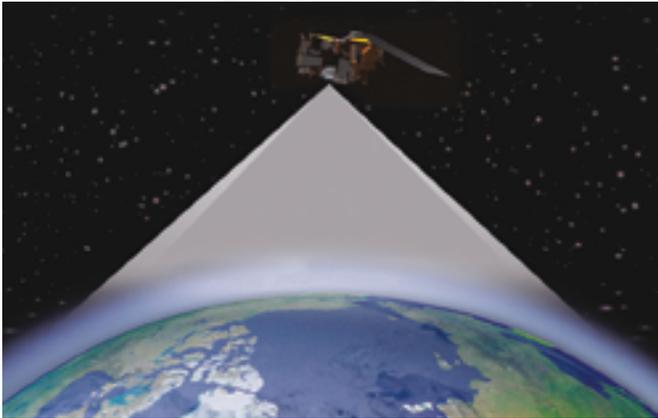
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InfoBeam

Airbus Defence & Space + ESA—A Highly Precise Contract



Airbus Defence and Space will be the European Space Agency's (ESA's) prime contractor for the development and construction of the high-precision Sentinel-5 instrument worth 144 million euros.

The instrument will monitor the composition of the Earth's atmosphere globally on a daily basis by taking measurements of trace gases and aerosols that have an impact on the climate and air quality.

"It is only with satellites and their instruments that we can observe the environment globally and continuously. ESA has entrusted us to take the Copernicus program forward by constructing the next key instrument, the high-precision Sentinel-5 spectrometer, at our optical space center in Ottobrunn, near Munich, Germany," said Michael Menking, Head of Earth observation, navigation and science programs at Space Systems.

"To date, we are already constructing three Sentinel satellites and various other Sentinel instruments for the Copernicus program that support a modern, efficient infrastructure for Earth observation and geo-information services. This demonstrates how our high-tech expertise serves global environmental monitoring as well as global security."

Sentinel-5 will be installed on a MetOP Second Generation (MetOP-SG) satellite and fly in a roughly 800 kilometer polar orbit around the Earth.

The high-tech instrument is expected to be delivered in 2019, while the launch of the satellite is scheduled for 2021.

With a swath width of around 2,670 kilometres, the Sentinel-5 will provide daily global coverage of the Earth's atmosphere with an unprecedented spatial resolution of 7x7km² at nadir, allowing atmospheric and climate scientists to accurately detect and analyze emission sources.

This includes determining the concentration of trace gases as significant components in the atmosphere, such as ozone, nitrogen dioxide, sulfur dioxide, methane, formaldehyde, carbon monoxide and aerosols.

At the heart of Sentinel-5 is an ultraviolet, visible, near-infrared and shortwave infrared (UVNS) imaging spectrometer. This large spectral bandwidth is an absolute necessity for measuring the types of molecules named above.

The mass-optimized instrument, weighing around 270 kilograms and with a service life of more than seven years, consists of the optical module—comprising a reflecting telescope, a beam-splitter optical assembly, two ultraviolet/visible (UV-Vis) and one near-infrared (NIR) spectrometer optics as well as two shortwave infrared (SWIR) systems and a calibration subsystem—and two control electronics assemblies.

Airbus Defence and Space is building a team of approximately 24 European suppliers for the development and construction of Sentinel-5.

Airbus Defence and Space has already constructed a large number of optical instruments that successfully operate on scientific, Earth observation and meteorological satellites.

The company gained valuable experience from developing ERS-1 and Envisat, key European low-Earth orbit environmental satellites; the Sciamachy instrument for mapping the ozone layer and the development of the ozone hole; the Sentinel-4, a dispersive imaging spectrometer operating from geostationary orbit, as well as the Near-Infrared Spectrograph (NIRSpec), the major European contribution to the NASA James Webb Space Telescope (JWST).

Climate change, air quality and the stratospheric ozone layer are important social issues.

Trace gas emissions and aerosols change the chemical composition of the atmosphere, which could have a lasting detrimental effect on the Earth's living conditions: trace or greenhouse gases heat up the Earth and cause climate zones to shift and sea levels to rise.

Combustion products such as nitrogen oxides and hydrocarbons cause air pollution from ozone and aerosols, and chlorofluorocarbons and halons have reduced the stratospheric ozone layer.

Sentinel-5 observes the Earth's atmosphere so that the human impact on the climate, air quality and stratospheric ozone can be monitored more closely and differentiated from natural emissions. Furthermore, it will make predicting the condition of the atmosphere easier, ranging from near-realtime, next-day air pollution forecasts to climate forecasts for the coming decades.

For further information, access <http://airbusdefenceandspace.com/>

NSG—Speaking Of SmallSats



NewSpace Global (NSG) has released their Global 2014 SmallSat Report.

This report takes a financially-focused approach to the small satellite ("SmallSat") sub-vertical, studying market histories, trends, and near-term forecasting to inform critical business decisions.

NSG Analysts, researchers, and contributors examine the global industry leaders, major investors, and sources of revenue in this sometimes obscure market, which has already raised hundreds of millions in investments and which NSG Analysts think could potentially exceed \$1 billion in revenue by the end of 2014.

The NewSpace Global 2014 SmallSat Report focuses on the SmallSat companies, revenue sources, and investors to provide key insights on this nascent but rapidly growing market.

This type of analysis is much more useful to those, such as CEOs, project managers, investors, and potential SmallSat customers, whose business decisions hinge on having current and reliable information.

The Report contains over 40 graphics and nearly 150 pages of extensive primary research, analysis, and data visualization evaluating:

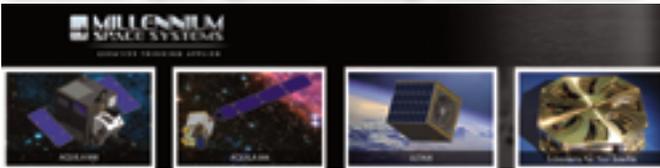
- SmallSat Investment
- 50+ SmallSat Companies
- 400+ SmallSats
- 20+ Launch Vehicle Providers
- 50+ Investors
- Survey Research from 100+ Industry Experts

The NewSpace Global 2014 SmallSat Report can be purchased either as part of a NSG subscription at a significant discount, or as a standalone product.

For more information, please visit <http://www.newspaceglobal.com/smallsatreport>.

InfoBeam

Millennium Space Systems—Building Block For Success



Millennium Space Systems executives, employees, business partners, and government officials have celebrated the opening of the company's "Factory of the New Millennium," in El Segundo, California.

The 70,000 square-foot facility will accommodate all of Millennium's satellite engineering, manufacturing and mission operations activities in addition to 12,000 square feet of dedicated SCIF space.

Strategically located adjacent to LA Air Force Base and the Aerospace Corporation, and less than two miles from LAX, the new factory supports Millennium's current programs as well as anticipated near-term expansion.

The factory was built to accommodate the design, engineering and production of more than 40 satellites simultaneously, and its layout reduces the risks associated with the manufacturing of space vehicles.

Assembly, integration, and test areas are located in the same building, all within eye contact of the engineering research and development area, promoting efficient communications and rapid development cycles.

"Co-location of business functions, engineering and manufacturing results in bottom-line cost and schedule efficiencies that we pass on directly to our customers," said Vince Deno, Millennium's President.

"Our new factory allows us

to design, manufacture, test and deliver a wide range of satellites, and to bring our proven efficiencies to all levels of space programs."

Millennium Space Systems is currently involved with several Government projects, providing solutions for national security and civil space programs.

The Company is developing both complete space vehicles and satellite components in its new factory.

Vertical integration allows the company to better control costs, schedule and quality, while avoiding the pitfalls of a rapidly dwindling aerospace supply chain.

"When we find a supplier or partner that has excellent products at good prices, we will buy. But when we see a gap in the marketplace, we are not afraid to make the necessary investments, and the new factory gives us plenty of space in which to do it," added Dr. Jeffrey Ward, Vice President of Product Development.

The general contractor for the project is Smith & Severson, Inc. and the architect is Withee Malcolm Architects.

For further information, visit <http://www.millennium-space.com/>

NASA—Suborbital Flights Services Proposals, Please

NASA is seeking proposals from U.S. commercial suborbital reusable launch vehicle providers to integrate and fly technology payloads for the space agency.

NASA uses companies for suborbital flights to encourage and facilitate the growth of this important aerospace market while also providing a means to advance a wide range of new launch vehicle and space technologies. The selected platforms may include suborbital reusable launch vehicles capable of flying to altitudes above 62

miles, as well as high-altitude balloons. The flights will expose the payloads to reduced gravity and near-space environments. Technology flights are expected to reduce risks associated with emerging technologies and procedures, and overall space operations in future missions, by demonstrating their applications in a relevant environment.

The announcement of opportunity can be viewed at <http://go.usa.gov/ZZNW>

InfoBeam

JAXA + MHI—A New Flagship For Space Transportation

The Japan Aerospace Exploration Agency (JAXA) has selected Mitsubishi Heavy Industries, Ltd. (MHI) as the prime contractor who will be responsible for the launch and space transportation services for a newly “to be” developed flagship launch vehicle.

JAXA will start developing the new national flagship launch vehicle in cooperation with a group of private companies led by MHI.

The new flagship launch vehicle is aiming to enter the international satellite launch market on a full scale with high competitiveness, all the while being responsible for Japan’s space transportation requirements after the 2020s by renovating the current flagship rockets, the H-IIA and H-IIB Launch Vehicles, and by improving usability through cost reduction of launches by half and other enhancements.

The main liquid-engine core rockets will be the same specifications for all launch vehicles in the new series so that manufacturing and operation can be more efficiently performed.

Up to six solid rocket boosters (depending on the needs) can be attached for a Geostationary Transfer Orbit (GTO) mission.

The development will start in early Japan Fiscal Year 2014 with a maiden launch targeted for JFY 2020.

- Launch vehicle development (structure, electronics/avionics, propulsion system, payload fairing)
- Engine development (for the first and second stages)
- Solid rocket booster development
- Launch pad and launch site ground facility development

As use of space is now imperative in various areas, such as using satellite data for daily lives, JAXA said it is important to secure an independent space transportation capability without relying on other countries to launch a satellite.

Accordingly, the Japanese government also stipulates an autonomous space launch capacity as a basic space policy.

The current flagship launch vehicle, H-IIA, is based on the conventional design concept of its predecessor, H-II, thus the H-IIA launch system applied many of the facilities built for the H-II. In other words, they are aging, now more than 30 years old, since the H-II days—maintenance costs are increasing year on year.



In addition, no new launch vehicle development project has been conducted for about 15 years after the H-IIA development. This means the skilled engineers who were involved in the actual development are approaching retirement.

If this situation was left unattended, Japan will face difficulty in maintaining their own development and launch capability of launch vehicles in the future.

Although the flagship launch vehicle technology is highly regarded, JAXA said launch costs need to be lowered in order to procure commercial satellite launch demand from overseas as well as Japan’s own government satellites.

JAXA will apply a more sophisticated high-performance liquid hydrogen rocket engine that has been our specialty field to the first and second-stage engines while cutting its costs and improving its reliability.

Then attached will be solid rocket boosters that are based on JAXA technology that has been proven through the development of the Epsilon Launch Vehicle and so on.

JAXA states they can cope with a wide variety of launch needs by varying the number of solid rocket boosters to be attached to the launch vehicle.

The basic structure of the new launch vehicle will be similar to that of the H-IIA, but will achieve two goals:

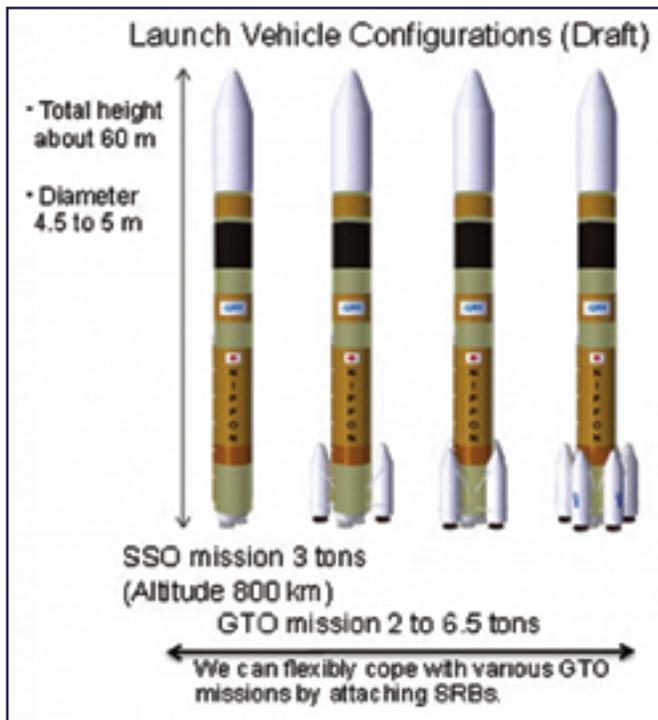
Low cost and high reliability. Simultaneously, cutting-edge technologies will be introduced into every area of development.

JAXA will be in charge of managing and integrating the overall development of the new flagship launch vehicle by capitalizing on their knowledge that has been acquired through past launch vehicle development experiences. and constructing the best seamless system of the launch vehicle, ground facility and key technologies indispensable to autonomy.

The private company (the prime contractor) will be responsible, from development and launch services of the new launch vehicle, to make it an internationally competitive rocket. JAXA will begin its development in cooperation with a group of private companies led by the prime contractor.

JAXA’s infosite is located at <http://www.jaxa.jp/>

Mitsubishi Heavy Industries infosite is located at <http://www.mhi-global.com/>



InfoBeam

Comtech EF Data's CDM-760 High-Speed Trunking Modem



CDM-760 Back Panel

Comtech EF Data Corp. recently announced that the company has reached a new milestone in satellite-based mobile backhaul.

The company is working with Intelsat S.A. and is now enabling 2G, 2.5G, 3G and 4G/LTE services on over 1.5GHz of capacity into a single market in South America.

The first region to benefit from this capability, South America, has grown steadily for mobile backhaul supporting 2G and

2.5G and also for 3G and 4G services in densely populated urban areas.

Satellite is being used as the primary links in Mobile Network Operators' (MNOs') core backbones and for restoration services where fiber and cable are used as the core.

The combination of Intelsat's high availability and comprehensive satellite coverage into South America and Comtech EF Data's award-winning mobile backhaul solutions has enabled continual growth in the market.

Bob Hansen, Senior Vice President and Chief Commercial Officer for Comtech EF Data, said, "We are very excited to be a part of the continual growth of mobile services in South America. Our CDM-760 Advanced High-Speed Trunking Modem, CDM-625A Advanced Satellite Modem and CX-U Series products are purpose built for the mobile market.

"We continue to develop and integrate technologies such as DoubleTalk® Carrier-in-Carrier®, RAN and WAN optimization, PtP (Precision Time Protocol) and satellite capacity optimization into our products to enable our mobile customers to reach more users while lowering overall cost to deliver these services."

Intelsat and Comtech EF Data provide mobile backhaul solutions that deliver true value for Mobile Network Operators.

Leveraging Intelsat's weather-resistant C- and Ku-band frequencies, MNOs can provide robust, cost-effective availability for aggregation or last-mile access with minimal operational complexity.

Comtech EF Data equipment is powering satellite-based infrastructure for MNOs globally. Its award-winning and patented technologies provide unrivaled spectral efficiencies and optimization to enable operators to fully leverage satellite capacity.

The technologies serve as the framework to reduce OPEX and CAPEX, increase service quality and facilitate sustainable and profitable connectivity.

For further information, access <http://www.comtechefdata.com/>

Executive Spotlight: David Bettinger, Chief Technology Officer and Senior Vice President of Engineering, iDirect

Mr. Bettinger joined iDirect as the Director of Hardware Engineering in 1996 and acquired the responsibility of all hardware and software development as the firm's Vice President of Engineering in 2002.

In 2005, Bettinger became Chief Technology Officer and is now responsible for the oversight of all technology decisions within iDirect. He drives the strategic direction for product development, technology alliances, as well as mergers and acquisitions. Mr. Bettinger currently serves on the Board of Directors for the Global VSAT Forum and is an active member of the Telecommunications Industry Association, IEEE and the IPv6 Forum.

Previous to iDirect, Mr. Bettinger was a senior member of the technical staff at Hughes Network Systems in the Satellite Networks Division. Mr. Bettinger is a graduate of Virginia Tech with a Masters of Science degree in Electrical Engineering and has been awarded six patents in the area of satellite communications.

SatMagazine (SM)

We have enjoyed a number of "conversations" with you over the past years and, as we are focusing in on maritime in this issue, please enlighten us as to what factors have been limiting the adoption of VSAT broadband in maritime in recent years.

David Bettinger

When you look at a market like maritime, and its need for high-speed communications, VSAT broadband plays an enormous role. Segments of maritime such as cruise, offshore oil and gas, and super yachts have already bought into the idea of VSAT and we are seeing powerful results. However, many segments within maritime continue to take a wait-and-see approach. This is due to the cost of bandwidth and hardware, as well as the ability to efficiently install and support the technology.

These companies are working under tight cost constraints. Yet, at the same time, they are being pressured to connect in more ways than they have ever imagined. From the ability to communicate high-value productivity data or maintenance information, to providing their crews with the ability to connect to the Internet, it's become increasingly apparent that the investment in VSAT provides measurable return on investment.

I think such factors are being addressed across all parts of the value chain, and certainly the coming of High Throughput Satellites (HTS) and other infrastructure developments present new opportunities to address these issues.





SM

Given your responsibilities as the Chief Technology Officer for the company, perhaps you could tell our global audience why the maritime market concentrations at iDirect continue to attract internal technology development and project funding, given the intense competition across the globe by numerous companies?

David Bettinger

We believe maritime presents an ideal match of technology innovation with market opportunity. This is one of fastest growing market segments for using VSAT, and rightly so, given the fact that more than 90 percent of worldwide trade is being served by maritime vessels. By 2016 we could see more than 26,000 vessels relying on VSAT as their primary means of communication, according to COMSYS.

HTS will play a major role opening up additional opportunities for existing maritime customers, while also allowing new segments of the market to justify the investment in VSAT.

iDirect remains well positioned, and is already considered the de facto standard within many vertical markets when it comes to hardware. In general, throughout the past seven years, iDirect has accounted for roughly half of all hub sales worldwide. The most recent figures from COMSYS reveal that iDirect took 51.1 percent of all global hub sales between 2011 and 2012.

Many of the major service providers rely on iDirect as their platform provider. This means we must stay on a

constant course of innovation in order to ensure we can serve the needs of the market at large, now and into the future. Working with all the major operators also places iDirect in a unique position to enable new business models associated with VSAT broadband. As I intimated in the previous question, we have a responsibility to continually develop and innovate in order to maintain our position as the technology of choice for these companies.

SM

What improvements has iDirect made to their product offerings for maritime comms?

David Bettinger

We continue to be the partner of choice for major operators, which is a credit to the strength and flexibility of our technology. For instance, when Inmarsat unveils its Global Xpress Ka-band satellite system later this year, it will be with iDirect technology at the heart of this ambitious rollout.

We were awarded the contract to design and supply the ground segment for GX back in 2011. The industry is entering a phase of rapid expansion into the higher frequency bands and iDirect is the enabling technology of choice for the largest providers in the market.

Our X7 remote has been adopted by service providers for maritime in order to help them deliver the data rates necessary to support high-bandwidth applications. The X7 is built on a multi-core processor, which means much higher throughput on a TDMA network. This makes the X7 suited for a range of enterprise voice and data services.

