

Worldwide Satellite Magazine – March 2017

SatMagazine

**Dear President Trump...
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North America—Leading the Market
Global Comms Require a Dedicated Architect
Risk Reduction for Smallsat Constellations
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The NA Market from the HPA Perspective
The Early Days of SATCOM
Banking on Reliability in Afghanistan
InfoBeam**

**Cover image: an artistic rendition
of a LeoSat satellite on orbit—
images courtesy of Thales Alenia
Space and LeoSat Enterprises.**



SatMagazine

March 2017

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Network Management Suite from Kratos To Assist Cyprus Teleport

Kratos Defense & Security Solutions, Inc. (www.kratos.com) has signed on Cyprus Telecommunications Authority (Cyta), a major international telecommunications hub in the Eastern Mediterranean, to provide Kratos' End-to-End Network Management Suite of products to support the latter's expanding satellite ground operations.

The network management suite will help Cyta scale its international operations by automating network functions and managing customer services and Service Level Agreements (SLAs) more effectively across hybrid satellite and terrestrial networks. The suite will be deployed at the company's Makarios Teleport Station.

The Makarios Teleport hosts a large number of Earth stations providing links to numerous satellites included in Cyta's extensive telecommunications network that delivers a wide range of international telecommunications products, services and solutions.

The network management upgrade is a key element of Cyta's enhancement program, which includes adding advanced services to support satellite operators in satellite control and monitoring operations.

As Bruno Dupas, President of Kratos Integral Systems Europe, explained, "Optimization of network performance and service delivery were two of Cyta's key objectives. The End-to-End Network Management suite configured for Cyta includes Compass® to proactively monitor and manage Cyta's network devices to reduce costly downtime, and, in the event of a device failure, reduce Mean-Time-to-Repair (MTTR) by identifying the root cause of device issues earlier and accelerating the remediation process.



The Makarios Teleport.

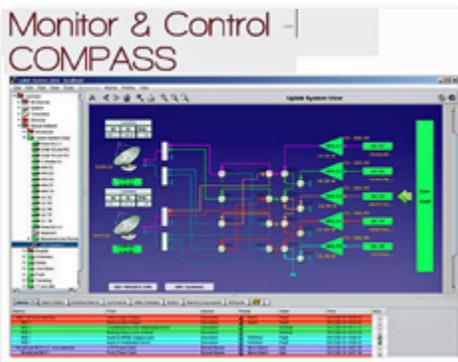
"In addition, Kratos' NeuralStar® SQM organizes and manages Cyta's services across its international network and helps improve service quality assurance. By bridging the management silos, NeuralStarSQM retrieves both device and service data from monitored systems at the Makarios Teleport and integrates it all into a common platform enabling Cyta to identify, prioritize and recover services quickly and improve service level delivery and maximize SLAs."

Makarios Teleport's operations are already supported by Kratos' Monics® integrated RF Monitoring System, which is connected to more than 60 satellite antennas and provides direct visibility to the satellite carriers transmitted and received at the site. Detailed information on the relevant parameters, such as modulation details of wanted and interfering carriers can be readily extracted.

Together, Compass, NeuralStarSQM, and Monics provide an end to end solution ensuring that Teleport personnel are continuously aware of the status of every device and service Cyta provides and can promptly take the necessary measures to address any situation effectively.

According to Costas Agrotis, Manager of the Cyprus Teleports, "Makarios Teleport along with the other two supplementary teleports continue to expand steadily and new equipment and infrastructure is regularly integrated to the existing facilities.

"Our new Network Management System will help us reduce costs and increase Quality of Service (QoS) by automating manual tasks and expediting recovery from network anomalies. It is a key component of our infrastructure enhancement as well as our continued growth."



Orbit Logic Laser Comms Assist

BridgeSat has awarded Orbit Logic a contract to provide their STK Scheduler software product for the BridgeSat Mission Planning System optical ground telescope network to plan laser communication contacts with satellites using their laser downlink services.

Orbit Logic will use their product as the core scheduling engine for the BridgeSat solution, coupled with a web application front end based on the Order Logic web app product. Orbit Logic will also provide software modules to integrate their software products with other BridgeSat ground system elements. Initial system delivery is planned for late 2017.

The BridgeSat Mission Planning System delivered by Orbit Logic will generate validated, de-conflicted, and optimized contact schedules for the BridgeSat ground telescope network to meet customer daily data downlink requirements. Contact scheduling and data transfer monitoring will be fully automated and will account for dynamically changing site weather conditions, bandwidth availability, updated customer requirements, site status, mission priorities, and the latest customer satellite orbit data.

For BridgeSat, the Orbit Logic solution provides a highly capable, low-cost, quick-turnaround, web- and COTS-based configurable scheduling software solution. The STK Scheduler planning algorithms generate optimized schedules in seconds, allowing for dynamic re-planning as needed. The Order Logic web application provides a secure portal with configurable permissions, data access, and workflows for customers to manage and track the status of requests and for operators to control and schedule system resources.



orbitlogic.com

bridgesatinc.com/

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Steerable Antenna for ESA

Gilat Satellite Networks Ltd.'s (NASDAQ, TASE: GILT) expertise has been tapped as well as Airbus and these companies will work on a joint project for European Space Agency (ESA) for an IFC antenna funded by Clean Sky 2 Joint Undertaking (CS2JU), as part of the European Commission's Horizon 2020 program.