We have expanded the iDirect platform to meet the specific speed and scale requirements of HTS, while ensuring we maintain the proper value to our customers. We realize the investment that many have already made in their technology infrastructure, so we work to develop solutions, such as our universal hub, that allows these customers to capitalize on their existing investment in iDirect.

SM

With forecasts pointing toward greater adoption of VSAT broadband across maritime in the coming years, which segments of the market—and what factors—will be among the major drivers for this growth?

David Bettinger

We already seen high-end segments like cruise, offshore oil and gas and super yachts lead the adoption of VSAT in maritime. We see these segments furthering their investment in VSAT in the coming years.

Commercial shipping is a great example. Of the 60,000 vessels operating in this segment, a small percentage has made the switch to VSAT. Those that



have are looking for the connection to improve crew welfare as well as to deploy applications that help improve productivity and operational performance of the ships. VSAT networks can be used for electronic charting and weather applications, remote IT services, and electronic port and customs documentation.

At the same time, we also anticipate that new segments of maritime will start to adopt VSAT due to the fact that HTS will help lower the economics of deployment. For instance, niche markets such as industrial fishing could begin to justify the cost of VSAT for purposes of operational efficiency such as the online sale of catches—or even for crew health via telemedicine.

SM

What impact will HTS have on improving the economics of maritime VSAT broadband adoption?

David Bettinger

We always talk about the cost/bit in satellite. HTS changes that formula by making capacity more affordable or by increasing the amount of capacity for the customer. This becomes a game changer in satellite and for customers in maritime, this will provide particular value in allowing them to use new services or enhance what they have already deployed.

SM

Given the numerous operator models that exist today within the maritime comms segment, what should a service provider consider before selecting the most feasible option for customers? What are the pitfalls that should be avoided?

David Bettinger

As HTS capacity comes to market new business models will begin to emerge, which will need to co-exist with traditional business models. For service providers, this

means new levels of sharing and collaboration with regard to infrastructure. The name of the game for service providers is to stay flexible and to choose the best operator model with which to align.

HTS will result in operators needing to take over more of the infrastructure management, but on the positive side, this frees them to focus more on the customer and to find innovative ways to add value. The managed service approach, for example, allows the service provider to scale services more rapidly and allow for global coverage with low capex, but have less management control of the NOC with less margin.

SM

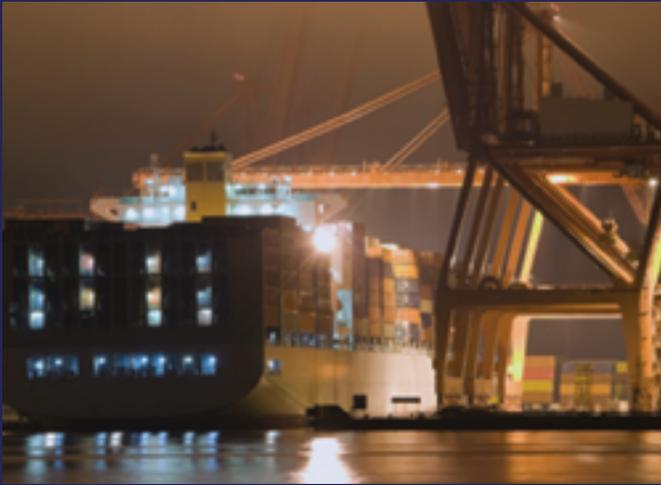
Would you please explain the importance of a Service Level Agreement (SLA) for maritime operators?

David Bettinger

HTS introduces new, complex satellite architectures. Satellite operators are faced with having to select different architectures in order to best serve various markets and geographies, which results in the sharing of spot-beam architectures.

This essential aspect becomes a matter of maintaining a consistent level of service in order to ensure your system can appropriately adjust and that you can continue to guarantee a quality standard when passing through unpredictable weather. Features like adaptive TDMA and ACM and even group quality-of-service play a critical role in the process, helping to prioritize traffic for customers in a shared network

Maritime customers continue placing critical and high bandwidth applications on the network and need the confidence that there will be zero degradation of service. More global coverage over a wide area places more emphasis on the importance of the SLA for maritime customers.



SM

How important is the role of SATCOM for crew welfare, and what exactly does this entail?

David Bettinger

We live in an age where crew want to have access to email. They want the ability to call home to their loved ones. They have grown accustomed to the always-on lifestyle where they can access videos or any other multimedia content whenever and wherever they desire. SATCOM enables this for maritime and ship operators are well aware of the competitive advantage this provides. Whereas in the past, this was never really a consideration, SATCOM has made personal connectivity a competitive advantage for vessel operators that have made the investment.

I think the role of SATCOM for crew welfare will only escalate in the years ahead, mostly centered around the concept of quality. It will no longer be enough to simply provide connectivity for the crew—but also to ensure that connection is of high quality.

SM

What SATCOM service considerations should be made for working shipping entities, such as tankers, fishing fleets and so on, as opposed to the leisure maritime industry (i.e., luxury yachting, cruise ships and so on).

David Bettinger

Working shipping entities need reliable connection to their corporate networks, to run business applications over the web and share large content files. You also have the personal aspect of connecting these vessels, such as helping crew monitor onboard mechanical and technology systems, and connect with operations back on shore.

Now, take a leisure maritime vessel, which can be considered a floating resort with full amenities. That

means passengers expect fast, plentiful broadband communications to be part of the experience, and they expect the same quality connection they experience on land.

For example, iDirect recently worked with Harris Caprock to deploy a fully managed, end-to-end VSAT solution over a combination of C- and Ku-band capacity to one of the world's largest cruise lines. They provide the, installation, maintenance, service and 24/7 proactive monitoring and support.

The network represented a huge competitive advantage for the cruise line in that higher bandwidth levels accommodate new service requirements for its guests and crew. It also allows for new entertainment solutions to be delivered—a competitive differentiator that we must be thinking about providing when working with leisure segments of maritime.

SM

What are some of the “big picture” issues that the satellite industry needs to address in order to take innovation to the next level?

David Bettinger

Satellite has proven it can perform in markets such as maritime, military and aeronautical. This only heightens the stakes for us to continually perform and to deliver the true seamless connection wherever and whenever it is needed.

That being said, topics like global roaming and dynamic bandwidth management need to become areas of discussion across the value chain in satellite. Solving such issues will impact the services being offered to customers across any market. iDirect is committed to championing such conversations in the market with the intent of elevating satellite's voice in the global communications conversation.

Top Mobile Satellite Trends To Watch... The View From Thuraya

By Rashid Baba, Director of Product Management, Thuraya

The global satellite industry has been undergoing significant transformations over the past few years, paced by the blurring of lines between consumer and satellite technology.

Some of the key trends and technology drivers that are shaping the future of satellite communications include:

- **Convergence of satellite and terrestrial mobile technology**

The convergence of the satellite and terrestrial mobile sectors has opened up opportunities for MSS players to introduce new products and service capabilities into the marketplace at a much faster pace—in order to accommodate the higher bandwidth requirements and mobility demands of satellite end-users. The global trend of “bring your own device” (BYOD) seems to be catching up in MSS market as well.

One area that clearly reflects this market development is the introduction of new, consumer-oriented form factors such as the Thuraya SatSleeve that enable users to enjoy satellite connectivity with greater ease and convenience. Being the world’s first and only satellite adaptor for consumer smartphones, the Thuraya SatSleeve represents a game-changing breakthrough in the MSS sector by making satellite technology more accessible and intuitive for consumers and enterprises alike.

Thuraya was prompt in identifying and addressing the global BYOD trend with the introduction of the Thuraya SatSleeve to cater to this growing market need, whereby the customer can use his or her own consumer device such as the iPhone or Samsung Galaxy as a satellite phone.

- **Greater focus on data applications and services**

The accelerating use of mobile devices for data applications is a major factor that is fast transforming how satellite services are being delivered today. To put this trend into perspective, a recent study estimated that four out of five Internet users worldwide in 2014 will be accessing data applications using their mobile phones¹.

To maintain the pace with evolving consumer behavior, Thuraya’s vision is to develop a pipeline of innovative satellite products that allow our customers to access the same kind of applications and services via their mobile devices, regardless of the network. To achieve this, we are putting more focus on expanding the capabilities of our data product lines, as well as enhancing our network infrastructure to facilitate this.

Thuraya is working closely with our partner ecosystem to develop technology solutions tailored to address the specific needs of key market segments such as the maritime, media broadcasting and energy sectors. Our collaboration with partners also extends to exploring how we can adapt to market needs more quickly. A recent partnership with SRT Wireless to launch the VIPturbo module, aimed at developing high-quality data terminals at a lower cost, demonstrates Thuraya’s commitment to accelerate product development processes.

- **Boost for machine-to-machine (M2M) communications**

M2M communications have been touted as the next wave of technology developments that will see rapid growth over the next few years, with global revenues for wireless M2M projected to have reached US\$50.1 billion in 2013². Advances in mobile technology have further opened up possibilities for businesses to incorporate the latest M2M systems into their operations, especially for effective, real-time monitoring of remote assets.

Across different fields of business, satellite-based M2M services will play a pivotal role in supporting remote facility monitoring, real-time asset management and industrial automation, driving up mobile bandwidth demands. Thuraya is currently working on enhancing its M2M product portfolio to cater to the growing demand for M2M services.



- **Changing dynamics in maritime communications**

While satellite has traditionally been a key enabler of maritime communications, major shipping companies from around the world are starting to adopt new, versatile solutions to meet the industry's changing demands. From ensuring connectivity at sea to providing VSAT backup coverage, L-band satellite technology is expected to remain as the industry's communications backbone—and in-service MSS maritime units were expected to grow from 368,000 in 2011 to 955,000 by 2012³.

Thuraya understands that maritime communication equipment must be designed for purpose and price security. These are key factors which we took into consideration when designing our new maritime broadband terminal. The launch of the Orion IP terminal, the first of two new maritime-specific terminals to be released by Thuraya in 2014, will further allow our customers to take advantage of the MBB offer to enjoy high-value connectivity. Additionally, Thuraya is able to offer flexible pricing packages that can be tailored according to specific data requirements, while broadening the available hardware options for bundling with VSAT services.

- **Increased demand for mobility**

Future application trends point towards growing user demands for mobility, putting added pressure on MSS operators to ensure that their networks are capable of handling a wide variety of IP applications. One of the key mobility trends Thuraya has identified is the growing adoption of robust communications-on-the-move solutions to allow remote users to collaborate reliably and efficiently while on the road.

To this end, Thuraya is introducing the new Thuraya IP Voyager, a satellite terminal specifically developed for rapid installation on any vehicle—with a fully autonomous tracking antenna that acquires and tracks the Thuraya satellite signal while on the move. The successful development of the Thuraya IP Voyager demonstrates our commitment to providing customers with the reliability and versatile performance they need to operate successfully in adverse environments.

At Thuraya, our product development roadmap is underpinned by our ability to respond to the latest market needs and get to market faster with innovative, consumer-friendly solutions.

As the industry continues to evolve, Thuraya remains well poised to deliver innovative platforms to help our customers succeed and stay competitive.

Additional information regarding Thuraya is available at <http://www.thuraya.com/>

About the author

Rashid Baba is Thuraya's Director of Products, responsible for driving Thuraya's product portfolio. Based in Dubai, Rashid is responsible for ensuring that Thuraya stays at the forefront of product innovation in the mobile satellite services industry.

A seasoned telecommunications executive, Rashid is backed by over 18 years' experience with leading telecommunications organizations. His experience lies in product management, pricing and product lifecycle management as well as strategic partnerships for product development. Prior to Thuraya, Rashid worked with Tata Communications where he was heading their mobile satellite services portfolio.

Rashid holds a Masters of Business Administration in Marketing from University of Kashmir.

Notes

¹eMarketer, *Mobile Phone Internet User Penetration Worldwide, by Region, 2012-2017, January 2014*

²Visiongain, *The Machine to Machine (M2M) Market 2013-2023: Smart Devices & the Internet of Things (IoT), October 2013*

³Northern Sky Research, *"Mobile Satellite Services, 8th Edition", May 2012*

Executive Spotlight: Andrew Loretta, Director of Business Development, Government + Maritime Services, ORBCOMM

Andrew is the Director of Business Development for ORBCOMM's Government and Maritime Services. Over the last 10+ years, Mr. Loretta has been involved in developing and implementing terrestrial- and satellite-based remote asset tracking solutions for the maritime industry, serving in Sales, Product Management, and Operations roles in support of marine-based Automatic Identification System, Long Range Identification & Tracking as well as Silent Ship Alarm Systems solutions.

During this time, Mr. Loretta has managed relationships with a broad range of major maritime companies and government authorities, vessel operators, and maritime information providers, including the U.S. Navy, U.S. Coast Guard, NOAA, Danish Maritime Authority, Moller Maersk, Horizon Lines, IHS Fairplay, Lloyd's List Intelligence, and The Maritime Information Services of North America.

Mr. Loretta graduated from Loyola Marymount University in Los Angeles, California with a Bachelor of Arts degree in History, and is fluent in Spanish and Portuguese. Mr. Loretta resides in Miami, Florida, with his wife and two children.

SatMagazine (SM)

Please tell us about your background and how you became involved in the satellite communications business and how did you decide to develop and further your career with ORBCOMM? What attracted you to the company?

Andrew Loretta

I've spent more than ten years working in satellite data communications technology, with much of that time in the maritime world tracking large commercial ships, tugs and barges, offshore drill rigs, fishing vessels and other assets. I soon became involved in developing AIS applications and,

when ORBCOMM announced that it was launching satellites that would be able to detect AIS messages from space, naturally I was intrigued with how well that would work and how it would impact the way AIS data is used.

SM

Given your previous experience with the U.S. Coast Guard and U.S. Navy, how does ORBCOMM bring the firm's commercial successes into the military environments, and what is required to gain the attention of acquisition agencies for AIS services? Are there any recent programs within this realm you could tell our readers about?

Andrew Loretta

The concept of detecting AIS messages from space was actually brought to ORBCOMM from the U.S. Coast Guard. They were looking to leverage existing commercial assets to be able to carry out a safety and security mission. The U.S. Coast Guard funded ORBCOMM's first AIS concept demonstration satellite, so there was a real public-private partnership to prove that this could be done.

The U.S. Navy, while not a direct participant, watched those developments closely and soon became customers of the data as well, along with a number of other reputable maritime authorities and militaries around the world.

SM

The Maritime and Government aspects of SATCOM are crucial components for the continued successes of our industry. What roles does ORBCOMM play within these market segments?



Andrew Loretta

ORBCOMM is a leading provider of Machine-to-Machine (M2M) satellite data communications solutions. ORBCOMM operates a constellation of Low-Earth-Orbit (LEO) satellites and gateway Earth station network around the globe, and provides data services via its network as well as through partner satellite and cellular networks.

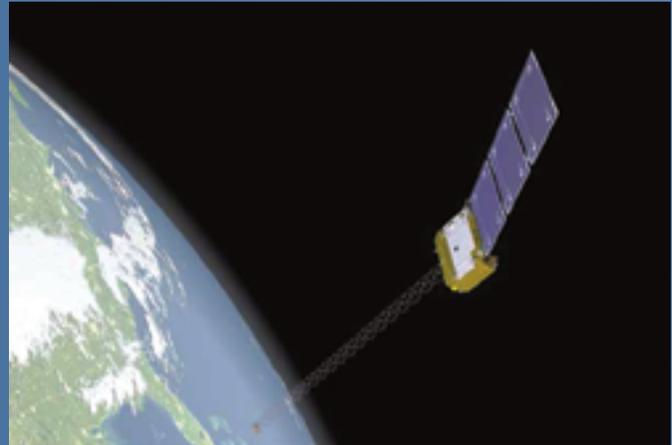
ORBCOMM recently acquired a company called GlobalTrak that focuses on M2M secure cargo monitoring for such customers as the Defense Logistics Agency and the U.S. Transportation Command. They are using ORBCOMM's GlobalTrak M2M cargo and container monitoring technology on goods that are transported out of places like Afghanistan and Pakistan. AIS is a logical segue for tracking this cargo once they have arrived at ports and are loaded on to cargo vessels. With AIS, you can now track the vessels.

SM

How did ORBCOMM become involved in the detection of maritime Automatic Identification System (AIS) messages from space?

Andrew Loretta

AIS was originally developed as a vessel collision avoidance system, so the normal range of a ship-board AIS transponder is 20-30 miles. There were many who were skeptical that AIS messages could be picked up from space, even though such capability could give maritime authorities and others tremendous visibility of global vessel traffic.



Sierra Nevada Corporation's SN-100 bus, upon which the OG2 satellite was built.

A number of early experiments with aircraft helped prove that AIS messages could be collected at high altitude, but it was agreed that a more cost-effective persistent platform would be preferred. Shortly after 9/11, the U.S. Coast Guard, through its work with Johns Hopkins University, approached ORBCOMM about the concept of putting an AIS receiver payload onto its satellites. ORBCOMM was awarded a contract to build a concept demonstration AIS satellite for the Coast Guard in 2004. This satellite, plus others with AIS payloads, was launched in 2008.

SM

How is satellite AIS data used?

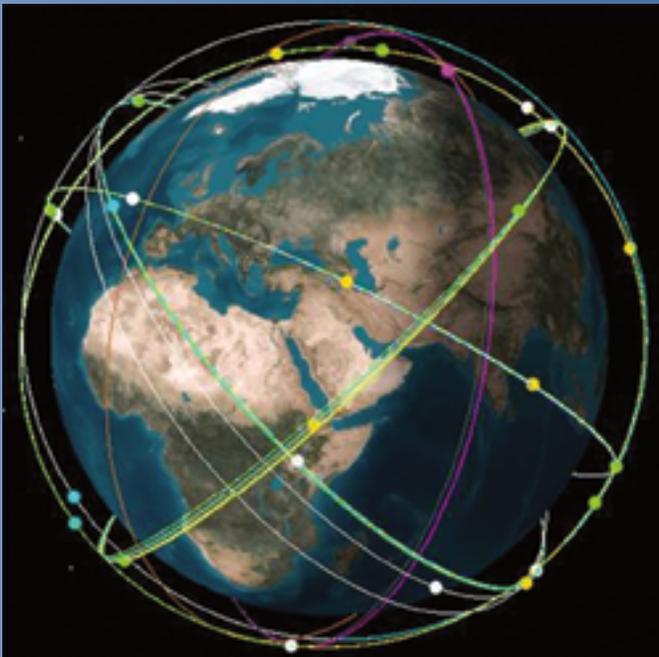
Andrew Loretta

Organizations such as the Coast Guard use satellite AIS for maritime domain awareness, in a similar fashion as how air traffic controllers manage the skies—maritime authorities use AIS to manage traffic in ports and coastal areas. The farther out they can see ships as they approach waterways and ports, the more they can anticipate who is arriving into their waters and where they might be coming from.

This information provides tremendous value for other homeland security organizations such as customs and immigration enforcement. Maritime authorities such as customs agencies, for example, can correlate cargo and crew manifests with vessels that are arriving in their ports, so if there is any other intelligence or red flags that one of those vessels is carrying any illicit/dangerous cargo or crew, the authorities can intercept that vessel before it arrives in port using AIS data to determine its location.

SM

What other uses are there for satellite AIS?



Artistic rendition of ORBCOMM's OG2 constellation.



OG2 satellite vibration tests. Photo courtesy of Sierra Nevada Corporation.

Andrew Loretta

In addition to security and safety applications for maritime authorities, satellite AIS data is also used in environmental compliance and investigation, such as surveillance of marine protected and fisheries areas. Authorities are able to determine what vessels are operating with their Exclusive Economic Zones and detect if there may be illegal fishing activity taking place. Many of these organizations are using other data sensors, such as radar and imagery, and advanced software platforms to develop a comprehensive situational awareness picture of what's going on in their jurisdiction.

Maritime authorities around the world have successfully been able to track foreign fishing vessels illegally fishing in their sovereign waters by using AIS. If they can see ships crossing into their boundaries and "lingering" around for a while, there's a pretty good chance that those vessels are engaging in illegal activity and the authorities can then deploy other assets, such as patrol boats or aircraft, to the scene to intercept those perpetrators.

SM

As a play within the overall tracking services environments, is ORBCOMM involved in terrestrial use of AIS, as well?

Andrew Loretta

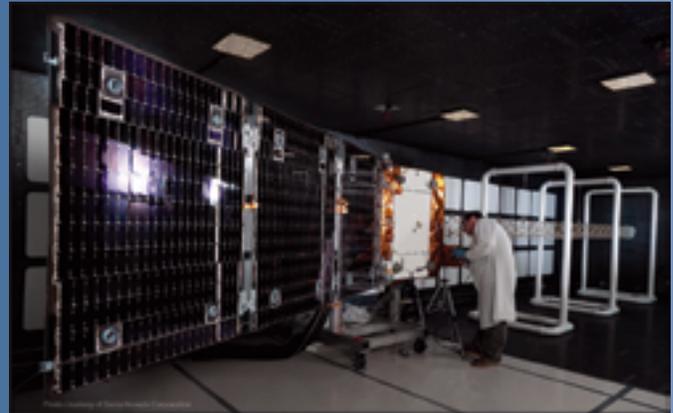
ORBCOMM sees satellite AIS as a complement to terrestrial AIS, so it teams with value-added partners who operate terrestrial AIS networks to provide the most comprehensive combined AIS footprint possible to its customers.

SM

What's in store for ORBCOMM's AIS service in the future?

Andrew Loretta

ORBCOMM plans to launch 17 next generation OG2



ORBCOMM's OG2 satellite being prepared for electro-magnetic testing. Photo courtesy of Sierra Nevada Corporation.

satellites that will replenish its existing M2M constellation. All of these satellites will have AIS receiver payloads on board, as well.

ORBCOMM is planning to launch these OG2 satellites this year, which could mean that, by early 2015, the company will be providing unprecedented global AIS coverage. These next generation satellites are being launched to replenish ORBCOMM's M2M satellite network constellation along with increasing its space-based AIS detection capability, so they are effectively dual-mode M2M and AIS satellites.

These satellites will have up to 12 times the capacity of our first generation satellites, up to six times the data access and twice the transmission rate. Our AIS message signal de-collision processing (or SDP) technology, which maximizes the collection of the AIS messages out of the "noise," is done on board the satellite, simply because the satellites have the power and computer processing capacity to do so.

All 17 satellites will be spaced out in to various planes in asynchronous Low-Earth-Orbit for maximum effective coverage for both our M2M and AIS customers.

SM

Why should potential clients consider ORBCOMM for their satellite and cellular services? What are ORBCOMM's selling points?

Andrew Loretta

ORBCOMM is clearly becoming the leading "Network of Networks" in the telematics space. In addition to operating its own satellite M2M and AIS network, it has established strategic partnerships with cellular carriers and other satellite data communications providers around the world to offer its customers the broadest range of wireless communications options available today.

SM

Acquisitions play an important role in a company's

growth... just recently, the firm garnered GlobalTrak, MobileNet and the SENS Asset Tracking Business from Comtech. Are there any additional technologies of interest to the firm to help boost their Maritime and Government services portfolio?

Andrew Loretta

ORBCOMM is continuing to evaluate various technologies that it could add to its portfolio, including in the government and maritime segments. All I can say is, stay tuned!

SM

Lastly, when you look back upon your career, what project or projects bring a true sense of satisfaction to you?

Andrew Loretta

Having been a part of AIS, from basically putting antennas on top of port buildings so we could track vessels locally, to now being part of a space-based solution, has been incredible. I am proud to have been a part of the development of satellite AIS over the last five years.

We expect to see a major jump in the performance of our M2M and AIS network once we launch our 17 OG2 satellites. We believe ORBCOMM will continue to be a major catalyst for emerging supply chain monitoring technology.

ORBCOMM Inc. has now made available their nexgen OG2 satellite modems, which are ideal for Original Equipment Manufacturer (OEM) integration into satellite M2M applications targeted for the transportation & distribution, heavy equipment, oil & gas, and government markets. These modems are 100 percent backwards compatible with ORBCOMM's current OG1 satellite network and are the first devices available to support OG2 services upon launch of their nexgen OG2 constellation.



There are two versions—the OG2-M with satellite communications and the OG2-GPS, which adds an on-board three-axis accelerometer and built-in GPS. With a single board transceiver and a footprint smaller than a credit card, the OG2-M and OG2-GPS feature a single, wide-range power supply input, which provides significant flexibility for product designers. The modems also use an industry-standard PCI Express physical interface for easy integration into a broad range of M2M applications. The unique ability to individually control power to various sections of the modem enables the modems to achieve extremely low power consumption and provide increased longevity for battery-powered applications.

Also created is a turnkey Developer's Kit designed to reduce development time and expedite deployment. The user-friendly kit includes an OG2 satellite modem, a modem evaluation board, universal power supply, antennas, USB to serial adapter, PC interface software to configure and control the modem, as well as a Quick Start Guide CD with full documentation. OEMs can utilize the kit to validate the modem's compatibility with their existing applications and to benchmark modem and network performance.

ORBCOMM's long-time partner, Quake Global, is also offering a full suite of devices that will enable M2M communications across ORBCOMM's OG1 and OG2 satellite networks. Quake Global's dual-mode QPRO is a self-contained, environmentally sealed device with GPS tailored for M2M applications in the heavy equipment, transportation and oil & gas industries that are powered by ORBCOMM's global networks.

SatBroadcasting™: 2014, A Year Of Change For Satellite Operators

By Chris Forrester, Senior Contributor



This year is proving to be one of profound change for the world's major satellite operators. For example, Telesat of Canada is just one of many smaller operators potentially up for sale while there are major changes in store for Intelsat, SES of Luxembourg and Eutelsat of Paris.

On April 3rd, Luxembourg-based SES' CEO Romain Bausch steps aside and hands over the running of the company to Karim Sabbagh. Bausch will stay on as a member of the operator's Board of Directors, and, even though Bausch is one of the world's most modest men, he might—just this once—take pride in what he has achieved in his 19 years of running the SES business.

This year, Intelsat expects a further 15 to 20 percent reduction in their military business. SES, on the other hand, is not so dependent on government business and, instead, saw a 1.9 percent rise in revenues. Additionally, this year, SES is anticipating a 6.5 percent rise in overall income.

As of December 31st, 2013, however, Intelsat was just ahead of SES in terms of dollar revenues (Intelsat at \$2.604 billion, with SES at \$2.563 billion).

Of course, rivalry takes many forms and the two players can still argue size and position in any number of ways. For example, Intelsat's contracted backlog (at \$10.1 billion) is good, but SES is currently better (at 7.5 billion euros, or \$10.3 billion)—the size of the satellite fleet is another measure, as is the number of transponders on



Romain Bausch, the previous CEO, SES.



Karim Michael Sabbagh, SES' new CEO.

SES' growth has been stupendous. Indeed, SES is already carrying more than 6,230 satellite channels, some 18 percent of the world's total channels (35,000), and sometime this year—if market expectations are reasonably accurate—the operator will overtake Intelsat as the world's largest satellite business measured by revenues.

The reason is that Intelsat is highly dependent on what is coyly referred to as 'governmental' business. That's industry shorthand for military contracts. With the U.S. budget cut-backs as well as the withdrawal of troops from Afghanistan, during 2013 Intelsat experienced a severe decline in those revenues.

the fleet. However, here's another metric that will soon become increasingly important: The number of Ultra-HD channels carried. SES serves TV-hungry Germany, France and Spain from its lucrative 19.2 degrees East neighborhood. SES has about 15 empty transponders at 19.2 waiting for the acceptance of Ultra-High Definition TV (UHD, or, UHDTV, or 4K).

Romain Bausch, speaking on February 21st, said that SES anticipates UHD taking off in a meaningful fashion for viewers in 2016 with the Rio Olympic Games and the Euro 2016 UEFA Soccer Championships (which occur in soccer-mad France).

This means that fans will need new 4K TV displays and broadcasters will have to supply or, more likely, adapt existing set-top boxes (STBs) to receive the fat signals, but new dishes will not be required. The same satellites, from the same positions, will supply the new signals.

The same applies to SES' other hot spot locations, not the least of which is 28.2 degrees East, which serves the United Kingdom (UK) and Ireland. One of the SES fleet will also carry UHD signals to the British Isles the moment BSkyB goes live with that service. The same argument applies to the Americom assets in the U.S., as well as other SES-owned satellites that girdle the Earth.

The world's current Number 1 operator, Intelsat, is itself going through dramatic changes. Last year's Initial Public Offering (IPO) in April placed the operation firmly in the public eye—President/CEO Dave McGlade is busy coping with the reduction of government business, as well as paying down its massive debt burden as fast as it possibly can. In November of 2013, the company refinanced a huge \$3 billion loan in order to trim some of its heavy interest charges, which were said to be around \$1 billion a year. As of March 2013, Intelsat's long-term debt burden was some \$15.8 billion. Just before the 2013 Christmas holiday, Intelsat paid down another \$100 million of this massive debt, taking last year's debt repayments total to approximately \$617 million.

The next steps for Intelsat are exciting and "Epic," which also happens to be the name for the firm's new fleet of extremely high-throughput satellites (HTS). The first of these satellites will be launched in 2015—(Intelsat 29e)—and Intelsat is already busy pre-marketing capacity on what will represent a quantum-leap in the company's bandwidth, and at lower prices (based on bit-rate pricing).

Lower debt and increased revenues will also give McGlade and his team some flexibility in possibly acquiring or merging with some of those operators looking to exit the business. Now that Intelsat has a stock exchange valuation, the company has the machinery to refinance, and be fleet-of-foot enough to—perhaps—pick up a new asset or two, and regain its Number 1 position. However, as every CEO and CFO will tell you, "any acquisition has to make commercial sense," which is absolutely true.



Dave McGlade, President, CEO, Intelsat

McGlade summed up his thoughts in February, "When we look at M&A opportunities, besides the ability to have an accretive deal from a free cash flow standpoint, we will look to enhance revenue growth to serve certain regions or customer sets. So it has to fit strategically with what we're doing."

McGlade added that additional contracts were being signed for its Epic series of satellites.

"Harris CapRock did an additional agreement that transition from existing capacity to a future Epic satellite. Panasonic Avionics also did a follow-on deal to expand their capacity in Europe and Asia. We also had standard capacity sold on Intelsat-35e. We still have a pre-sales campaign underway. And we feel confident that we'll be able to expand other customers and customer applications on Epic. So we feel good about where we are today."

In other words, don't write this company off just yet as the industry leader. Far from it... this year's revenue expectations are in the \$2.45 to \$2.5 billion range, which will allow Intelsat to pay down another large chunk of debt—or an acquisition made!

Naturally, SES isn't lying down, either. SES has its own HTS scheme. Four O3b MEO orbiting satellites are already in space, and another eight will be launched this

SES Launch Manifest

ASTRA 5B*	Mar 23 2014	Ariane 5	31.5E	CEE / Russia
ASTRA 2G	Q2 2014	Proton	28.2/28.5E	UK & Ireland / EMEA
SES-9	H1 2015	Falcon 9	108.2E	Asia-Pacific
SES-10	H2 2016	Falcon 9	67W	Latin America

Note: Astra 5B also carries the EGNOS-2 hosted payload

Data: SES

year in two batches of four each. Once there are eight of them orbiting, then a full service can be initiated for the “other 3 billion” (O3b) underserved consumers.

In addition to these MEO craft, Romain Bausch is leaving his successor with a busy launch manifest of conventional geostationary satellites.

Astra 5B launched on March 23rd. Bausch confirmed in February an order for SES-10, another ‘expansion’ satellite that will replace current capacity (AMC-3 and AMC-4) over South America and the Caribbean (67 degrees West) and, in with the other satellites in the launch manifest, an extra 110 transponders will be added to the fleet by 2016.

Bausch denied that the extra supply going into the LATAM market would lead to an over-supply—SES-10 had a guaranteed client

in the Andean Community, which was planning to use the craft for broadband services.

Taking a snapshot of the past year (since year-end 2012) the SES fleet will have grown 24 percent by the end of 2016 with the launch of the just announced SES-10 (and representing a massive 193 extra transponders in orbit).

Interestingly, Elon Musk’s SpaceX Corporation and its lower-cost Falcon-9 rocket launcher will be responsible for two of these upcoming launches (as part of a long-term four-launch contract with SpaceX). Bausch explained that its multiple launch supplier relationships would continue, and this included French-backed Arianespace, although he expressed a strong wish to see lower costs from the European launch community.

SES’ similar multi-launch options and obligations towards Arianespace have all been fulfilled, although Bausch said SES would maintain a ‘multi-launch’ supplier portfolio, including International Launch Services, as far as launch contractors were concerned.

SES-10 will be built by the Airbus Defence and Space owners). SES-10 will carry 50 transponders, and although it will use electric plasma propulsion for on-orbit positioning, it will have a conventional chemical system for orbit-raising.

“The new satellite, ordered through SES’s wholly-owned subsidiary SES Satellite Leasing, will expand SES’s capabilities in Latin America and the Caribbean through high power beams tailored to provide DTH broadcasting, enterprise and broadband connectivity services in the entire region,” said SES. “SES-10’s comprehensive

coverage includes Mexico, Central America and South America, as well as the Caribbean.

“The satellite will be positioned at the 67 degrees West orbital position, pursuant to an agreement between the Andean Community (Bolivia, Colombia, Ecuador and Peru) and SES, which provides for use of the Andean Community’s Simon Bolivar 2 satellite network. The specifically designed beam of SES-10 over the Andean Community Member States, combined with its optimum elevation angle, represents a unique proposition for telecommunications operators, broadcasters and service providers for the Andean countries.”

Eutelsat + SES: Peace Breaks Out

For the past year or so Europe’s two satellite giants, SES and Eutelsat have been slugging it out over the 28.2/28.5 deg East orbital position. The location serves the British Isles. The dispute was resolved with much fanfare in an “historic agreement”. The dispute centered over access to 500 MHz of frequencies. A Eutelsat craft occupied the 28.5 deg East position and had been responsible for dozens of channels being beamed into the UK and Ireland.

Indeed, Central and South America is the focus for the world’s Number 3 operator, Paris-based Eutelsat, which is fast becoming a true global service provider. On January 1st, it wrapped the purchase of Mexico’s SatMex.

Back on September 16, 2013, following a decision by the French Chamber of Commerce arbitration process, SES announced they had won the dispute and would start transmission on October 4th on its own satellite, which it did. Eutelsat’s clients switched to the SES satellite.

Sarah Simon, a senior analyst at Berenberg Bank, summed up the three key elements of the agreement:

1: Of the 500MHz that was in dispute (using German filings) and which has been operated by SES since October 4, 2013, following the ruling of the Bonn court, Eutelsat has acquired outright 125MHz, with a one-time capital payment, thus allowing it to continue to monetize that portion of the capacity.

2: Of the 250MHz which was previously operated by Eutelsat using French filings, all will be operated on SES satellites, but Eutelsat will buy back all of this capacity in a one-time payment, meaning that the revenue effect is zero (this capacity was never in dispute).

3: SES has additionally made a payment to Eutelsat in relation to the co-ordination agreements that the two companies have



Michel de Rosen, CEO, Eutelsat.

reached across the entire 0 degrees to 52 East arc. This payment has not been quantified, although we should be able to see it in SES's next balance sheet. SES has indicated that it will amortize this payment over multiple years to which the agreement relates. Eutelsat is recognizing the payment to the tune of five million euros per quarter.

In summary, Berenberg said, "In short, there is a payment from Eutelsat (to purchase capacity), and a payment by SES for the co-ordination agreement. Eutelsat's top line becomes whole (until such time as it has amortized the payment by SES), and SES gains the ability to operate in orbital positions where presumably it would have had a problem had it not reached this agreement with Eutelsat."

The agreement gets close to the old established status quo that had existed between the two parties since 1999 (the 'Intersystem Co-ordination Agreement'). Sources say that the structure of the new agreement resolves a number of outstanding technical and coordination issues between the two operators stretching over Europe, Africa and the Middle East and further afield. The coordination also applies to power-levels.

Eutelsat's CEO Michel de Rosen is aggressively pursuing a policy of expansion and has cleverly created a number of 'partnerships' with locally important players such as Russia's RSCC/Express, Egypt's Nilesat, Qatar's Es'Hail Sat, Turkey's Turksat, as well as Spain's Hispasat, although most observers see the Hispasat friendship as cooling somewhat. Each of these relationships gives Eutelsat access to frequencies, as well as valuable revenues and growth and, sometimes, without the aggravation and cost of building new satellites.

Typical is a January 29th signing in Kabul of a potentially valuable MOU with Afghanistan's Ministry of Communications & Information Technology (MCIT), which will see Eutelsat deploy an existing in-orbit satellite (Eutelsat 28B) immediately to 48 degrees East to deliver full national coverage and extensive reach of Central Asia and the Middle East. The satellite will be officially called Afghanisat-1 by the Government of the Islamic Republic of Afghanistan, reflecting Afghanistan's entry into the commercial satellite business.

Minister Amir Zai Sangin said, "Afghanisat-1 is a new milestone in the development of the ICT sector in Afghanistan, which, in the last 12 years, has already seen mobile telephony coverage of 88 percent and penetration grow from zero to 75 percent through the licensing of six operators, ICT sector employment provided for more than 138,000 people and more than \$2.1 billion invested in the national economy. We are very happy to partner with Eutelsat on Afghanisat-1 which will provide access to ICT and broadcast services to Afghans, especially in unserved areas, and support our vision of transforming Afghanistan into an information society."

Eutelsat's launch manifest			
Express AT-1	56 deg East	Mar 2014	19 Ku transponders*
Express AT-2	140 deg East	Mar 2014	8 Ku transponders*
Eutelsat 3B	3 deg East	Apr 2014	30 Ku/12 C/9 Ka-band
SatMex 7	114.9 Deg West	Q1/2015	34 Ku/12 C-band
Eutelsat 9B	9 deg East	Q1/2015	60 Ku-band
Eutelsat 8WB	7/8 deg West	Q3/2015	40 Ku/10 C-band
Eutelsat 36C	36 deg East	Q4/2015	52 Ku/18 Ka-band*
SatMex 9	116.8 deg West	Q4/2015	40 Ku-band
Eutelsat 65WA	65 deg West	Q2/2016	24 Ku/10 C/24 Ka-band

*These are Eutelsat leased transponders from RSCC and thus make no capital demands on Eutelsat
 Data: Eutelsat, Feb 14

Michel de Rosen, agreed, saying, "This MOU represents the fastest and most effective route to accessing infrastructure configured to deliver full coverage of Afghanistan and surrounding regions. It enables Afghanistan to scale up capacity as and when needed and to offer broadcasters, telcos and ISPs the immediate benefit of resources providing exceptional reach and performance. We are honored to be Afghanistan's chosen partner for this important initiative."