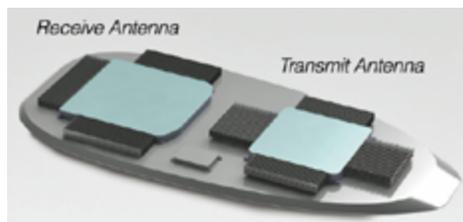
The fully embedded airborne antenna technology will be demonstrated in flight on an Airbus Technology Demonstrator based on the C295 aircraft to support the Clean Sky 2 (CS2) objective for more efficient and greener transport.

Gilat was selected to develop a Ka-band ESA terminal based on its Phased Array Antenna (PAA) expertise.

The antenna array will be embedded into the wing structure of the airframe including the amplification and radiating elements.

The development will include the design, prototyping, manufacturing, and testing "on ground" and "in-flight" of the airborne terminal in collaboration with Airbus.

Gilat will develop the embedded antenna in coordination with Airbus with



the goal to demonstrate a full satellite communication airborne link without impact on the aircraft's performance.

The Gilat ESA aero terminal will be installed into the Airbus Technology Demonstrator for in-flight validation tests planned to be carried out in Seville, Spain, using a satellite with EU coverage.

The phased array technology of the ESA IFC antenna enables high integration and embedding of the antenna into the airframe structure, as part of the panel fairing, which connects the aircraft wing to the fuselage.

The original panels will be replaced by new composite structures with embedded phased array antenna elements, thus eliminating any protruding components.

This solution adds the IFC capabilities

without affecting aircraft performance and maneuverability by avoiding aerodynamic drag and reducing fuel consumption.

The embedded antenna will contribute to the reduction of CO2 emissions thus supporting one of the key challenges of smart, green and integrated transport.

"Gilat is proud that its ESA/PAA technology was selected as the leading de-facto electronically steered antenna solution, for an aeronautical application. The selection by the EC gives us the opportunity to join forces with Airbus, a leading airframe provider, to collaborate on the future development of IFC."

"The technology will support high IFC data rates and its scalable nature supports customization for various aircraft types," said Michael (Miki) Barak, RVP Commercial Aviation and Mobility, at Gilat. "Due to its fast electronically steerable beam capabilities, the solution is suitable for IFC utilizing GEO, MEO and future LEO satellite constellations."

gilat.com/

airbus.com

The Winds Behind Their Fleet Xpress Sails with SMART4SEA Win for Inmarsat

Inmarsat's Fleet Xpress was awarded the SMART4SEA Excellence Award 2017 which was presented by the Greek publisher whose special focus is safer, smarter and greener shipping.

The Excellence Award, presented to Inmarsat after the SMART4SEA Conference in Athens earlier this year, recognized the organization best able to demonstrate technological excellence in smart maritime activity during 2016.

Fleet Xpress, launched in March 2016, provides fast and reliable service for ship-to-shore connectivity critical to the success of smart shipping applications. The SAFETY4SEA, GREEN4SEA and SMART4SEA award winners are selected through online voting, ensuring that recognition comes from industry itself. Voters in the SMART4SEA Excellence Award 2017 category selected Fleet Xpress for its role in advancing shipping's technological excellence and sustainability.

Fleet Xpress is powered by Inmarsat's latest Ka-band satellite constellation, Global Xpress,

and the reliability of L-Band. The service is augmented by the Inmarsat Gateway, which hosts business applications for operations that currently include voyage optimization and video surveillance. Inmarsat is also working with Singtel's Trustwave to develop a ship-specific managed Unified Threat Management (UTM) cyber security solution which will launch in a few months, and this will be offered as a standard option of the Fleet Xpress service.

Securing the 2017 SMART4SEA Excellence Award 2017 rewards the hard work that went into the years of ground-breaking innovative development leading up to the commercial launch of the Inmarsat Fleet Xpress in 2016 and a commitment from over 7500 vessels to use the service," says Drew Brandy, Senior Vice President, Market Strategy, Inmarsat Maritime.

"Fleet Xpress brings the high-speed data, seamless global mobility and continuous connectivity to shipping that deliver greater operational efficiencies. SAFETY4SEA voters include some of shipping's largest ship owners and managers. It is an honor to

emerge victorious from such a strong field and a very high quality shortlist including acknowledged technical innovators in shipping".

"Fleet Xpress has also been recognized for the way it provides better connectivity with family and friends, video on-demand, social media, online training and telemedicine, which not only changes life on-board, but also minimizes the administrative burden," says Apostolos Belokas, Managing Editor of SAFETY4SEA.

"In the period after the Fleet Xpress launch, owners were quick to sign firm commitments, including MOL, 'K' Line Singapore and Nanjing Tankers and this allied with the strategic partnerships with Speedcast, Marlink and Navarino covering migration from other Inmarsat services indicate that SMART4SEA voters are in good company."

safety4sea.com/forum/2017-smart4sea-forum/

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DigitalGlobe's EO Has AI

A hurricane hits a shore town. What is the estimated property damage? A city is doing an inventory of trees. How many are there? An aid group is trying to get food to an impoverished rural population. What's the best location to make a drop?