Eutelsat 48B/Afghanistan-1 is good until 2020, despite some on-board capacity problems.

These recent expansions mean that Eutelsat can now (from its SatMex acquisition) cover most of 'the Americas' as far as 116.8 degrees West, and an orbital arc that stretches three-quarters of the planet as far as the old GE slot at 172 degree East. De Rosen explained that its recent acquisitions (the GE craft and SatMex deal) meant that their priority was now to consolidate, although did not deny that there were further M&A possibilities. He remained convinced that the industry would continue to further consolidate. However, another key priority was that Eutelsat wanted to maintain its investment grade—and suggested that borrowing to finance any potential acquisition would be limited.

In conclusion, it is anyone's guess as to who might buy Telesat of Canada, or Israel's Spacecom, or Malaysia's Measat, or Singapore's Optus, or any number of other smaller—but locally important—players in the satellite business.

The next few years will see at least some of these assets transferred. However, the industry is already preparing for its next expansion stage: UHDTV, which will start transmissions this June in South Korea and Japan. From these embryonic tests will flow full-fledged 4K broadcasts by the fall of 2015, and then a significant number of channels will be on air by the summer of 2016.

About the author

Senior Contributor Chris Forrester is a well-known broadcasting journalist and industry consultant. He reports on all aspects of broadcasting, with special emphasis on content, the business of television and emerging applications. He founded Rapid TV News and has edited Interspace and its successor Inside Satellite TV since 1996. He also files for Advanced-Television.com. In November 1998, he was appointed an Associate (professor) of the prestigious Adham Center for Television Journalism, part of the American University in Cairo (AUC), in recognition of his extensive coverage of the Arab media market.

SES missions 1995-2014*

Astra 1E	October 1995
Astra 1F	April 1996
Astra 1G	December 1997
Astra 2A	August 1998
Astra 1H	June 1999
Astra 2B	September 2000
Astra 2D	December 2000
Astra 2C	June 2001
Astra 3A	March 2002
Astra 1K	November 2002 (failed)
AMC-9	June 2003
AMC-10	February 2004
AMC-11	May 2004
AMC-15	October 2004
AMC-16	December 2004
AMC-12	February 2005
Astra 1KR	April 2006
AMC-18	December 2006
NSS-8	January 2007 (failed)
Astra 1L	May 2007
Sirius-4	(aka Astra 4A) November 2007
AMC-14	March 2008 (failed)
AMC-21	August 2008
Astra 1M	November 2008
NSS-12	October 2009
Astra 3B	May 2010
SES-1	April 2010
SES-3	July 2011
Astra 1N	August 2011
SES-2	September 2011
QuetzSat-1	September 2011
NSS-14	(aka SES-4) February 2012
Astra 4B	(aka SES-5) July 2012
SES-6	June 2013
Astra 2F	September 2012
Astra 2E	September 2013
SES-8	December 2013
Astra 5B	Spring 2014
Astra 2G	Spring 2014
SES-9	1H/2015
SES-10	2H/2016

*Projects and missions initiated when Romain led the company

Long-Term, Remote Monitoring Of Satellite Performance Using USB Power Sensors

By Sook Hua Wong, Agilent Technologies



Satellite communication systems are driven by demands for increased data rates. Many satellite communication systems operate at microwave frequencies, such as X-, Ku- and Ka-bands, which help support a wider modulation bandwidth, increase capacity, and enable the use of smaller antennas. The increase in bandwidth, coupled with high operating frequencies, creates significant challenges for RF engineers who are testing a satellite system, module or component.

This article describes typical satellite applications that require power measurements as well as important factors to consider when selecting power meter and sensor solutions. The article also explains how these solutions can help simplify your work, and improve accuracy, reliability and test coverage.

Satellite Applications

Power measurements are critical in conducting satellite-related tests. To illustrate this, the following sections describe three major applications where obtaining power measurements are required.

Continuous monitoring of power received at a satellite antenna tower. Due to the long distance between a satellite and Earth, the signal received at the Earth station is usually very weak (below -100dBm). The condition can worsen with weather conditions such as cloud cover, humidity, and extreme temperature ranges that cause high atmospheric attenuation.

Antenna misalignment can also result in power degradation. Continuous remote signal monitoring is important to ensure that the received signal-to-noise ratio is high enough so the communication link can function properly. A spectrum analyzer working together with a power sensor can help to ensure accurate measurements are obtained.

Satellite manufacturing test. Before a satellite is launched into space, it needs to be tested in a thermal vacuum chamber in order to simulate space's various extreme environmental conditions. The tests last for several months, running 24/7. During this time the chambers are cycled through hot and cold temperatures and other environmental conditions. Ports on the side of the chamber allow various test equipment, in numerous racks, to be connected to the satellite within the chamber.

Power measurement is very important during the testing stage as it monitors the output power of the transmitters and detects any instability, power spikes, or glitches. Up to 20 power meters and sensors can be connected simultaneously to the satellite in order to perform comprehensive testing over the Ku- and Ka-bands. Power measurements are polled once per second to ensure stability.

A strip chart recorder is connected to the power meter's recorder output to record the data. If the transmitted power starts to vary, the test software shuts down the satellite to prevent damage.

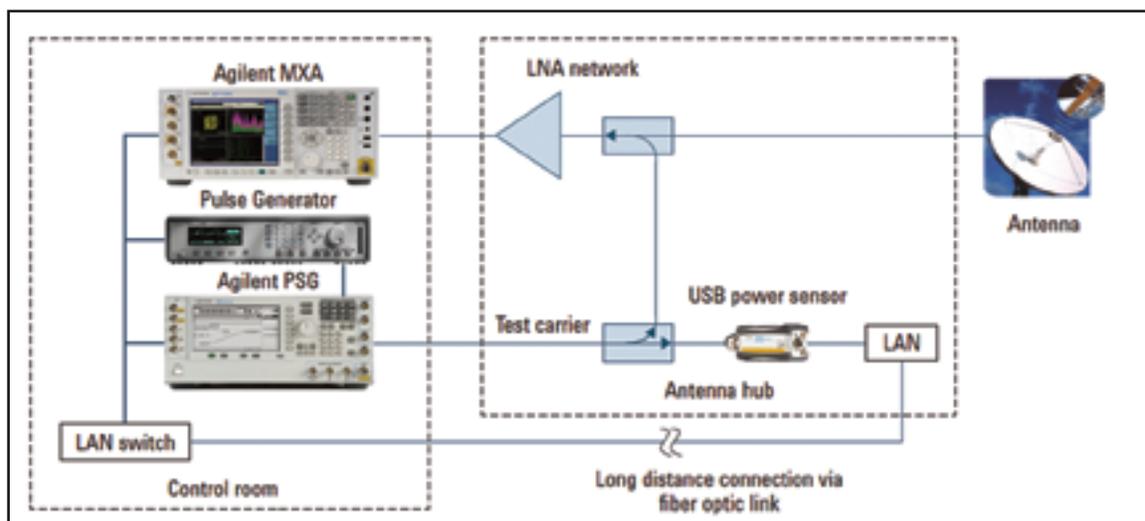


Figure 1. Typical test setup for continuous monitoring of the received power at a satellite antenna tower.

With a test cost of close to \$1 million per day, it is critical to ensure that all measurements are done correctly and accurately.

Satellite component test. Traveling wave tube amplifiers (TWTAs) and repeaters are key components of a satellite communication system and require accurate power measurements. TWTAs are used as amplifiers in satellite transponders when the input signal is very weak and the output signal requires higher power.

TWTAs are commonly used in a satellite due to their wide frequency coverage and high power capability. All TWTAs need to be tested to ensure that they can generate sufficient output power for the satellite transponder to function properly. Repeaters, on the other hand, are used to amplify and retransmit the signal at another frequency. Each repeater acts as a receiver, frequency translator, and transmitter.

Sometimes called a transponder, a repeater typically consists of a low noise amplifier, a mixer or local oscillator, and a high-power amplifier such as a TWT. As the receiver and transmitter in the repeater operate at the same time and in close proximity, careful testing needs to be carried out to ensure that the transmitter does not interfere with the receiver.

Power Meter + Sensor Selection Considerations

Due to a wide variety of requirements as illustrated, careful considerations have to be made to select the appropriate power meter and sensor. Below are some key considerations.

Frequency range: Many satellite communication systems operate at microwave frequencies identified in bands, such as the X- (8 to 12GHz), Ku- (11 to 15GHz) and Ka- (18 to 40 GHz) bands. It is important to select a power sensor that covers the correct frequency.

Long-term, remote monitoring: In satellite applications, whether they involve remote monitoring of a satellite antenna tower or testing a satellite in a vacuum chamber, the distance between the control room to the actual measurement point can be several hundred feet. Conventional power meter and sensor solutions are limited by a 200-foot maximum cable length.

A USB power sensor comes with a five meter cable, however, this can be extended up to 90 meters with a network USB hub or USB extender. The sensor must offer long-term data logging of up to a year and be capable of alerting the user when power limits are violated. RF amplifiers in the satellite generate

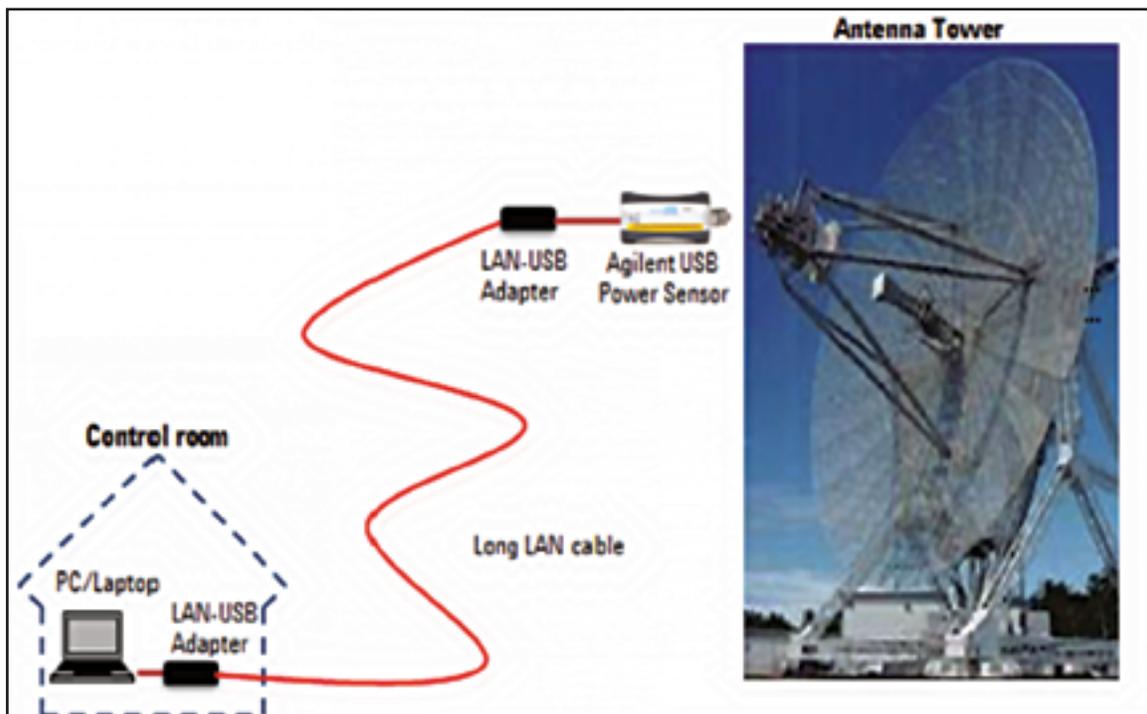


Figure 2. The maximum cable length of a USB power sensor can be extended up to 90 meters with a network or USB extender.

multiple tenths of kilowatts of RF power making it important to shut down the amplifiers when power levels are detected to be over the limit to prevent catastrophic failure or damage.

Zero and calibration: Access to the sensor is not always possible during remote monitoring of a satellite antenna tower or testing in a vacuum chamber. The sensor must be capable of performing accurate, long-term testing remotely.

Features such as internal zero, calibration and excellent long-term drift performance must be considered during the selection of the right power sensor. With a built-in DC reference source and switching circuit, a sensor with internal zero and calibration allows users to perform zeroing and calibration while the sensor is still connected to a DUT. This feature removes the need to connect and disconnect the sensor from an external calibration source and reduces test times, measurement uncertainty, and wear and tear on the connectors. The sensor can run independently in the satellite terminals for many months.

Multi-channel operations: A USB power sensor, due to its compact, faceless form factor, comes with companion software. It is important to choose a USB power sensor with software that is able to control and display the measurements of multiple sensors (up to 20) simultaneously. The software allows users to continuously monitor many different satellite transmitters at the same time and to perform mathematic operations, such as ratio and delta, between channels.

Performance over temperature: During comprehensive testing in the vacuum chamber, the satellite will be subject to extreme temperature tests. It is crucial that the power sensor comes with built-in temperature compensated calibration factors to ensure that the measurements are accurate over a wide temperature range. Correction factors are stored in the sensor's memory to correct for variations due to frequencies, power levels, and temperature.

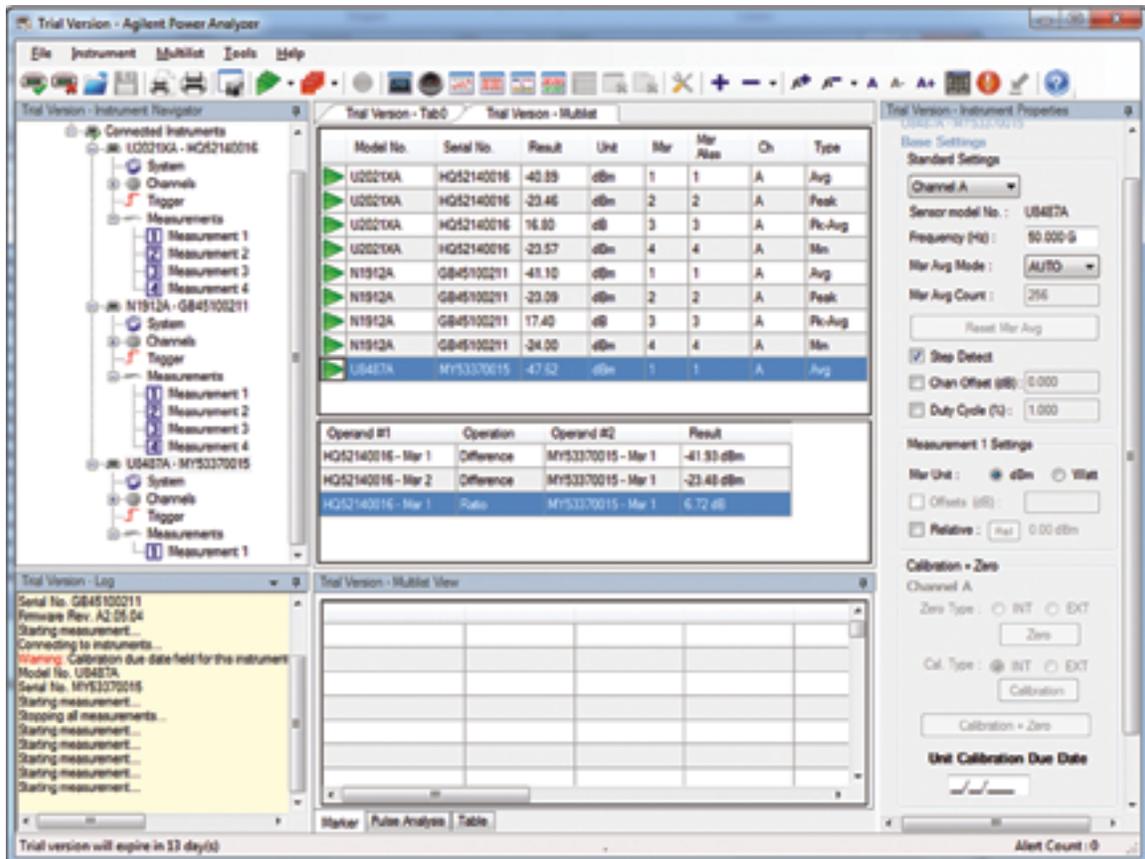


Figure 3: Multi-list display format of Agilent N1918A power analysis manager supports more than 20 USB power sensors simultaneously.

The sensor's built-in thermistor detects ambient temperature changes so that the right correction factor will be applied to compensate for any temperature-related drift. This will ensure that the USB power sensor is able to maintain high accuracy over a wide temperature range.

Type of measurements: Typical satellite performance monitoring requires simple average power measurements that are offered by most power meters or sensors. A built-in recorder output aids in archiving measurement results. The recorder output can be activated to output a voltage proportional to the measured average power, over a range of 0 to 1 V. For troubleshooting problems, connect to a plotter or strip chart recorder in order to print out a history of the measurements.

Avoid Dramatic Consequences

Satellite testing, whether it is for components, modules, or the whole system, is growing increasingly complex, and demands high accuracy and reliability. Defects and non-conformance can lead to dramatic consequences. Manufacturers must deliver high quality, reliable products to effectively test satellites and meet the stringent expectations of customers. Agilent, with its 50-year history of producing reliable power measurement tools, offers a wide variety of power measurement equipment that is ideal for accurate and reliable satellite testing.

For additional details about recommended power measurement solutions for satellite testing, read the related application note at the *Power Measurement Hints and Tips* page (www.agilent.com/find/rfpowertips).

Small Cell Over Satellite: Connecting Rural Areas Cost Effectively

By Doreet Oren, Director, Product Marketing, Gilat Satellite Networks



There's an untapped market niche that mobile operators have not been paying enough attention to: the millions of currently unserved, potential rural customers worldwide, who clamor for cellular voice and data broadband connectivity in areas with no communication infrastructure availability.

Several drivers converge that can help boost this market:

1. New, small cell technologies enable a viable business case.

The base station has evolved from traditional, bulky and costly macro cells, which require very high capital expenditure (CAPEX) with costly towers, large diesel generators and indoor and outdoor equipment. These structures also require never-ending operating expenditure (OPEX) of high fuel costs and logistics. These costs cannot be justified when connecting a village of a few thousand people. Low-cost, outdoor small cells make rural connectivity a reality.

2. Digital-divide regulations and funding (USO/USF).

Governments offer incentives to deliver affordable, accessible Internet connectivity to rural areas, in attempts to boost educational and economic opportunities. These incentives are offered by governments worldwide, and represent an opportunity—and challenge—to deliver not only Internet access, but quality, broadband access to rural areas. This trend is now becoming more prevalent in Africa, following the footsteps of adoption in Latin America.

3. High Throughput Satellites (HTS).

This up-and-coming technology uses multi-spot beams to optimize bandwidth, enabling reuse of the frequency band across coverage areas. This approach substantially increases satellite broadband capacity while reducing bandwidth costs (OPEX). HTS adoption further supports a viable business case for expanding into rural areas via satellite backhaul.



The Small Cell Over Satellite Solution

The Small Cell

Small cell technology comprises low-powered 2G/ 3G / LTE cellular radio access nodes. It was developed to overcome macro cells' difficulties in providing dense urban areas with high data rates in non-line of sight and within buildings.