Answering those and myriad other questions about our planet usually takes painstaking boots-on-the-ground work. However, satellite imagery and advanced machine learning, AKA deep learning, is changing all that.

Anyone who's ever toyed around with Google Earth knows the eyes in the sky can capture amazingly detailed images of what's on the ground. The new AI is now teaching those orbiting cameras what they're seeing.

"The challenge is, how do you convert all those pixels into meaningful information?" said Shay Har-Noy, vice president and general manager of platform at satellite imagery provider DigitalGlobe. And that's exactly what the Colorado-based company is doing.

DigitalGlobe collects about 73 terabytes of satellite images every day, adding to a 16 year running archive of photos of locations around the world.

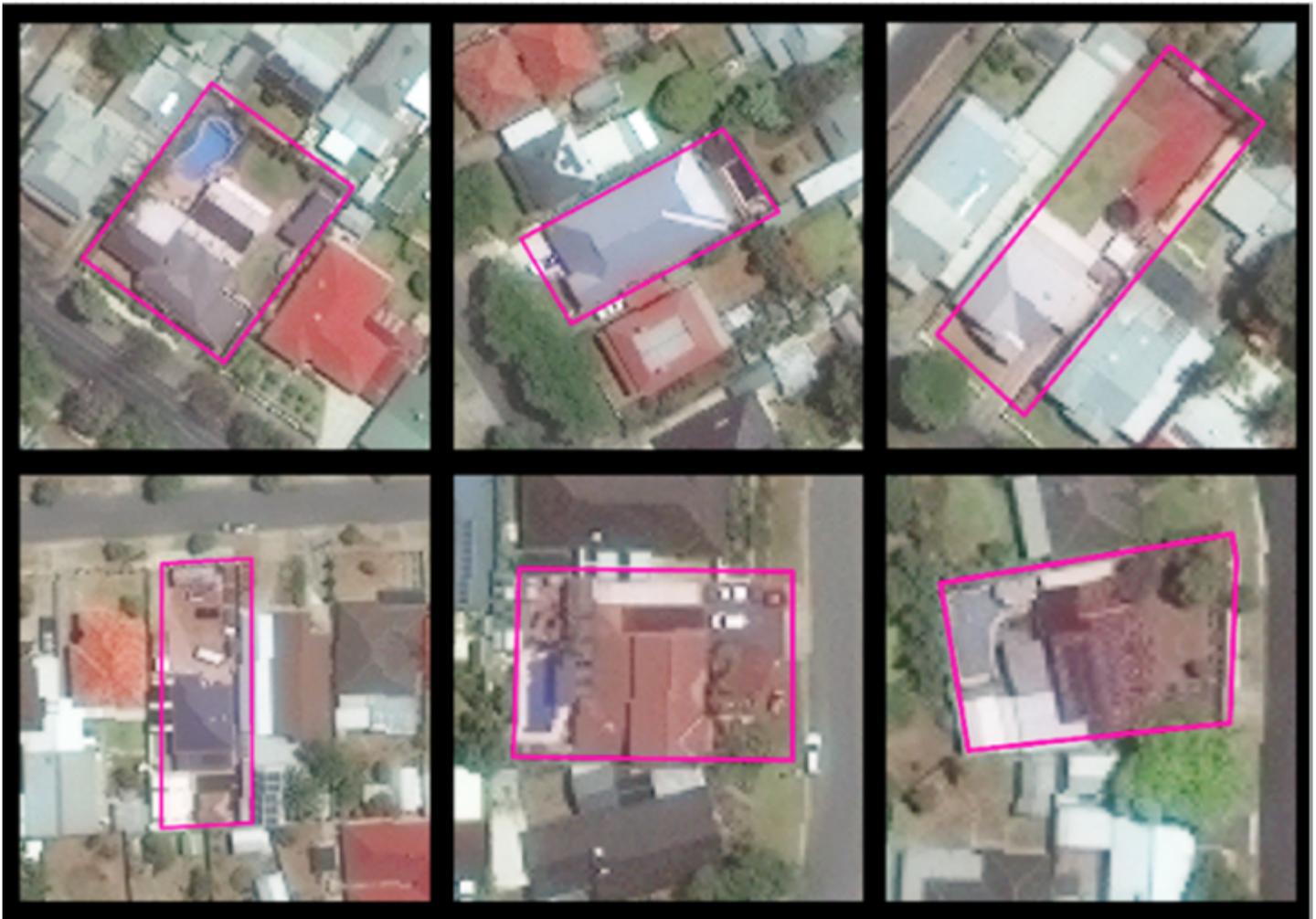
DigitalGlobe has developed a "geospatial big-data" platform it calls GBDX that trains computers to automatically detect relevant objects in those satellite images.

Using deep learning, a technique that harnesses large sets of data to develop multi-layered mathematical structures to

classify images, audio, or text, DigitalGlobe's cloud-based systems can accurately pick out and analyze points of interest in the photos without a great degree of human effort.

That has allowed the company to reach new customers who are interested in accessing structured geographical data they can work with in tools like Excel, but aren't interested in manually sifting through huge sets of raw images.

Potential users range from insurers and investors looking to understand real estate development patterns, to aid organizations aiming to serve populations in sparsely mapped areas of the globe.



Each of the above images contains a pool inside the pink polygon. Note the variability of color, location, size, and visibility. PoolNet is a classifier implemented on GBDX that relies on a convolutional neural network and vast amounts of crowdsourced training data to distinguish properties that contain swimming pools. [Photo: DigitalGlobe]



Airplane recognition results at Beijing Capital International Airport. Photo is courtesy of DigitalGlobe.+

Among DigitalGlobe's new customers is PSMA Australia, a consortium of Australian federal, state, and territorial agencies working with the company to build a national database of info about man-

made structures across Australia.

The database, called Geoscape, saw its first data release last month and is ultimately slated to include satellite-imagery-derived information about more than 20 million structures across the continent.

The GBDX platform relies on the Amazon Web Services cloud to store DigitalGlobe's enormous collection of data—the company was among the first to use Amazon's Snowmobile service, which uses a shipping container filled with data storage equipment to transfer huge volumes of information to Amazon's servers.

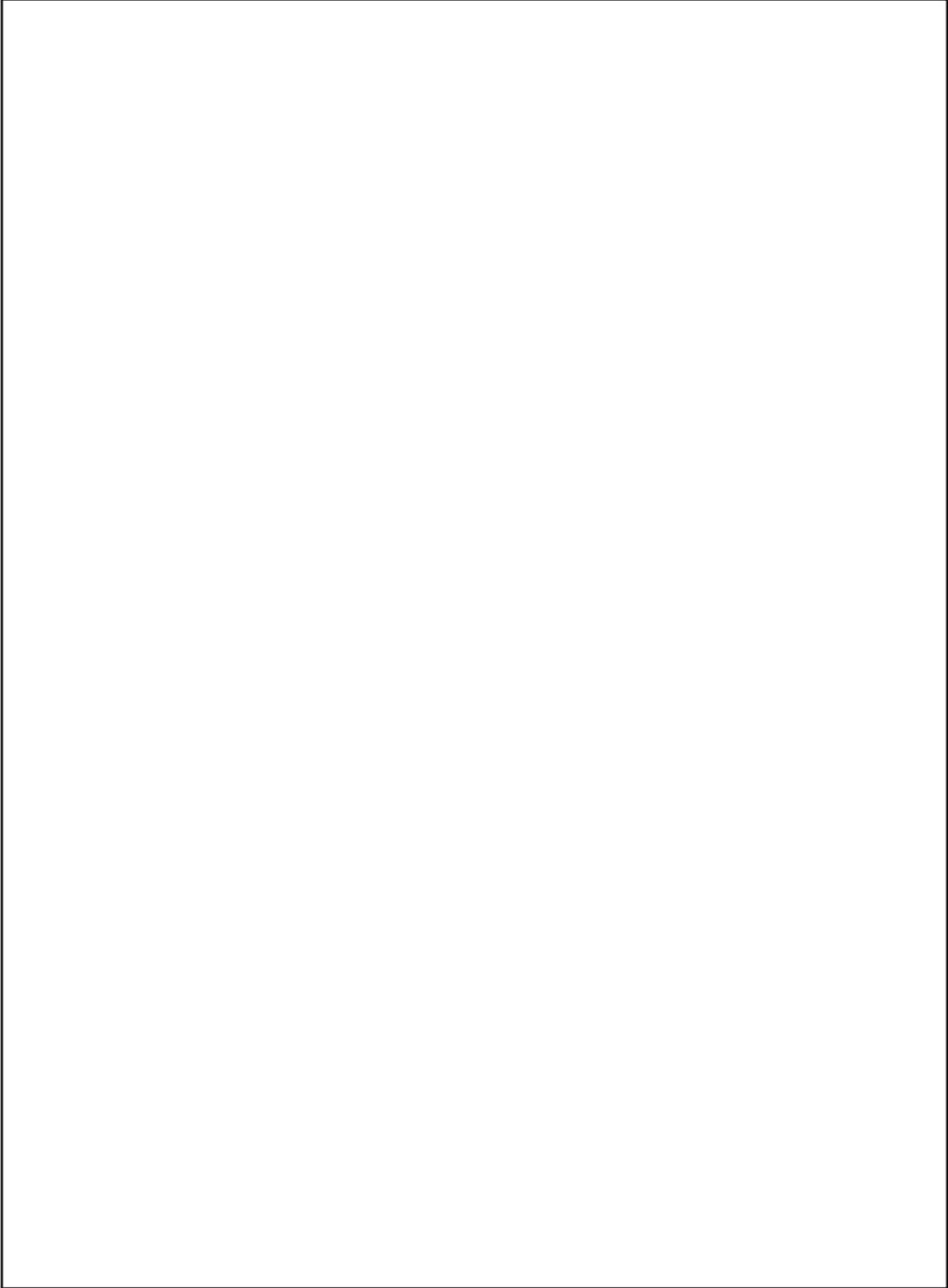
The platform enables developers to process that image data with DigitalGlobe's machine learning algorithms or their own, either for their own use or for resale to their own customers interested in the results.