Small cells overcome this issue and provide better coverage and capacity for ever-growing, bandwidth-hungry content that is streamed over cellular networks. This technology is ideal for smaller rural communities with 16 to 32 simultaneous calls over an area of up to about a 3 kilometer radius.

This technology solves the issue of placing macro cells in deep rural areas, which is pure overkill: and certainly, not a business case, since ARPU in these locations is low, and traffic is not very high.

Small cells serve as an excellent communications media, since they were designed originally for data handling. Gilat offers the CellEdge small cell over satellite solution, featuring the latest version of 3G – HSPA+, with data rates of up to 21Mbps in the downlink and 5Mbps in the uplink.

The equipment is low cost, compared to macro cells, and is easy to install and to maintain. Because small cells "live" outdoors, they require no ground shelter, and they are long-lasting, requiring no maintenance.



However, perhaps one of the most compelling factors favoring small cells is their ability to be operated by solar power. That's a big contrast to the expense and effort involved in diesel generator refueling, used in macro cell deployments.

The Backhaul

The small cell on its own is not a full solution. The next challenge to overcome is: which backhauling technology is most appropriate for coupling with the small cell?

The two common solutions include:

1. Traditional, copper or fiber lines.

Although this solution is widespread, it is mainly used in urban areas. It is not economically viable for rural areas, because it requires infrastructure to distant, often challenging, terrain.

2. Microwave transmission.

This technology's higher frequencies enable transmission of large quantities of data. However, microwave communications require line of sight and flat terrain to be cost effective, not usually found in remote, mountainous regions.

Obviously, neither of these prevalent technologies is the answer for rural connectivity.

Satellite backhauling is becoming more and more the backhaul of choice, and often the only solution for rural areas. Various technological developments, especially in Ku- and Ka-bands, are reducing satellite communication costs, making satellite backhaul an affordable alternative.

Today, we are also seeing higher frequency Ku- and Ka-band solutions that can address the rain fade consideration with sophisticated adaptive coding and modulation techniques. This advancement reduces CAPEX, because smaller lower cost antennas are sufficient for broadband communication.

The reduced costs are further supported with TDMA modems, instead of the traditional, dedicated, and more expensive SCPC links. On-demand bandwidth allocation is better suited to low traffic rural communities where efficient allocation of the satellite resources can be provided, as needed.

An Integrated Way to Connect The Unconnected

With all these great technologies, providers are still challenged: How do they connect the dots? They require a tightly integrated solution, preferably from one vendor as one point of contact, who can help them deliver cost-effective 2G/3G/LTE cellular services to unconnected communities quickly and economically.

This single solution ought to be able to support high capacity, wide coverage and high transmission rates, while saving substantially on bandwidth costs and supporting the use of exceptionally low-cost solar power at off-grid locations.

To deliver a quality broadband experience for cellular voice and data, tight integration between the small cell and the backhaul must be implemented to ensure that resource allocation is efficient enough to support the payload required by the cell, with minimum protocol overheads.

Gilat, experts in satellite backhaul to rural areas with more than 2,000 cellular backhaul installations worldwide, offers the turnkey, CellEdge high-performance small cell over satellite solution, which features optimization of voice and data compression techniques, in addition to high bandwidth efficiency algorithms. This technology minimizes satellite space segment overhead, combined with satellite bandwidth allocation on demand, reducing satellite OPEX by as much as 80 percent.

Additionally, the integrated CellEdge solution ensures an enhanced user experience, using TCP and HTTP acceleration to overcome the inherent satellite delay.

To see how it works, please visit
<http://www.gilat.com/Small-Cell>

About the author

Doreet Oren (doreeto@gilat.com) is Director of Product Marketing for Gilat Satellite Networks. In this role, Oren works closely with the Commercial and Defense divisions to define product positioning, messaging and go-to-market strategies, and is responsible for market research and analyst relations.

Oren has more than 20 years of industry experience, and has held management positions in R&D, product management and product marketing for international high-tech companies. In this capacity, she contributed to next-generation product definition and was responsible for delivering the company's vision to the media and analyst community. Oren has published thought leadership articles in renowned international journals, and has spoken at numerous industry conferences worldwide. Oren received a BSc in Computer Science from George Washington University.



Satellite Scaffolding: Form + Function

By Jos Heyman, Senior Contributor



Unlike motor vehicles and aircraft, satellites do not lend themselves well to mass production manufacturing due to the specific focus of an individual satellite's purpose.

In particular, a satellite should strike a delicate balance between mass and space availability on the launch vehicle as well meeting the specific payload requirements. As such, many satellites are custom built around mission payloads.

Nevertheless, the techniques of mass production have had some influence in the manufacture of satellites through the adoption of standard platforms to which a customer's specific requirements are then added.

In particular the USSR/Russia has been using this technique from the early days of space exploration. For instance, the Vostok spacecraft in which Yuri Gagarin made the first crewed spaceflight in 1961 used a space platform that had also been used extensively for a range of other spacecraft. Those included the Zenit 2, Zenit 4, Zenit 6 and Zenit 8 military reconnaissance satellites, as well as their variants, such as the Voskhod three crew spacecraft, of which five were flown (two with a crew), the Bion biological satellites, the Foton materials sciences satellites, the Resurs F series of Earth observation satellites as well as a number of scientific satellites in the Interkosmos and Kosmos series.

The use of a space platform has been mainly limited to communications satellites, which possess a basic platform that contains attitude control, navigation, power supply and other systems, all combined with the specific suite of transponders as specified by the customer.

In the United States, the earliest notion of a satellite platform was introduced by the Hughes Space and Communications Company, which was formed as a subsidiary of Hughes Aircraft in 1961 and remained independent until 2000, when it was purchased by Boeing and became Boeing Satellite Development Center. Apart from building satellites, the company also became involved in the operation of communications satellite services.

Hughes Space and Communications designed and built the world's first communications satellite in geostationary orbit, known as Syncom-1, and which was launched on February 14, 1963. The platform was known as HS-301 and was used for the entire Syncom series of three satellites. All of these satellites, as well as a number of additional Hughes satellites, were, essentially, of like design for a single customer.

RCA Astro Electronics, a company that was established in the late 1950s as a division of RCA, was another leading manufacturer of satellites and related systems. It was purchased by General Electric in 1986 and was renamed GE Astro Space, eventually sold to Martin Marietta in 1995—that company merged with Lockheed in 1995 to become Lockheed Martin Space Systems.

RCA Astro Electronics introduced the AS1000 platform on December 13, 1975, followed a few years later by the AS3000 platform on April 7, 1978. However, similar to the early Hughes HS-301 satellites, these were developed for a single customer—the RCA SATCOM branch of the RCA conglomerate of companies.

Introduced in 1972, the Hughes HS-333 with a mass of 574kg was the first platform used for communications satellites builds for various operators.

Introduced in 1980, the Hughes HS-376 was the smallest of the spin-stabilized platforms offered by the company. With a typical mass of 654kg, the platform included four hydrazine thrusters with 136kg propellant, a Star 30 apogee kick motor and solar cells mounted on outside

of cylindrical satellite body which provided 990W of power and recharged two NiCad batteries. When Hughes was taken over by Boeing, the designation became BSS-376.



HS-333 (Palapa-1)

Sub-versions were the HS-376HP, a High Powered version that was later redesignated as BSS-376HP as well as the HS-376L (for Large) and HS-376W (for Wide), which was fitted with a single antenna.

RCA Astro introduced the AS4000 platform in 1985, a three axis stabilized platform with a mass of about 1000kg and fitted with solar arrays. The AS4000 is an excellent example of the versatility of such a platform as, apart from having been used for some



HS-376 (Morelos-1)

communications satellites, it has also been used for the Navstar 2R series of navigational satellites.



AS4000 (Navstar 2R)

The Space Systems Division of Ford Aerospace entered the market in 1989 with the FS-1300 platform. The division was acquired by Loral Corporation in 1990 and became known as Space Systems/Loral, with the platform known as LS-1300.

Since then, the space platform has gone through an evolutionary process to deliver increasingly higher power, greater flexibility and a longer mission life. The earliest models had a mass of 5500kg and required a 4m diameter fairing, whereas current models are 6,700kg and need a 5m fairing. The platform is built using a lightweight and high-strength structure and includes fuel-efficient attitude and attitude control subsystems, high-efficiency and reliable solar arrays and batteries, and advanced command and control subsystems.



LS-1300 (DirecTV-7S)

Hughes introduced the HS-601 platform in 1990. The 4135kg platform had a height of 2.29m and a span of 18.30m. It was three-axis stabilized and was fitted with one Marquardt 490 N bipropellant thruster. Twin solar wings of three, 2.16 x 2.54m panels, carried large area silicon cells on Kevlar substrate to satisfy the 3.3kW requirement. It was later designated as BSS-601 and versions included the HS-601HP, a high powered version of the HS-601 that became BSS-601HP, and HS-601M, also known as BSS-601M.



BSS-601 (TDRS-9)

The RCA Astro AS5000 platform was introduced in 1992. With a typical mass of 2850kg, the three axis stabilized satellite had two solar arrays with a span of 24m as well as 20 monopropellant hydrazine thrusters for attitude control.

A further development, the AS7000, was introduced in 1993. These satellites were heavier, in the range of 3400kg, and were also fitted with solar arrays.



AS5000 (Intelsat K)

The A2100 platform entered the market in 1996 and made extensive use of modular subsystem and components, allowing an A2100 based satellite to be delivered within 18 months of having placed an order. It can be configured in four different sizes, identified as A2100A, A2100AX, A2100AXS, A2100AXX and A2100M, the latter for military satellites.



A2100 (AEHF-1)

Originally designed as the Hughes HS-702, the Boeing BSS-702 was based on the HS-601 but was more powerful and incorporated a bipropellant propulsion system, which could lift the 5,200kg satellite into final orbit after separation from the launch vehicle. This spacecraft was introduced in 1999 and was adaptable to medium Earth and geostationary orbits. Modularity extended to the power system and various configurations of solar arrays could be accommodated.



BSS-702 (SkyTerra-1)

A more recent participant in the development of space platforms has been Orbital Sciences Corporation—the company produces the STAR Bus platform. Measuring 1.75m x 1.70 m x 1.80m and with a basic structure mass of 800-1,500kg, the STAR Bus provides a relatively small platform, compared to some of the other commercially available platforms. This modular design was introduced in 1997 and is based on composite thrust cylinders to which the spacecraft systems and payload are attached, as well as the two solar wings. The STAR platform is compatible with the Ariane 5, Soyuz, Zenit Land Launch, Proton, H2A, Falcon-9 and Zenit Sea Launch vehicles and has a typical mission life time of up to 15 years.



STAR Production

In Europe, Matra Marconi Space was established in 1990 as a joint venture between the space and telecommunication divisions of the Lagardère Group (Matra Espace) and the GEC group (Marconi Space Systems). In 2000, the company merged with the space division of DaimlerChrysler Aerospace AG (DASA) to form Astrium.

Similar to its U.S. counterparts, the first platform produced by Matra Marconi was the Eurostar 1000 that was used for four Inmarsat launches. From that success, Matra Marconi developed the Eurostar 2000, which was introduced in 1991. The platform allows a mass of up to 1900kg and has with a three-axis stabilization. A further version is the Eurostar 2000+ which has a capacity of as much as 2850kg.



Eurostar 2000 (Orion-10)



Eurostar E3000 (Astra 5B)

The Eurostar E3000 was first used in 2004 and allows a launch mass of up to 6000kg, with solar arrays that span 35 to 45 meters.

Another European company, the Thales Alenia Space corporation, has its heritage in the

Alcatel Alenia Space company. The Thales group was established in 2005. The latter company can actually trace its heritage to 1893 when the Thomson-CSF company was established to operate patents of the U.S. Thomson-Houston Electric Corporation in the then-emerging markets of power generation and transmission. Thomson-CSF adopted the name Thales in December of 2000.

After building the Spacebus 100, 300 and 1000 for select customers, the company introduced the Spacebus 2000 in 1990, followed by the Spacebus 3000 in 1996 and the Spacebus 4000 in 2005. The Spacebus platforms



Spacebus 4000 (Eutelsat W-7)

have all been designed with a variety of missions in mind—the latest development, the Spacebus 4000, can be used for payloads of up to 6000kg. They come in a range of versions designated as Spacebus 3000A, B2 and B3 as well as Spacebus 4000 B2, B3, C1, C2, C3 and C4.

In China, the Dongfanghong-4 (DFH-4) platform was designed and built by the China Academy of Space Technology (CAST). Production began in 2001 with the first satellite launched in 2003.



DFH-4 (NigComSat-1)

The DFH-4 platform has a payload capacity of close to 600kg and is now extensively marketed in international markets as a low-cost alternative to those offered by companies in the United States, Europe and Russia. In particular China is targeting developing countries in Asia, Africa and South America, offering them an all-inclusive package that includes satellite design and fabrication and the launch of the satellite via a Chinese rocket from a designated Chinese launch site.

Other countries that have produced space platforms include India and Russia. However, these platforms have been basically used for single customers and are not (yet) marketed as open market platforms for a variety of customers.

Platform	first	last	#
HS/BSS-376	15-Nov-1980	29-Mar-2002	59
AS4000	28-Nov-1985	17-Aug-2009	30
LS1300	5-Jun-1989	on-going	92
HS/BSS-601	9-Jan-1990	4-Mar-2010	77
Spacebus 2000	30-Aug-1990	30-Jan-1997	10
AS5000	2-Mar-1991	10-Jun-1992	4
Eurostar 2000	16-Dec-1991	3-Jun-2010	26
AS7000	16-Dec-1993	18-Jun-1998	13
Spacebus 3000	9-Jul-1996	18-Apr-2008	26
A2100	8-Sep-1996	on-going	44
STAR	12-Nov-1997	on-going	31
HS/BSS-702	21-Dec-1999	on-going	27
Eurostar 3000	16-Jun-2004	on-going	31
Spacebus 4000	2-Feb-2005	on-going	22
DFH4	29-Oct-2006	on-going	11

Various satellite platforms.



Clyde Space 2U Frame

Finally, the recent development of CubeSats has opened up a totally new and growing market of space platforms. Originally designed at the Californian Polytechnic Institute at Cal Poly, San Luis Obispo, California, a broad range of companies now offer CubeSat frames and components as commercial-off-the-shelf (COTS) products and can be acquired at lower costs than a standard satellite platform.

About the author

Jos Heyman is the Managing Director of Tيروس Space

Information, a Western Australian consultancy specializing in the dissemination of information on the scientific exploration and commercial application of space for use by educational as well as commercial organizations. An accountant by profession, Jos is the editor of the Tيروس News Bulletin (<http://tiros.zarya.info/>) and is also a regular contributor to the British Interplanetary Society's Spaceflight journal. Jos is also a Senior Contributor for SatMagazine.

Careers: Overcoming “Candidate Polishing”

By Bert Sadtler, Senior Contributor

Today, companies must re-assess their talent needs in order to remain competitive and drive growth. The satellite communications industry faces challenges but remains ripe with opportunities. Great talent can make a huge impact. Employers need to get it right and make a “great hire.”

For CEOs and hiring managers, what could be more straightforward than interviewing candidates? You are managing people and growing your business. Interviewing and hiring is just another aspect of your business.

Not so fast.

Maybe it is time to change the conversation for the interview. Do these considerations make you think differently about interviewing today:

- What type of talent are you seeking? Hire the smartest candidate? Hire the most qualified? Hire the candidate with the best potential? Hire the cheapest?
- When developing your interview questions, are you wondering if your candidate has already been practicing, rehearsing and “polishing” the answers?
- How have you the CEO / hiring manager been able to neutralize the emotional bond you have to your company and make an objective analysis of the candidate?

• If you are a believer of First Impressions, how do you know if the candidate is meeting you right after receiving some really good news or some really bad news that has influenced your first impression experience?



• Are you winging-it or are you conducting a discussion to determine if the candidate can solve the business problem you defined?

The evolution of business is a simple fact of life. Trends are changing constantly. Businesses hire critical talent to solve an important business problem. There is little margin for error. You have to get it right.

If we agree the stakes are high, then we must also agree that the most effective interviewing efforts in the past may no longer be the most effective efforts today. For example, job seekers now have an industry of resources at their disposal who will provide resume writing, interview preparation, interview rehearsing, interview role playing, interview filming and additional job seeking assistance.

“Candidate-polishing” has become a big business. How does a hiring manager remain an effective interviewer?

The most effective interviewing approach is the one that is most effective today! (Not the one that used to be the most effective.)

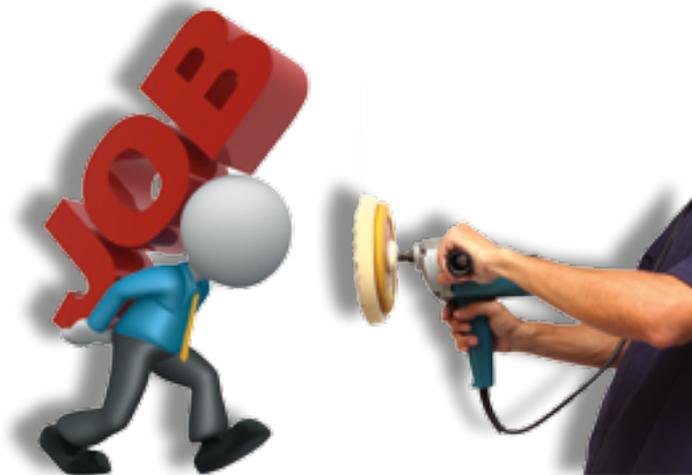
Getting positioned to be an effective interviewer may require an adjustment to your interviewing philosophy as well as your interviewing execution.

As a hiring manager, do you want to hire a smoothly polished candidate or do you want to hire a professional who fits the culture of your business and solves your business problem? Does the best interviewee make the best employee?

It can be argued that individuals who score well as impressive candidates in a traditional interview may not necessarily be great employees. They may be too focused on polishing their candidacy and not focused enough on the solving the business problem they would be hired for.

On the other hand, those who are great at solving their employer’s business problem day after day, may lack the necessary interview savvy to project the appearance of being a strong candidate.

Strange as it may sound, the candidates with “over the top” interview skills may make terrible employees and the lesser skilled interviewees (who spend their time actually solving business problems) may make the best employees.



How can the interview be adjusted? Is the interview approach and the interview positioning due for a change? Is it time to change the conversation?

If we strip away all of the hiring manager's interviewing techniques, the heart of interviewing is to enter into a dialogue that would reflect the candidate's true personality and qualifications.

"Changing the conversation" starts with the hiring manager. The hiring manager has to take ownership of the hiring process and lead it by example. No one can do it for the hiring manager if you really want to get it right.

The hiring manager needs to become the owner of the hiring process. The hiring manager needs to place a dedicated amount of time toward interviewing and the overall hiring process. Many times, strong candidates get turned off by hiring managers due to their lack of follow-up and apparent lack of interest in the candidate.

As part of "changing the conversation", hiring managers need to define and declare the business problem they need to solve by hiring talent. A tone of openness is critical in positioning the hiring manager and the business. The tone is saying, "Our business needs the

talent of someone who knows how to solve our problem better than we currently can."

While our discussion on positioning and "changing the conversation" has been brief, it can't be over emphasized in its importance. The goal is for candidates to see this as a fresh approach and as a result, for candidates to take an open and direct approach with their responses.

Effort and resources have been invested in studying human nature and then applied to "candidate-polishing". What if interviewing were to remove all of the sophisticated techniques and instead, it involved a straightforward conversation?