The platform has also been used for processing data in the wake of natural disasters. After Hurricane Matthew struck Haiti and the southeastern US last fall, DigitalGlobe was able to detect areas covered by water before and after the hurricane and combine those regions with open-source data from OpenStreetMap to determine where roads and buildings were submerged or at heightened risk of flooding.

DigitalGlobe also maintains crowdsourcing networks of people who can quickly hand-label images after a disaster, letting aid workers know where to look for damaged buildings and people potentially in need of assistance.

That technique helped the company provide guidance to nonprofits and first responders after the 2015 earthquake in Nepal, Har-Noy said.

"We were the very first company to capture imagery of Kathmandu, which had a very large amount of damage," he said. "What we were able to do is capture imagery, run it by these crowdsourcing detections in order to detect rubble, destroyed buildings, etc., and we were able to make it accessible to various NGOs that were being deployed on the ground."



Crowdsourcing can also help with training and testing machine-learning algorithms, since human workers from around the world can be paid to quickly label features on satellite images or verify labels applied by machines, he added.

Both crowdsourcing and automation allow DigitalGlobe and their customers to extract more detail from satellite images than ever before, Har-Noy said, and the company is taking steps to protect people's privacy and safety.

The resolution of commercial satellite images, regulated by the US Commerce Department, means people aren't recognizable at the level of detail the company releases, Har-Noy said. DigitalGlobe also doesn't release images of active US combat areas.

"We take privacy very seriously with regard to the information we release, we make accessible, and also that other people derive," Har-Noy said.

Still, machine learning's apparent success in understanding satellite images raises questions about how automated processing of higher-resolution photos, like those from aerial photography, may impact privacy in the future, said Jay Stanley, senior policy analyst

at the American Civil Liberties Union.

"This is part of a larger trend, which is that machine learning and artificial intelligence techniques in general are allowing monitoring to take place on a mass scale that used to be very expensive because it required human attention," he said.

As wide-area aerial imaging, such as the controversial plane-based surveillance reportedly deployed in Baltimore last year and the balloon-mounted cameras used at last year's Summer Olympics in Rio de Janeiro, potentially becomes more common, lawmakers and the public will have to decide appropriate limits on how the technology and data are used and automatically processed, Stanley said.

"These are decisions we're going to have to make as a society if we want to go down the road of allowing us to be monitored by machine," he said. "If you start adding more advanced analytics to a tool like that, you could do some very invasive things."

Article by Steven Melendez,
FastCompany.com

Editor's note: An interesting video featuring James Crawford, the Founder and CEO, Orbital Insight, discusses how GBDX allows the firm to "see" the forest and the trees, simultaneously. The video is available for viewing at:

platform.digitalglobe.com/gbdx/

Skyline Reaching New Heights, Once Again, with DataMiner

Skyline Communications reached new heights again in 2016, as adoption of the firm's DataMiner multi-vendor, end-to-end NMS/OSS software technology continues to gain traction around the world.

With a growth of 35 percent in sales in 2016, and effectively tripling sales over the course of the last three years, the company further strengthens their thought leadership in the field of advanced, next-generation NMS/OSS software for the media industry.

The company was also listed for the third consecutive year in the prestigious Deloitte Fast50 ranking as one of the fastest growing tech companies, and recently announced its plan to hire over 100 new talents to further support its continuous growth in 2017.

Ben Vandenberghe, the CEO at Skyline Communications, reported that the company has experienced continued growth across all geographical areas and in all the individual media industry segments that the firm serves. The scales of deployment keep on increasing very rapidly. Consolidation of the industry, seismic shifts in its business models and

consumer expectations, the need to drive down operational cost and simultaneously increase quality of experience... it all continues to fuel the need for sophisticated end-to-end network management and orchestration software, and DataMiner has become synonymous for that in the media industry.

Recent technology transformations, including major waves of virtualization, make DataMiner an even more indispensable strategic asset for cross-vendor and cross-technology end-to-end orchestration.

DataMiner effectively enables operators to harness the complexity of today's technology ecosystems, while at the same time enabling them to unlock their systems' true potential and flexibility with its powerful orchestration capabilities.

While in the past the solutions and business models offered by customers were pretty much hardwired and locked into their underlying technology infrastructure, there is now an increasing shift towards the overarching end-to-end DataMiner software platform, which serves as the single pane

of glass for end-to-end orchestration of the entire operation.

DataMiner was selected for DVB-T2 in Germany and deployed for the world's largest DTT network by RTRN in Russia, and this after earlier deployments in Vietnam, the Philippines, Singapore, Australia, Norway, Belgium, and so on.

More than 80 percent of satellite operators have deployed DataMiner and the impact there continues to grow massively, fueled by the product's solutions that enable new services over satellite, such as OTT video delivery, new business models such as VNO, and new GEO multi-spot beam and LEO constellations. DataMiner solutions are endorsed by more key technology and system integration companies than ever before.

At present, in each of the market segments, the company has technology integration programs and supply agreements with the vast majority of companies leading the industry to the next evolution.

skyline.be

Curtiss-Wright Has Got the COTS

Italy's ELV SpA (Avio Group) has enlisted Curtiss-Wright's Defense Solutions division to provide a COTS-based telemetry data system for ELV SpA's new mid-sized Vega-C launcher.

And ELV SpA knows what they want as they are the major contractor on the Vega-C Launcher System and GPM Development and Qualification Program for the European Space Agency (ESA).

This agreement represents the first use of Curtiss-Wright's new radiation tolerant Smart Backplane technology on a European launch vehicle.

Under the contract, Curtiss-Wright will provide ELV with a full telemetry system, including data acquisition, data handling, and RF transmission.

The Vega-C development contract runs from January 2017 until first launch in June 2019, with a value estimated at \$5 million. The value of the subsequent production phase is estimated at more than \$10 million over the lifetime of the program.

The Vega-C rocket will be launched from Europe's Spaceport in Kourou, French Guiana. ESA's requirement for Vega-C flights include a minimum of three launches per year, with expected demand for at least four per year.

Curtiss-Wright will develop and manufacture the telemetry system for Vega-C at its facilities in Dublin, Ireland. Ireland's industrial and research participation in the programs of ESA is coordinated by Enterprise Ireland in collaboration with the Department of Jobs, Enterprise and Innovation.



Photo of the Vega W01 launch vehicle, courtesy of ESA.

Despite the Vega-C's mid-size, the craft is designed to deliver government, commercial, and science payloads weighing three tons or less, such as small satellite constellations to LEO while appreciating the goal of keeping the cost down.

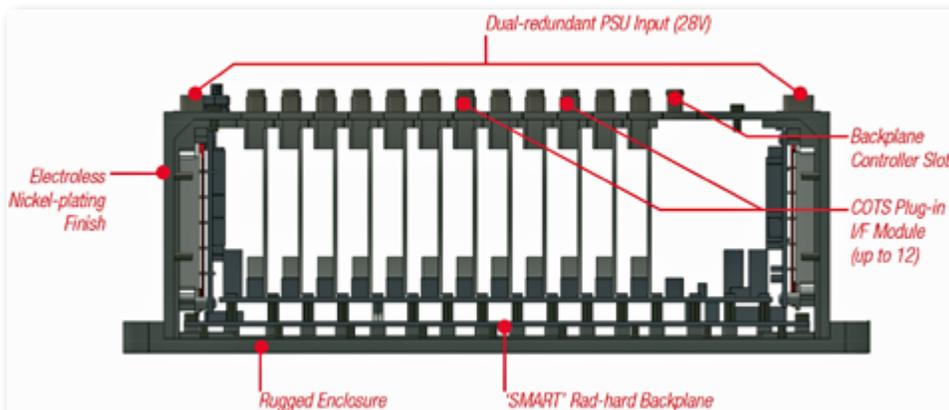
ESA's goal is for the Vega-C launcher to serve as a next-generation launch vehicle that is able to support the same, or greater, mission objectives as the original Vega launcher, but at reduced cost, which is why Curtiss-Wright's cost-effective COTS electronics systems approach was selected to support this challenging goal.

Lynn Bamford, Senior Vice President and General Manager, Defense Solutions

division, declared, "We are very excited about being selected by ELV to provide our cost-effective Space COTS telemetry system for use on the Vega-C, especially as this is our first avionics design win on a European launcher. Our unique Smart Backplane technology enables radiation tolerant electronics to be used in many applications across many market sectors, allowing lower cost COTS modules to be reliably used in harsh space environments."

John Halligan T.D. Ireland's Minister of State for Skills, Research and Innovation added, "This is a significant achievement by an Irish-based operation working at the cutting edge of space technologies. This contract award demonstrates how Irish operations, such as Curtiss-Wright's business unit in Dublin, are developing technologies to the highest levels of performance and reliability for the European space program.

"These technologies have the potential to lead to increased sales in the global market and the creation of high value jobs in Irish operations in line with the Government's strategy for Ireland's membership in ESA."



The Smart Backplane chassis (KAM/CSB/12U) is a rugged 12-user slot chassis that has been designed specifically with space-related data acquisition, data processing and recording in mind.

curtiswrightds.com/space

asi.it/en/agency/companies/elv

Christenson Transportation Truckin' On with ORBCOMM

ORBCOMM Inc. has been selected by Christenson Transportation, Inc. (Christenson) to provide an industry-leading logistics tracking solution for their trailer fleet—ORBCOMM's end-to-end solution will provide wireless connectivity through its proprietary hardware and a web-based reporting platform for optimal fleet management.

A successful truckload carrier based in Springfield, Missouri, Christenson specializes in hauling high-value, high-risk and time-sensitive freight including tires, pet food, paper, electronics and other general commodities for customers across North America.

Christenson is using ORBCOMM's end-to-end telematics system, which is self-powered with solar recharging technology and does not require external power, to track and monitor its dry van trailers located at multiple locations.