There is a win-win. Employers are seeking the best fit which combines both a technical qualification and a cultural fit. Candidates want to join an organization where they can excel. It doesn't mean that everyone is suited for every job. It is not a failure for a candidate to recognize they are not the right fit during an interview. It is worse when the candidate exaggerates their qualifications only to fail in their new role within the first 30 days.

Once positioned correctly, executing the interview is easy and enjoyable. It transitions into less of an interview format and more of a conversation. I prefer to speak with

a candidate in multiple conversations for 20 to 30 minutes instead of one meeting for several hours. This allows for the ability to reflect on each conversation and observe consistencies or inconsistencies.

Summary of the Interview:

- *The hiring manager discussing their business and their business problem in some detail.*
- *Then the candidate may have questions based upon the hiring manager's initial comments.*
- *Once the hiring manager establishes more of a dialog approach and less of an interrogation style a candidate will relax.*
- *A relaxed candidate is more likely to resemble what they will be like as an employee and less what they are like through the influences of being a polished interviewee.*
- *The contents of the dialog should include the interviewer's focus on the candidate's capability to solve the business problem they are interviewing for. Here is where the so-called interview questions should be conducted.*
- *Note: in my experience, strong candidates ask excellent questions. Candidates should be invited to ask questions. Their questions alone tell a lot about them.*
- *The hiring manager asks the candidate to discuss their thoughts and their qualifications on solving the hiring manager's business problem.*
- *As the interview conversations further develop, some form of an action plan should evolve. Through the collaboration of the hiring manager and the candidate, an agreed to "plan of attack" needs to be developed.*
- *Through the development of some form of an action plan, the hiring manager is determining in real-time if they are compatible with the candidate and if they are convinced the candidate can deliver results.*

- *Through the development of an action plan, the candidate is able to evaluate their compatibility with the hiring manager in real-time.*
- *The outcome from an action plan places the newly hired talent as a fully vetted professional with a clear direction of their new role starting on day one of employment.*
- *Obviously candidates who could not effectively address solving the business problem and developing an action plan did not end up being hired.*
- *Through several interactions, the hiring manager will have developed a feeling about the candidate along with some concrete data.*
- *My experience is that the best candidate is the individual who meets the minimum technical requirements while at the same time is the best cultural fit, having the best chemistry with the hiring manager.*

This interviewing positioning and "change of the conversation" philosophy can be applied to most any field of business. The specific industry's details become intertwined into solving the business problem and intertwined into the interview discussion.

To hiring managers who are looking to change the conversation and have a better interview outcome, here is an opportunity to consider the most effective approach today.

Good hunting.

About Boxwood Search + the author

Boxwood is a management, consulting-recruiting firm with offices in the greater Washington DC region and in the Tampa Bay, Florida area. Boxwood provides solutions for employers needing critical talent.

As a dedicated, consulting resource to the employer, Boxwood develops strategy for organizational growth through the evaluation and acquisition of critical talent. Market sectors include: SATCOM, Government Contracting, Communications and Technology. Bert Sadtler is an invited speaker to discuss the shift in the recruitment paradigm toward acquiring critical senior level talent as well as the shift in the employer's performance based compensation model.

Bert can be reached at BertSadtler@BoxwoodSearch.com.

Using SkyTrac's Satellite Technology To Track Aircraft Positions

By Brian O'Flynn, Vice President of Sales, SkyTrac Systems Ltd.

Recent media focus on aircraft tracking technology underscores significant gaps in traditional approaches (radar, transponder, Automatic Dependent Surveillance-Broadcast (ADS-B), and radio communication). These technologies, or combinations of them, are typically used by the scheduled commercial air transport sector (please refer to Figure 1). The gaps are particularly relevant when tracking aircraft in remote areas where traditional tracking infrastructure can be limited, for instance outside radar coverage.

For off-shore oil and gas operations, satellite tracking is the preferred solution as it offers reliable tracking where there is often no radar coverage due to offshore, sea level landing pads and 'over-the-horizon communications' are not always available. In other cases, such as Air Medical Services, satellite tracking simply fits the cost, size, weight and operational requirement perfectly.

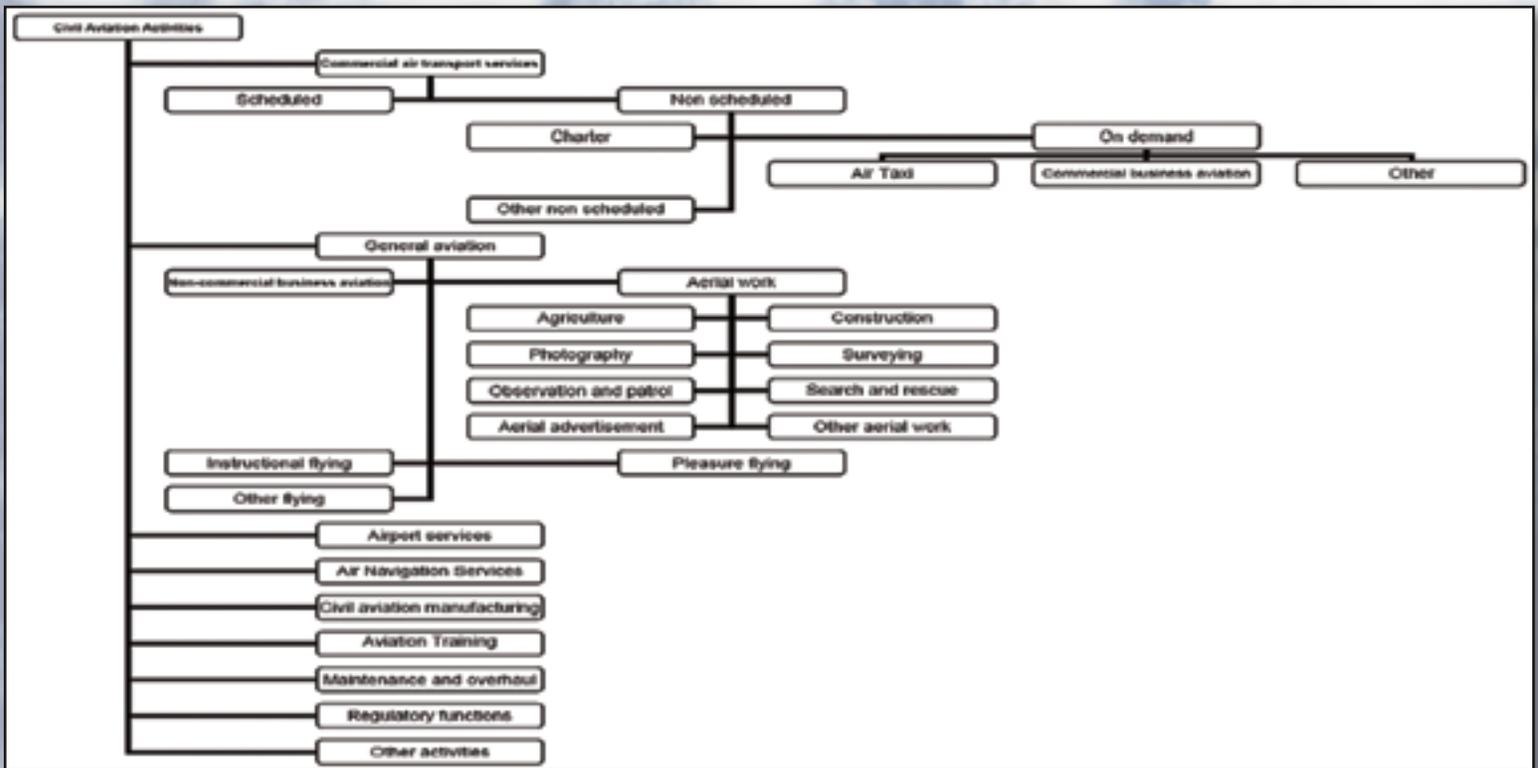


Figure 1. Proposed ICAO Classification of Civil Aviation Activities.

An alternative—satellite tracking technology—has been quietly tracking aircraft in other market segments for decades with great success and reliability rates. Satellite tracking was first developed and adopted over twenty years ago because no other technology was practical due to size, weight, or cost constraints. In some cases, for example aerial firefighting (part of 'Aerial Work' in Figure 1), flight tracking is now mandated by many aviation authorities because it offers the best solution for tracking complex low altitude aviation operations in remote locations with the possibility of congested airspace and potentially limited visibility.

The reliability, simplicity and cost effectiveness of satellite tracking systems raises key questions about why this technology is not used for scheduled commercial air transport sector.

SkyTrac Systems Ltd., a leading provider of aircraft tracking and aviation data solutions, has been in the business of flight-following, monitoring flight data, and supporting aviation businesses for more than 20 years. The high-tech company based in Kelowna, British Columbia, Canada, has a global customer base of hundreds of operators who rely on SkyTrac's innovations to ensure they know where their aircraft are at every moment of flight.

What started out as a simple GPS-based aviation tracking system 20 years ago has developed into a complex and far-reaching flight monitoring capability that offers unforeseen advantages to operators all over the globe.

"We offer a simple and effective tracking solution to our customers" said SkyTrac CEO, Stephen Sorocky.

"Typically our customers are in the oil and gas, leasing, firefighting, medevac, charter, news or police aviation sectors. These operators regularly fly below radar coverage—if radar is even present—and often out of range of effective radio frequency communications, so they have sought solutions that offer them critical connectivity during their missions. They rely on our small, lightweight systems—no bigger than a toaster and weighing approximately 2 kilograms—to provide minute-by-minute tracking and to integrate flight data into their business operations on the ground. In addition to tracking, our real-time data helps them with fundamental business operations such as billing, tracking pilot flight hours, or documenting passenger or cargo manifests. We also provide invaluable information for aircraft

provides mapping as well as a long list of smart tools to ensure there is a two-way information flow between the ground and the aircraft.

With Low-Earth-Orbiting (LEO) constellations there are no 'blind spots' or gaps in global coverage, and SkyTrac's data centers have multi-layer redundancy to ensure 24/7/365 coverage. Using LEO constellations, aircraft of any size can be tracked, monitored and connected from any Internet access point.

In addition to continuous tracking of aircraft position and aircraft data, over the years SkyTrac has built in intelligence to automatically transmit alert messages if unforeseen events take place (commonly known as 'exceedances'). Anomalies as simple as straying outside a flight corridor, flying too fast at low altitudes, or missing a way-point can trigger an instant alert to a flight following ground station or directly to your cell phone.

Other exceedances examples include (but are not limited to) abnormal altitude/speed combinations, landing gear position, flaps, engine temperatures or cockpit warning light status, excessive maneuvers or aggressive changes in attitude.

In a recent real-world case study, an aviation accident emphasized the criticality and utility of the SkyTrac tracking system. The tragic accident involved a helicopter crashing into water in an extremely remote area. In this case there were no distress calls or other emergency notifications by the crew. SkyTrac's system was the first to raise the alarm due to an exceedance being automatically tripped by SkyWeb. Within minutes of the accident, an automatic notification was sent to the flight's tracking team and this alerted the team that there was a potential problem with the flight.

Upon quick reference to SkyWeb the ground team quickly ascertained the last know position of the aircraft so an immediate search and rescue team was dispatched to the crash site. In this case National Search and Rescue assets were alerted but did not launch due to the speed and pin-point accuracy of the tracking team in reaching the crash site. Without the SkyTrac system the emergency notification would not have been received quickly and the location of the crash site would have been near impossible to find quickly or easily. The aircraft would have eventually been reported as missing but valuable time would have been lost and there would have been no solid clues as to where to start the search.

"Our technology brings benefits such as real-time business system integration and flight data monitoring, but at its core it provides a clean, simple real-time tracking capability," says Sorocky. "This technology is readily available today, affordable, light weight and provides 100 percent global coverage for aircraft no matter where they are flying."



Figure 2. SkyTrac's ISAT-200A aircraft tracking transceiver.
(H x W x D = 5.24" x 3.90" x 13.30"
[133.1mm x 99.1mm x 337.8mm], 2.21kg)

maintenance programs—engine data, fuel data, and other critical flight system data—all transmitted off-board in real-time."

SkyTrac's products are certified by Transport Canada, FAA, EASA, and ANAC so there are no regulatory barriers to installation on aircraft. SkyTrac's ground-based software (SkyWeb—please refer to Figure 3 on the next page) connects with the on-board hardware. SkyWeb

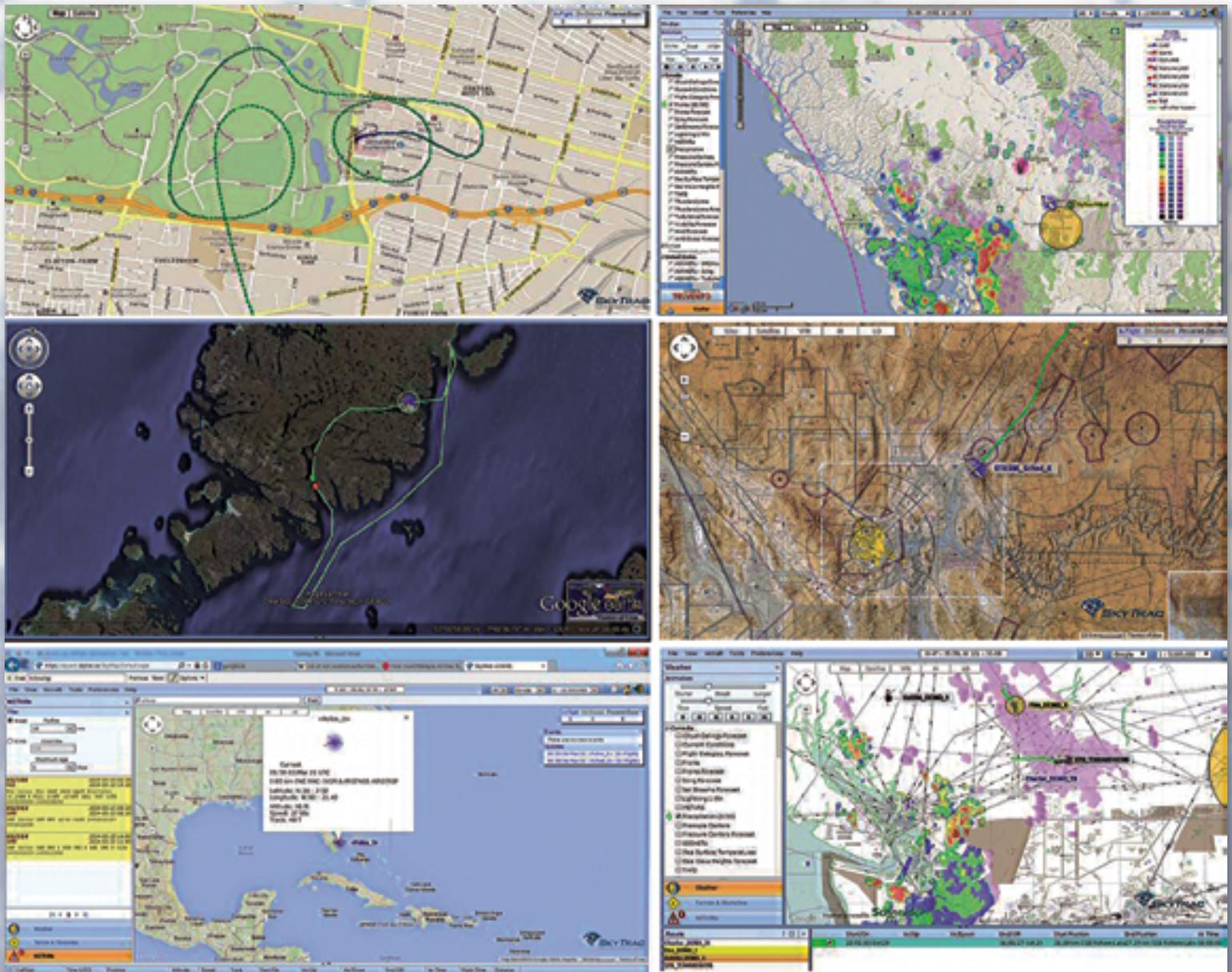


Figure 3. SkyWeb mapping options (Google maps with high resolution tracking data, satellite imagery, VFR/IFR charts. Also showing weather overlays and NOTAMS)

Even with sound reasons to use satellite tracking technology in the commercial air transportation sector, it is seldom used. Sorocky explains, "The commercial airline industry has traditionally used a combination of older technologies to track their flight operations. There are long term fixes on the horizon but today, and for the foreseeable future, there are large gaps in global tracking coverage. Despite compelling new technology and some early adopters, the scheduled commercial air transportation sector has been slow to adopt satellite tracking. We are making steady progress in this sector and we believe it is only a matter of time before satellite tracking technology is on every aircraft."

For further information, please contact
 Stephen Sorocky, CEO at SkyTrac Systems,
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About the author

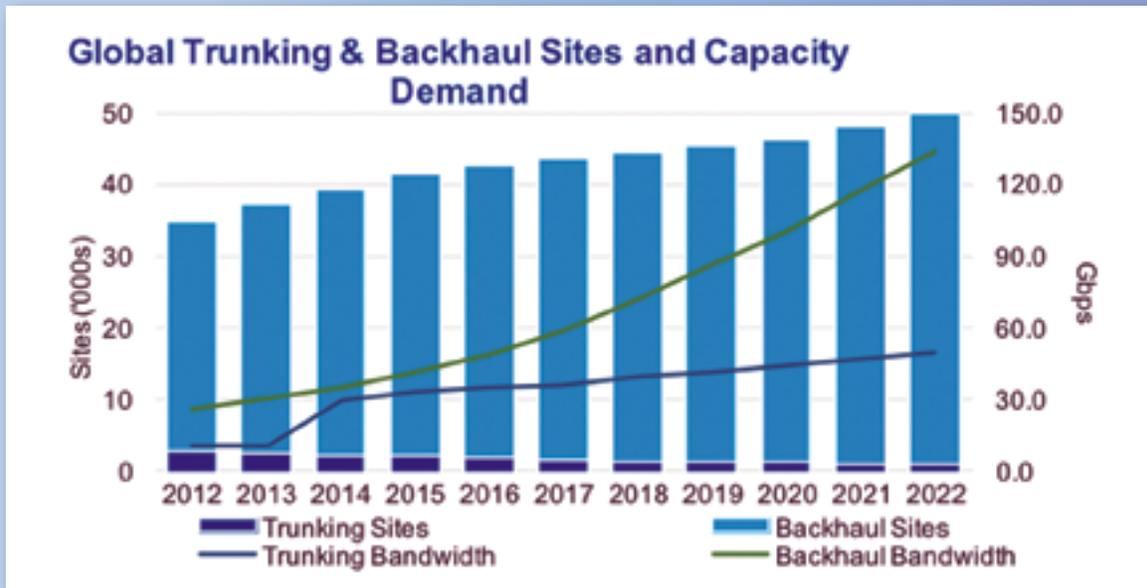
Brian O'Flynn is Vice President of Sales at SkyTrac Systems Ltd. Brian has an undergraduate degree in Industrial Engineering from University College Galway, a master's degree in History from the University of Alabama, and extensive U.S. Air Force schools. His background includes Manufacturing Engineering at Boeing Aircraft, Operations Analysis in the Systems Engineering Group at Sikorsky Aircraft, Principal Investigator at Energid Technologies, and Managing Director at Carmanah Aviation business unit. His U.S. Air Force career includes flight operations as an Air Weapons Officer on-board the E-3 AWACS and Commander at a Close Air Support (CAS) squadron.