The device's ruggedized, sealed and waterproof solar panel provides continuous power to rechargeable batteries, offering reliable service without maintenance or battery changes for the typical life of the asset. The complete ORBCOMM solution installs easily in less than 15 minutes, enabling Christenson to reduce its installation resources and costs by more than 60 percent.

ORBCOMM's solution includes a robust web application with data reporting and analytics capabilities to increase visibility and security of Christenson's dry van trailers, whether they are en route or unhooked sitting in a yard.

ORBCOMM's telematics solution also integrates with the McLeod LoadMaster™ dispatch software platform, enabling Christenson to capture near-real-time asset data every 15 minutes, including operational condition, start/stop reports, scheduled maintenance and GPS position, through one comprehensive system. Christenson expects to complete deployment of ORBCOMM's solution in the second quarter of 2017.

orbcomm.com

christensontrans.com/

SSPI Honors Four as Satellite Hall of Fame Inductees

The Society of Satellite Professionals International (SSPI) on March 7 inducted four new members into the prestigious Satellite Hall of Fame—they joined the leaders who created, sustained and expanded the industry over the past 60 years, including Dr. Arthur C. Clarke, Dr. Harold Rosen, Rene Anselmo, Takuya Yoshida, David Thompson, Eddy Hartenstein, Romain Bausch, Pradman Kaul, Sidney Topol, John Celli, Giuliano Berretta, Mark Dankberg, Peter Jackson and Jean-Yves Le Gall.



The 2017 honorees are Dr. Walter Scott, Founder and CTO of DigitalGlobe; Mary Cotton, CEO of VT iDirect; James Monroe III, Chairman and CEO of Globalstar; and Thomas Choi, Co-Founder and CEO of Asia Broadcast Satellite.

"The 2017 inductees uphold the proud tradition of the Satellite Hall of Fame," said SSPI executive director Robert Bell. *"Their business achievements are remarkable in themselves, whether in creating a new sector of the industry or vastly expanding businesses through vision and innovation. Their careers offer lessons to an industry poised on the edge of revolutionary changes. Their work also dramatizes the immense contributions of satellite technology to human welfare, economic growth, better government, greater security and deeper understanding of our world."*

The latest members of the Satellite Hall of Fame were inducted during a ceremony that was the high point of the 2017 Hall of Fame

Benefit Dinner on March 7 in Washington DC. They were selected by SSPI's Board of Directors under the leadership of Chairman Bryan McGuirk, Chief Commercial Officer of Globecom, and President Dawn Harms, Vice President of Business Development for Boeing Satellite Systems International.

The SSPI Satellite Hall of Fame was introduced in 1987 to recognize the enormous contributions of the visionaries and pioneers who have made possible the age of satellite communications—individuals who have devoted their careers to the advancement of technology and to helping build the political and commercial foundations of the industry.

The 2017 Satellite Hall of Fame Inductees:

Dr. Walter Scott

Founder and CTO, DigitalGlobe

Walter Scott was driving home from a paintball game nearly 40 years ago, according to an article in SpaceNews, when he came up with an idea—one that would help give rise to the US commercial remote sensing industry and change how people see the world.



At the time, he worked at the Lawrence Livermore National Laboratory on space-related projects such as the Brilliant Pebbles missile defense program. When the US Congress passed the Land Remote Sensing Policy Act in 1992—which legalized commercial satellite imaging—Dr. Scott founded WorldView Imaging Corporation. The company won the first government license to collect and sell imagery at a resolution of 3 meters across, then unprecedented outside military and intelligence applications.

The early years of the company were filled with challenge, starting with the need to raise money for something no company had done before. WorldView, as well its new competitors that entered the market, were also plagued by an early string of launch and satellite failures.

With a patient group of investors and Dr. Scott's laser-like focus and sense of purpose—he describes it as "boundless enthusiasm and a lack of common sense"—the company finally launched its first successful satellite, QuickBird, in 2001.

By 2009, the company went public as DigitalGlobe and launched a second satellite with multispectral capabilities. Four years later, it combined with competitor GeoEye, and over the next few years, launched WorldView-3, which offered higher resolution and shortwave infrared sensing, followed by WorldView-4, which doubled the company's capacity to collect images at a remarkable 30cm resolution.

By the close of the firm's 2015 fiscal year, DigitalGlobe had a record \$702 million in revenues after five years of 20% revenue growth. However, the company's financial success pales in comparison to its impact on business, the economy, security, human welfare and our daily lives. Commercial satellite imaging contributes to agriculture, property development and urban planning, energy and mining, government, border protection and national security, disaster response and recovery – the list is almost endless. Most of us carry it in our pocket in the form of Google Maps.

By giving planet Earth a mirror in which to see itself, Dr. Scott has changed the lives of billions for the better.

Mary Cotton

CEO, VT iDirect

September 2017 marks Mary Cotton's 10th anniversary as CEO of iDirect. Mary has led the company through a decade of tremendous growth, guiding the development of new satellite technologies and steering iDirect toward a leading position in key vertical markets around the world.



The company has a remarkable 57 percent share of the VSAT hub market

and has grown to become the leading enterprise TDMA supplier. Eight of the top ten maritime service providers and the top three names in in-flight broadband have made iDirect their platform of choice.