NSR Analysis: Satellite Backhaul + Trunking Are Capacity Driven Markets

By Jose Del Rosario, Research Director, NSR Manila

Within its recently released **Broadband Satellite Markets 12th Edition study**, NSR undertook an assessment of key global trends in the interrelated satellite backhaul and trunking markets.

While NSR sees a continued role for C- and Ku-band provisioned backhaul services over the entire forecast period, as well as the emergence of some widebeam Ka-band backhaul networks, it is nonetheless expected that the installed



For the arguably more important backhaul segment, NSR forecasts a better than 50 percent increase in the global installed base of backhaul sites between 2012 and 2022. Much of this will be driven by the dual trends towards picocell/smallcell backhaul and HTS/MEO-HTS provisioned backhaul services.

NSR continues to maintain that the single most important trend for the satellite backhaul market is the need to cost effectively serve 3G/4G/LTS backhaul requirements for mobile operator clients. This will inevitably drive the backhaul market to the use of HTS and MEO-HTS capacity in the coming years with NSR projecting that combined HTS/MEO-HTS capacity demand will grow by 133.5 Gbps by 2022 for backhaul services alone.

base of C/Ku backhaul sites will peak in 2015 and then begin to decline.

For the satellite trunking market, it is no secret that this segment has been under pressure for the last several years. The total global base of satellite trunking sites is projected to drop by almost 70 percent between 2012 and 2022. Most of the decline will be for legacy C/Ku-band services giving way to encroaching undersea cable and terrestrial fiber, mainly in the Sub-Saharan African and Asian markets.

However, this drop in installed base disguises a critical trend in the satellite trunking market of new MEO-HTS provisioned trunking services emerging with capacity cost points competitive with fiber. Starting with the commercial launch of O3b Networks service in 2014, NSR expects a significant increase in trunking bandwidth demand driven mainly by these high throughput MEO-HTS trunking sites.



Further, NSR believes that the migration to MEO-HTS capacity will help to stabilize trunking revenues for the satellite industry. Granted, legacy C-/Ku-band trunking service providers will see declining revenues, but at least much of that will transition to those players who successfully sell MEO-HTS and HTS trunking services to end clients.

For the combined satellite trunking and backhaul markets, there is no doubt that the backhaul market vertical overshadows the trunking market in terms of pure installed base. Yet, this analysis misses the fact that the trunking and backhaul markets are much more a satellite capacity play than an installed base play. In particular, the emergence of MEO-HTS and HTS provisioned trunking and backhaul sites will be the key trend in these market verticals in the coming ten years.

For the last several years, the installed base of mainly C-band trunking sites has been declining in the face of new undersea cable and terrestrial fiber. This trend will continue, however already in 2013 for HTS-provisioned trunking services and starting in 2014 with MEO-HTS trunking, NSR expects to see a reemergence of growth in satellite-provisioned trunking services as the much more

cost competitive MEO-HTS and HTS trunking solutions begin to be adopted in many regions around the world.

Similarly, HTS-provisioned backhaul is already making strong headway in Asia and NSR expects to see the rapid spread of HTS and MEO-HTS backhaul sites the world over as the satellite industry seeks to position itself to cost effectively meet the backhaul needs for rapidly expanding 3G/4G/LTE networks. There is even real potential for new hybrid terrestrial/satellite backhaul solutions even for the most developed countries.

Information for this article was extracted from NSR's report: Broadband Satellite Markets, 12th Edition. More info at <http://www.nsr.com/>

About the author

Mr. Del Rosario is a senior member of the consulting team where he focuses his research on quantitative modeling, data verification, and market forecasting for the commercial and government satellite communications sectors. He conducts ongoing research with specialization in policy analysis, economic indicators, regulatory initiatives and end user demand trends. In addition to authoring numerous syndicated reports in his areas of focus, Mr. Del Rosario has been involved in a wide range of strategic consulting projects. He has advised clients on market trends, implications, and strategies.

Naval Research Laboratory Models The Deepwater Horizon Oil Spill

By Kyra Wiens, Naval Research Laboratory

Dr. Jason Jolliff is an oceanographer with the U.S. Naval Research Laboratory (NRL). "The emphasis here," he said, "is on developing models of the ocean environment to help the naval warfighter." His most recent paper, published in the March of 2014 *Ocean Modeling* magazine, reveals that NRL can also forecast where oil will go following a major spill.

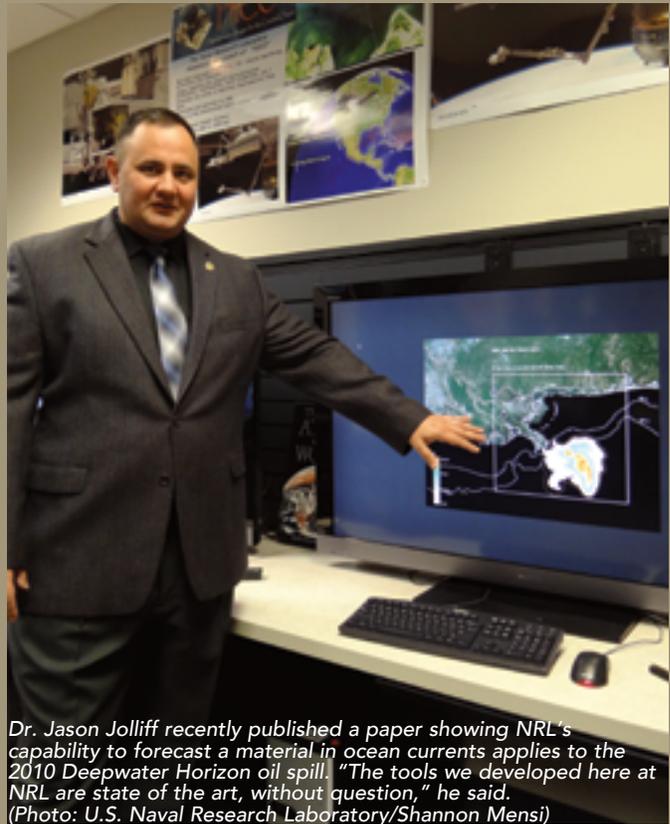
"If you're going to do forecasting," he said, "you have to get the ocean circulation correct. It's fundamental to all else." Jolliff plugged the distribution of surface oil following the 2010 Deepwater Horizon oil spill—when it was still well offshore—into a powerful NRL forecasting tool. He accurately predicted what would happen to the oil; in particular, the processes that made inevitable its landfall on Louisiana shorelines fully four days later.

Jolliff's second key point is, "When we look at oceanographic problems, we have to understand the scales of time and space we're dealing with."

In 2010, there was concern about oil washing up on Florida beaches. But oil does evaporate and degrade; so knowing how far the oil will go over what period of time helps predict which beaches are at most risk.

Jolliff is part of a team developing a tool called Bio-Optical Forecasting (BioCast). "We're developing this framework where you can combine satellite images, that give you an estimate of what is in the ocean, with ocean circulation models." BioCast calculates "how those materials will ultimately be transported and dispersed."

Jolliff is interested in how "tracers"—like plankton or nitrate distribution—change water clarity. "That will



Dr. Jason Jolliff recently published a paper showing NRL's capability to forecast a material in ocean currents applies to the 2010 Deepwater Horizon oil spill. "The tools we developed here at NRL are state of the art, without question," he said. (Photo: U.S. Naval Research Laboratory/Shannon Mensi)

help the Navy predict ocean optical properties." Divers need good visibility, as do airborne platforms that use electro-optics to "look" for mines in shallow waters. "But the general knowledge that we gain can be applied to a very wide range of forecasting problems, including contaminant distribution and oil spill response."

Jolliff validated NRL's capability for future operations by applying integrated forecasting to the Deepwater Horizon oil spill. He describes two sets of experiments: one at a local scale, focusing on currents near Louisiana; the second at a mesoscale, looking at the entire Gulf of Mexico.



Deepwater Horizon platform site. Photo courtesy of NOAA.

Predicting Where Shoreline Oil Would Be Worst

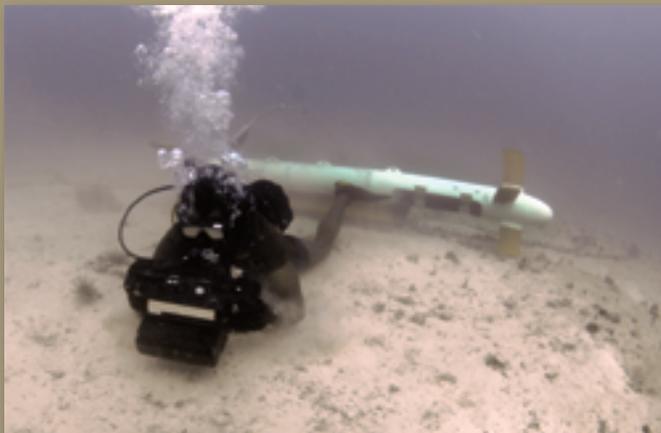
Using satellite images from May 11, 2010—which show oil slicks still well away from shore—Jolliff forecast how oil would move over the next 96 hours. He predicted oil would make a substantial landfall on the Louisiana coast, west of the Mississippi River Delta, on May 14. “The forecast was qualitatively accurate,” he said. “That’s precisely what happened.”

Jolliff uses the NRL tool, Coupled Ocean-Atmosphere Mesoscale Prediction System (COAMPS®). “[COAMPS] was designed to provide a direct forecast of oceanographic and atmospheric variables, things like surface temperature, surface humidity, sea surface temperature, current speeds, and atmospheric visibility.”

With forecasts of how water is moving from COAMPS, Jolliff predicts how a tracer will be transported through that system using BioCast. With a tracer like surface chlorophyll, which indicates phytoplankton abundance, he might forecast water clarity for a naval operations environment. By using oil from a well-documented spill as a tracer, Jolliff validated how the models work together.

“One of the things we can do at NRL is we can start to explore areas that weren’t necessarily thought of when [COAMPS] was designed,” said Jolliff.

Following Deepwater Horizon’s blowout, “the main surface aggregation of oil was offshore.” For the oil to reach shorelines, surface water from the deep ocean would have to carry it in and exchange with coastal waters. “What we find, generally,” said Jolliff, “is that the water near shore tends to stay near shore, and the water off shore tends to stay off shore. So in order to forecast if this oil is going to impact some coastal area, you have to know where this water mass exchange is going to take place.”



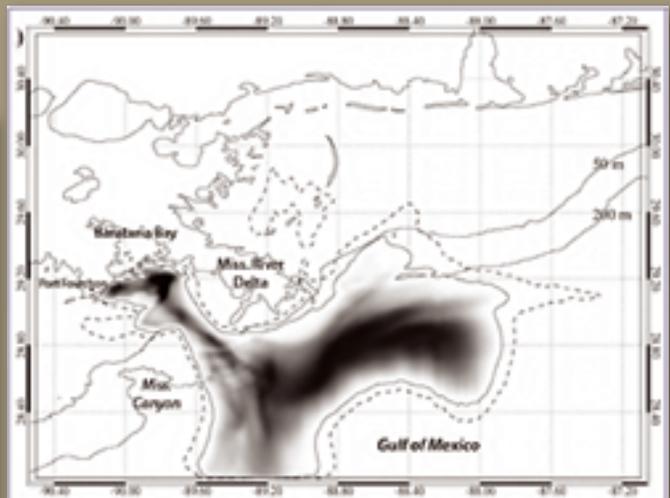
A diver tests underwater imaging system in the Arabian Sea, after an airborne platform “saw” this mine through the water. “The emphasis here,” said Dr. Jason Jolliff, an NRL oceanographer who forecasts ocean optics, “is on developing models of the ocean environment to help the naval warfighter.” (Photo: U.S. Navy)

With COAMPS, Jolliff was able to explain the water mass exchange that led to the severe oiling in Louisiana. Where the Mississippi River Delta landmass protrudes out into the Gulf of Mexico, coastal currents can mix with offshore surface waters. “Oil that is initially offshore, it’ll come near shore and bump up against the Mississippi River Delta. And then it gets whipped around and swept into this coastal current.”

Additionally, there’s an unusually deep feature on the ocean floor to the southwest of the Delta, called the Mississippi Canyon. The irregular ocean depths, or bathymetry, between the Delta and the Canyon; prevailing winds; and fresh water that drains from the Delta all contribute to water mass exchange.

To show oil would be concentrated where currents converge, and dispersed where currents diverge, “We had specific buoyancy restoring term in the model that would bring oil back to the surface.” He was able to account for the tendency of oil, pulled under by currents, to rise back to the surface—critical to forecasting material transport. A three-dimensional framework made these zones of divergence and convergence easier to identify than in 2010 (Eulerian versus Lagrangian). (A future model that sought to include subsurface oil in the initial inputs would need a more complex accounting of how hydrocarbons interact with seawater and chemical dispersants.)

Jolliff doesn’t compare his predictions to what federal agencies made at the time, because they were continuously updating their simulations. “The take home message is that COAMPS was able to forecast the atmospheric and oceanographic conditions that



Dr. Jason Jolliff used surface oil estimates following the Deepwater Horizon blowout to forecast where oil would first hit shorelines 96 hours later, on May 14, 2010. “If you’re going to do forecasting,” he said, “you have to get the ocean circulation correct. It’s fundamental to all else.” The protruding Mississippi River Delta mixed offshore oil into coastal currents. The underwater Mississippi Canyon helped funnel oil toward Barataria Bay. (Image: Jason Jolliff; labels superimposed)

made that funnel [of water mass exchange] operate. And so what was happening in the model then happened in reality.”

Mesoscale

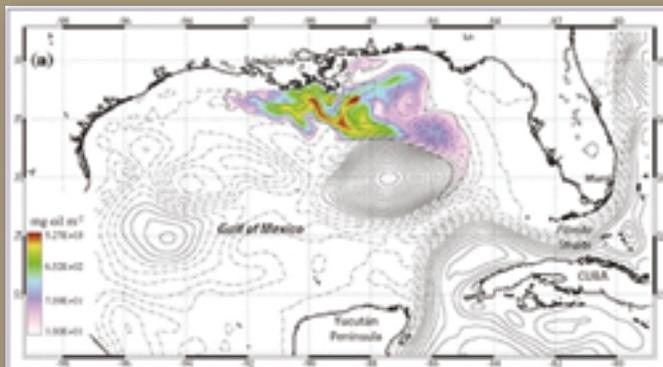
Next, Jolliff sought to explain what happened to oil over a longer time period and wider region. Unlike the first set of experiments, “We’re doing what’s called a ‘hindcast’; and that’s every 12 hours, the ocean model is assimilating information from satellites to correct deviations from those observations.”

Except for two gaps, land hems in the Gulf of Mexico. As a result, ocean current tends to flow in through a gap between the Yucatan and Cuba, and then into a forceful clockwise Loop Current that turns toward the southeast.

Most of the time, the Gulf’s Loop Current is able to squeeze out through the Florida Straits. “But it’s unstable,” said Jolliff, “so with some frequency, this big loop detaches and forms this sort of closed, clockwise circulation of water—what oceanographers call a mesoscale eddy.” And with the hindcasts, Jolliff observed exactly that.

“You see that the Loop Current itself pinched off to form an eddy.” This fortuitous event prevented the current from carrying aggregated surface oil to Key West and eastern Florida beaches, like Miami. “This emphasizes the point that the only way you’d know that is to forecast the ocean circulation.”

In addition to understanding regional currents, time scale is also very important. For the 96-hour forecast, Jolliff could assume oil was an inert tracer. But over time, oil “weathers”—evaporating and biodegrading. Jolliff accounted for weathering in the mesoscale by assuming a rate of decay. He acknowledges this oversimplifies the true chemical properties of oil, and could be improved in a future model; but in 2010, most forecasters didn’t account for weathering at all.



Dr. Jason Jolliff’s hindcasts, following the Deepwater Horizon blowout, show the Gulf’s Loop Current pinched itself off in a closed eddy. The natural weathering of oil, as he modeled with a decay constant, also explains why Florida beaches weren’t harmed. “When we look at oceanographic problems, we have to understand the scales of time and space we’re dealing with,” he said. (Image: Jason Jolliff; labels superimposed)

Even if the current had carried oil to Florida, the damage likely wouldn’t have been severe. “What we see is that it takes more than 10 days for that surface oil to finally get entrained into the Loop Current. Enough time has elapsed that these materials are now significantly degraded.”

Improving Ocean Models Supports Readiness

While Jolliff tested NRL’s operational capability against the Deepwater Horizon oil spill, he could make similar forecasts for a spill anywhere in the world. “What’s very powerful about COAMPS,” he said, “is we can take models that are much larger in scale, and we can zoom in to these local areas.”

Going forward, he’ll focus on integrating more cross-interacting variables directly into COAMPS to give naval operators a more accurate and complete forecast. “In any complicated system,” he said, “you’re going to have various feedbacks. The ocean and the atmosphere are constantly exchanging energy.” By bringing the tracer directly into COAMPS, instead of using BioCast to perform transport calculations separately from COAMPS, he could see if materials in the ocean impact air-sea interactions.

He and NRL colleague Dr. Travis Smith are researching the biological, chemical, and physical properties of key tracers. “As you go out to longer and longer time scales, you have to bring more and more of inherent reactivity of these materials into your calculations: things like phytoplankton growth, settling of particles.” Incorporating these properties, similar to what he did with the decay constant for oil, improves forecasts of ocean optics.

“The tools we’ve developed here at NRL are state of the art, without question,” he said.

About the author

Kyra Wiens is a Public Affairs Specialist for the U.S. Naval Research Laboratory (NRL). She’s written about the lab’s achievements in alternative energy, biochemistry, space science, and more; sharing with social media and reporters. She’s an All American triathlete and helped edit the Cambridge University Press book, *Oil in the Environment: Lessons and Legacies of the Exxon Valdez Oil Spill* (August 2013).



About the U.S. Naval Research Laboratory

The U.S. Naval Research Laboratory is the Navy’s full-spectrum corporate laboratory, conducting a broadly based multidisciplinary program of scientific research and advanced technological development. The Laboratory, with a total complement of nearly 2,800 personnel, is located in southwest Washington, D.C., with other major sites at the Stennis Space Center, Mississippi, and Monterey, California.

NRL has served the Navy and the nation for over 90 years and continues to meet the complex technological challenges of today’s world. For more information, visit the NRL homepage at <http://www.nrl.navy.mil/>

The 30th Space Symposium—Government’s Best Bargain Ever

By Elliot Pulham, Space Foundation Chief Executive Officer

The key metrics we track for our annual Space Symposium are looking better than ever. We are sold out of exhibit space, ahead of plan in sponsorships, ahead of forecast in advance registrations and have confirmed our largest number of speakers ever.

There’s a bumper crop of off-agenda meetings, ranging from the Aerospace States Association to the Coalition for Space Exploration, the Hosted Payloads Alliance, the Space Generation Advisory Council and more. Commercial, entrepreneurial and international participation, which have been on a steady upward trend for the past eight years, continues to look particularly strong. Significant international participation is expected from Japan, Canada, China, France and other countries—probably 25 or 30 countries when all is said and done.

But that’s not to say there won’t be challenges. Historically, the participation of key U.S. government agencies like the Air Force, NASA, NOAA, the NRO

and others has been a fundamental strength of the Space Symposium. Yet nonsensical, politically motivated, hard-to-fathom events like government shutdowns, sequestration and a highly politicized, witch-hunt mentality surrounding government travel have made the past two years surrealistically challenging for us, in a frustrating, doesn’t-pass-the-common-sense-test kind of fashion.

The Space Foundation has been able to overcome those challenges, and there are some important positives for us heading into the run-up to the greatest Space event on Earth:

- *First, unlike 2012 and 2013, the specter of a nationwide federal government shutdown no longer hangs over us like a Sword of Damocles.*



- *Second, federal agencies know what their budgets are for 2014. Some, like NASA, actually have more money in their budgets than they expected. But, whether they like their budgets or not, at least they have a budget. This makes planning for critically important meetings like the Space Symposium at least possible.*
- *Third, government agencies have had a year to adapt to new travel regulations triggered by OMB's over reaction to internal government (read GSA and IRS) conference scandals. No matter how draconian or illogical an agency's current travel restrictions may be, people at least now know how to navigate them.*

Despite all these positive trends and indicators, we know that we cannot expect government to always function in a common-sense way, and we know that the politics of perception plays a much more significant role than it should. We know that many of our government colleagues who can most benefit from attending the

Space Symposium will confront internal gatekeepers of the arch-conservative accounting and legal tribes—those who, even in the best of circumstances, will always look for a reason to say “no” when they should be looking for a way to say “yes.”

To help with those conversations, here are a few direct and factual answers to the questions that gatekeepers sometimes have about the Space Symposium:

#1. Optics. “Why is the Space Symposium at the Broadmoor? If only the conference venue weren’t so nice.

One of the big issues for me in this question is the assumption that government employees are only doing their job if they are suffering. Clearly this wouldn’t be a question if the conference were held in a sweltering hot canvas tent in the middle of a third world desert. We ought to all reject this notion.

The simple answer is that the Space Symposium is in Colorado Springs because one of the world’s largest and most important space agencies—U.S. Air Force Space Command—is here. While the Symposium is an international phenomenon that cuts across all sectors



of the space enterprise, foundational to that enterprise is AFSPC, the 800-pound gorilla of the global space community. Virtually everyone who has anything to do with space needs to keep current and connected to AFSPC. That is why the Space Symposium is here.

Understand that, and understand that the Space Symposium attracts about 9,000 people, and you understand that The Broadmoor is the only venue in the city that has the physical infrastructure to host the event. That infrastructure needs to include scores of meeting rooms, theater seating for 1,800 people at a time and nearly 200,000 square feet of total conference space. There are no other facilities in the region with that capacity. Period.

Beyond that, it is important to understand that the vast majority of attendees don't actually stay at The Broadmoor; 750 rooms versus 9,000 participants—do the math. There are 10 official conference hotels, most are in the mid-range pricing tier, and most offer rooms at the official government per diem rate.

#2. Cost. Wouldn't it be cheaper to go to other conferences?

No. It simply wouldn't. On so many levels.

First, there is no other conference that delivers so much value for the government. Because of the vast attendance by both national and international space community leaders, it offers a more target-rich environment for networking and meetings than the next half-dozen space conferences combined. Travel once to the Space Symposium, or travel six, eight or ten times to lesser events. Which costs the government less? The Space Symposium, obviously.

Second, the Space Symposium is actually a pretty cheap conference for government to attend. When budget axes started swinging and travel restrictions started popping out of the ground like Whack-A-Mole, the Space Foundation—very conscious of the challenges faced by our government customers—rolled back our government pricing to 2010 levels. The all-inclusive government registration rate of just \$790 is far less than our actual per-person cost of putting on the event, and is heavily offset by fees paid by exhibitors, sponsors and other registrants and guests. Government employees can attend the technical program for just \$300.

Third, the Space Symposium is a lot cheaper for our government customers to travel to than other conferences. While you would have to attend a half-dozen other conferences to get the benefits you get from attending the Space Symposium, we could, for comparison purposes, look at the annual International Astronautical Conference (IAC) as a near-peer—despite it attracting a more narrowly focused audience and usually

only one-third as many participants. The IAC was in Beijing last September. At this writing, a round trip airline ticket from Washington, D.C. to Beijing is about \$1,639 and the average hotel room rate in Beijing is \$266. For Colorado Springs those numbers are \$350 and \$115, respectively.

#3. Let's just give up. Well then, we're going to save money by just not going to any conferences!

The data suggests that if you just stay home, you will drive your agency's travel costs up. It's just that those costs will show up as program expense rather than overhead.

One of the things we learned last year, based on a single government agency that did not attend, was that necessary business and program meetings that normally take place at the Space Symposium often have to be rescheduled as stand-alone meetings throughout the rest of the year. One customer told us that they had to schedule at least 60 other, individual trips throughout the rest of the year to make up for meetings they would normally schedule during the Space Symposium. And those individually scheduled meetings are charged back to the government contract. It is far, far cheaper for a government agency to participate in the Symposium than not.

Think of it this way: most CEO-level company executives, and their senior government counterparts, schedule, on average, anywhere from 25 to 75 meetings during the Space Symposium. (That's not a typo. A 14-hour day schedule of 15-minute power meetings is not uncommon. Some executives take as many as 90 meetings during the event.) How expensive would it be to conduct that many meetings in any other environment?

Of course, those are just sort of the nuts and bolts financial mechanics of why participation in the Space Symposium is so very valuable for the government. The larger issue is that which has been so well articulated by the U.S. Travel Association and others—the amazing power of ideas and collaboration that takes place when people come together face to face to meet in a conference or symposium environment.

We fundamentally believe that the communication and information-sharing that takes place during the Space Symposium makes us all better as an industry, as a community and as individuals. Whether we



work for government, industry, academia or non-governmental organizations—our participation in the Space Symposium makes us better and more effective as individuals, as professionals and as employees of our respective organizations. Collectively, we make our organizations better, too.

The exploration, development and utilization of space, whether for civil, commercial, national security, homeland defense, entrepreneurial, academic, scientific or other purposes—is profoundly a team sport. The annual “team meeting” is the Space Symposium—and you cannot play well at a skill position if you do not attend.

All the indicators suggest that the 30th Space Symposium is going to be our best event ever.

The *View From Here* is that it is also government’s best bargain ever. And we look forward to seeing all of you here May 19-22.

By the way, if you haven’t attended the Space Symposium lately, please visit our website for all the details about new programs such as our day long classified session on Space Situational Awareness, our new Technical Track sessions of paper presentations and technical panel discussions, our trail blazing New Generation Space Leaders program, Cyber 1.4 and more!

The Space Symposium infosite is located at <http://www.spacesymposium.org/>

About the author

Named chief executive officer of the Space Foundation in 2001, Elliot Pulham leads a premier team of space and education professionals providing services to educators and students, government officials, news media and the space industry around the world. He is widely quoted by national, international and trade media in coverage of space activities and space-related issues.

Prior to joining the Space Foundation, he was senior manager of public relations, employee communication and advertising for all space programs of Boeing, serving as spokesperson at the Kennedy Space Center for the Magellan, Galileo and Ulysses interplanetary missions, among others. He is a recipient of the coveted Silver Anvil Award from the Public Relations Society of America—the profession’s highest honor.

In 2003, the Rotary National Awards for Space Achievement Foundation presented him with the coveted Space Communicator Award, an honor he shares with the late legendary CBS News Anchor Walter Cronkite and former CNN News Anchor Miles O’Brien. Pulham is chairman of the Hawaii Aerospace Advisory Committee, a former Air Force Civic Leader and advisor to the Chief of Staff and Secretary of the Air Force and a recipient of the U.S. Air Force Distinguished Public Service Medal. He serves on the editorial board of *New Space Journal*.

Euroconsult Analysis: How Will Future HTS Satellites Impact Maritime Telecommunications?

By Capucine Fargier, Consultant, Euroconsult

The maritime SATCOM market has seen tremendous changes over the past ten years, notably with the introduction and growth of maritime VSAT services in C- and Ku-band that allowed for higher throughput and, therefore, a range of new, previously unthinkable IT applications at sea.

2014 may mark another milestone in the maritime SATCOM industry and the entry into the next era of maritime satellite communications with the arrival of High Throughput Satellite (HTS) systems targeting the maritime sector that will allow for yet another major leap forward in terms of telecom applications allowed on board vessels. In 2013, the global maritime satellite communications market comprised around 350,000 active SATCOM terminals, of which the vast majority, more than 95 percent, were still legacy narrowband L-band terminals using the Inmarsat and Iridium systems for voice communications, safety and regulatory compliance. In recent years, growth in the sector has however mainly been driven by broadband applications and increasing data usage, with strong growth in maritime VSAT and MSS broadband systems.

While the overall maritime SATCOM market grew at approximately 4.5 percent in 2013 in terms of active terminals and approximately 10 percent in wholesale revenues, active maritime VSAT terminals increased at a CAGR of over 13 percent in the last three years, nearly doubling since 2005 to more than 11,000 terminals in 2013. Growth of maritime broadband systems was observed across all major maritime verticals such as merchant shipping, passenger vessels, fishing, oil & gas and leisure. It was driven by increasing throughput requirements per vessel, a range of new, bandwidth intense applications for ship operations and crew, and a relative price and performance advantage compared to the

legacy narrowband L-band solutions, for which Inmarsat has raised prices.

In particular, the fast-increasing crew communications on board merchant ships and the increasing demand for passenger communications needs on cruise ships and superyachts have generated huge capacity and throughput requirements in recent years, which cannot be met by MSS services at an affordable cost. For operational communications, new applications such as real-time monitoring, remote engine diagnostics, maintenance, route planning, and electronic port declaration are being adopted by an increasing number of vessels; all of these applications drive growth of on-board bandwidth requirements.

Consequently, the installation of broadband VSAT systems has become inevitable, especially for high-end vessels such as cruise ships, superyachts, offshore rigs, tankers, oil and gas survey vessels and an increasing number of merchant ships.

However, with the ongoing growing need for data and throughput, traditional C- and Ku-band VSAT systems may as well soon reach the limit of what they can provide to the maritime sector in a cost efficient and affordable way for certain market tiers. Therefore, a number of operators have started to invest in HTS multispot-beam systems in Ka- as well as Ku-band, which will allow them to offer higher data rates, better efficiencies, more affordable bandwidth, and smaller equipment to the maritime sector.

The leading MSS operator, Inmarsat, announced its Global Xpress (GX) new Ka-band service back in 2010, with its Boeing contract for the delivery of three Ka-band satellites (I-5), each providing 89 fixed spot-beams. Each of the new satellites will provide over 20 times more capacity than the current satellites in orbit that provide MSS services through L-band capacity.



The first I-5 satellite was launched in late 2013, and two additional I-5 satellites are expected to be launched later this year, for a start of global GX service sometime in early 2015. Inmarsat announced that Global Xpress will be able to provide services of up to 50 Mbps per ship. Although this could be true for the very high-end part of the market, average data rates provided through GX are expected to be much lower.

According to Inmarsat, GX will however still provide about double the capacity of current maritime VSAT offerings for the same or slightly lower monthly fees. While ramping up its installed base of new Ka-band terminals will be an issue in the early years, Inmarsat intends to leverage heavily on its leading position in the sector, its active L-band and Ku-band VSAT subscriber base, as well as its global distribution network.

As one of the major suppliers of maritime C- and Ku-band capacity today, Intelsat as well plans on launching HTS capacity for the maritime market in Ku-band. In 2012, the world's largest FSS satellite fleet operator announced its next generation HTS satellite series, called Epic, with a high performance open architecture design primarily consisting of Ku-band spotbeams.

While Inmarsat GX will be a closed architecture requiring Inmarsat-certificated end user antennas and terminals, Intelsat chose an open architecture strategy for EPIC and intends to leverage on the current installed base of maritime Ku-band terminals. Intelsat claims that EPIC satellites will each provide 25-60 Gbps, typically 10 times more than a traditional FSS satellite. The first Epic satellite, Intelsat 29e, is planned for launch in 2015 and will ensure coverage over the Northern Atlantic as well as the Gulf of Mexico. In total, Intelsat has announced five Epic satellites to be launched over 2015-19. As of today, Intelsat has signed two major maritime customers

on Intelsat 29e; MTN, a service provider focused on passenger ship and government markets, and Harris CapRock, a service provider focused on the offshore and cruise ship markets.

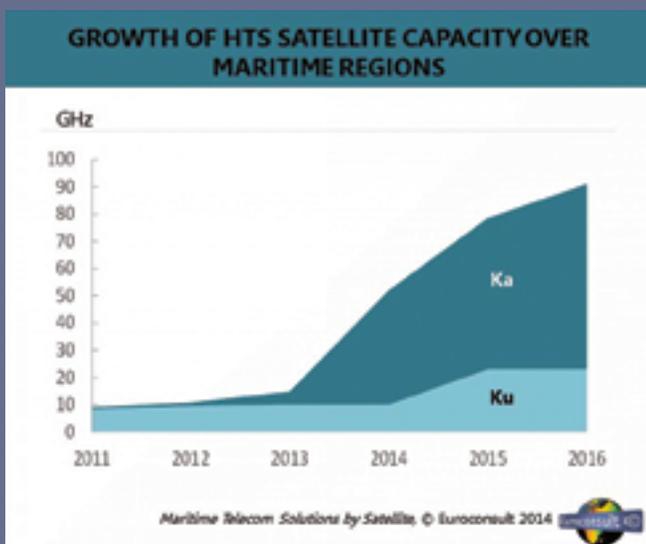
These are merely two examples from a number of HTS systems that will be launched over the coming years, with a number of them providing ocean coverage, including ViaSat-2, Telenor's THOR 7, O3b, Telesat VANTAGE, and several others. In total, Euroconsult expects that with the launch of currently announced HTS systems, the Ku/Ka-band capacity available over ocean regions will increase from approximately 15GHz in 2013 to approximately 90GHz in 2016, a six-fold increase in raw capacity. And HTS systems will also be more efficient in terms of Mbps provider per MHz.

However, one has to be careful when looking at the increase in capacity supply through HTS systems, differentiating the total amount of capacity over ocean regions (aggregate) and the amount of capacity available to a single ship at any given point in the ocean. Given the multispot-beam architecture of HTS systems, the two measures will be substantially different and the available capacity per ship, although growing significantly, may not rise to levels that some reports might suggest. As an example, Euroconsult expects that maximum available capacity for a given point in the Northern Atlantic will increase from approximately 1.7 Gbps today to 4.5 Gbps in 2016.

The impact of this significant increase in capacity over the oceans has to be reviewed in detail, but it is quite certain that new HTS systems will change the way satellite communications are used at sea over the coming years. In early years, SATCOM was mainly used for basic voice and low-data applications for safety applications. With the arrival of broadband services, such as Inmarsat FleetBroadband, Iridium OpenPort, or mini-VSAT services, the market started to use more bandwidth-consuming applications.

As of today, maritime satellite communications moved to fully-integrated IP applications providing Internet access, audio and video streaming, and integration of the ship into corporate networks. HTS systems are expected to significantly increase data traffic and the available bandwidth per vessel, consequently enabling a range of new applications for end users over the coming years.

In late 2013, Microsoft expressed an interest in developing an adapted version of its popular Skype product for use over satellite. Such applications are extremely appreciated by the crew to stay in contact with their family and friends. As part of crew and passenger entertainment, the access to live television and video broadcasting are applications that also gain in popularity at sea. Also e-commerce and the way business is done in general will continue to drive the maritime market.

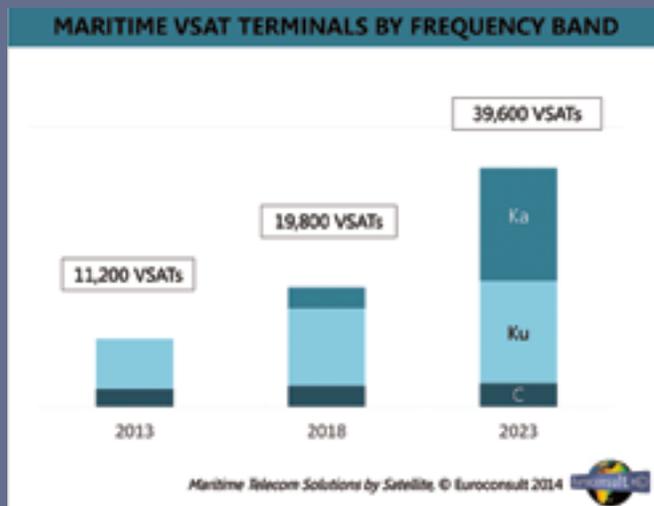


Growth of HTS Satellite Capacity over Maritime Regions

Commercial ships and fishing vessels need real-time information about the market prices of their goods and real-time information systems to adapt routes, ports of destination, and the ability to sell fish stock while the ship is in transit.

Cloud solutions are other examples of applications that drive the need for high throughput connectivity at sea. In addition, applications focused on content could also start to take-up more significantly, enabled by the availability of more capacity. 2013 already marked an increased push from service providers towards a richer suite of value added services—including content and cloud applications.

In May 2013, KVH acquired Headland Media Limited, a media and entertainment services company providing commercially licensed news, sports, movies, and music content in the maritime, hotel, and retail markets. Inmarsat also has plans for a service enablement platform (SEP) that will include an application hosting infrastructure over its future Global Xpress Ka-band network as well as the current FleetBroadband L-band networks. Software companies connected via the platform will need to be approved as certified application providers (CAPs). By the end of 2013, Inmarsat had approximately 75 CAPs, including Microsoft.



Maritime VSAT Terminals by Frequency Band

The addition of contents and cloud applications into the service portfolio could be a differentiating factor for satellite operators and service providers and possibly a smart way to generate additional ancillary revenues, and drive more usage of connectivity. Content such as movies, news, and sporting events broadcasting are increasingly demanded by crew members. The acceptance of such content over satellite mainly depends on the pricing strategy and content quality. The acceptance of applications seems more challenging since it will

take time to discover the crews' specific needs, and to educate ship owners and crew on these new tools. Professional applications will require shipping companies to adopt applications and integrate them into existing operations. However, in the case where such applications could become mandatory, there will be a huge potential addressable market, enabled by HTS systems.

In addition to the vast new range of applications that HTS systems should enable, other impacts of these systems will most likely include a decreasing price per Mbps, a decrease in hardware prices, and ultimately new maritime VSAT markets that would have historically not been addressable for satellite providers.

Growth in number of terminals should consequently be driven heavily by HTS systems in the next ten years with both Ku- and Ka-band in our view coexisting, offering the end user a broader choice of solutions. Euroconsult expects the number of VSAT terminals to grow at an average annual rate of approximately 13 percent over the next ten years to more than 40,000 active maritime VSAT terminals by 2023.

The upcoming launch of HTS systems and services over the next years is expected to drive the maritime SATCOM market, however it will also lead to a number of changes, both on the supply and on the demand side. On the satellite operator and service provider side, Euroconsult expects the market to become more competitive, with lower capacity prices and an increasing focus on value added services. For the end users, the market will likely provide better services with more affordable choices and range of new and exciting applications that were once unimaginable.

About the author

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About Euroconsult

Euroconsult is the leading global consulting firm specializing in space markets. As a privately-owned, fully independent firm, we provide first-class strategic consulting, develop comprehensive research, and organize executive-level annual summits for the satellite industry. With 30 years of experience, Euroconsult is trusted by over 560 clients in 50 countries. We rely on a multi-cultural team of over 30 full-time experts based in Paris, Montreal and Washington, D.C., complemented by a network of senior affiliate consultants

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