During Mary's tenure, iDirect Government, a wholly owned subsidiary of iDirect, grew its presence to become the leading player in the defense and intelligence communities. Early on, she said *"satellite communications is an unsung part of many networking solutions and the industry tends to think of itself as being marginalized. I look at satellite connectivity as ... something that drives business for our partners and customers."*

That focus on customer value, innovation, and her ability to "see around corners" has translated into substantial success. The company was first to combine TDMA and SCPC technology on one platform, dramatically reducing costs and increasing flexibility.

iDirect Evolution[®], a broadband network platform introduced in 2008, was powering over 1,600 networks with more than 350,000 remote terminals by 2016.

Perhaps the greatest testimony to the company's innovative spirit came with the advent of HTS technology. Under Ms. Cotton's leadership, iDirect won a major contract to develop Inmarsat's Global Xpress ground network infrastructure. Through this partnership and others with leading satellite operators, Mary further secured iDirect's name as an integral player in satellite.

iDirect Velocity[®] and iDirect Pulse[®], were game-changing technologies. Today that innovative drive grows even stronger with transformational iDirect DVB-S2X technology designed to set a new standard for ground infrastructure performance, removing every barrier to growth for partners and customers.

Beyond revenue and market share, however, is the human impact of iDirect's success. The company's technology supports communication with ships that carry the world's trade, and with energy exploration and production that power its economy. Its cellular backhaul technologies connect the unconnected, while portable

VSAT terminals coordinate disaster relief and emergency response. Millions of schoolchildren around the world connect to the Internet and access distance education through iDirect VSAT networks. By driving the growth of her business in service to customers, Ms. Cotton has contributed directly to the world's prosperity, understanding and security.

James Monroe III
Chairman and CEO, Globalstar

Jay Monroe has built companies worth billions of dollars by relying on a sharp eye for changes in technology, changes in regulation and new business or consumer trends.

In the process, he has transformed a bankrupt satellite service provider into an international brand-name company that has saved literally thousands of lives and brought hope to thousands more.



Mr. Monroe was selling equipment for Stewart & Stevenson, a supplier to the oil and gas industry, when he founded the Thermo Companies in 1984 with US\$40,000 he and his wife made from selling their home. He saw an opening to develop co-generation plants under a new energy deregulation law, but his employer did not want to own power plants; it wanted to sell equipment to them. It helped Monroe win \$60 million in financing to build a 76-megawatt plant in Colorado. That was the first of four plants and the Thermo Companies went on to found or acquire companies in natural resource development, industrial equipment distribution, real estate, telecommunications and financial services.

In 2004, Mr. Monroe seized the opportunity to buy a satellite phone company called Globalstar out of bankruptcy, believing it could be turned around by simplifying and reducing prices to attract more customers. After Globalstar restructured the billing model for monthly subscriptions, sales rose 124 percent to \$137 million within three years.

Mr. Monroe both invested and raised more than a billion dollars allowing Globalstar to successfully launch the company's second-generation satellites, offering the fastest mobile data speeds in the industry.

During that time, Mr. Monroe saw a need in the market for an affordable handheld satellite tracking and messaging device, leading to the development of the first generation SPOT Messenger. SPOT, now on its 5th iteration, gives users the ability to share their location data and short messages, to track vehicles and other mobile assets, and to hit an SOS button to call for help. To date, it has documented nearly 5,000 rescues on land and sea.

A satellite Wi-Fi hub called Sat-Fi followed, which has become vital to field operations for businesses, the newest version of which also includes an SOS button embellishing the company's core life-saving message. The company's satellite phone technology is a staple of disaster relief operations as well as being incorporated into communication and tracking systems for aircraft and vessels around the world.

With an entrepreneur's sharp eye for value, Mr. Monroe and SPOT have helped save lives and make the world a safer, more prosperous place.

Thomas Choi
Co-Founder and CEO
Asia Broadcast Satellite

Thomas Choi is a successful serial entrepreneur whose innovations have greatly expanded the contribution of satellite to the economies, societies and people of the developing world. He entered the satellite industry through an executive position with Hughes that made him responsible for all business development in Asia-Pacific.



In 1999, he left Hughes to found SpeedCast, a ground-based satellite service provider, in a joint venture with AsiaSat. SpeedCast focused on providing satellite-based voice and data networks to support such critical industries as maritime, energy and finance, while delivering connectivity crucial to education, government operations and disaster recovery.

In 2005, Mr. Choi left SpeedCast to help found another company, ABS Global. He seized the opportunity created by the sale of the Lockheed Martin Intersputnik-1 satellite to do something highly unusual in the satellite business: launch a business with a working satellite on orbit.

The success of ABS-1, previously LMI-1, made it possible to commission ABS-2, one of the biggest satellites ever launched at the time, for which the company won crucial financial support from the Export-Import Bank of the United States. It was launched in 2014 with most of its capacity already committed. With 89 transponders, the satellite brought a significant increase in capacity over the Middle East, Africa, Asia-Pacific and CIS/Russia to support television distribution and satellite newsgathering, cellular backhaul, broadband trunking and maritime connectivity.

Other satellites followed, either acquired from other operators or ordered by ABS. ABS-3A and ABS-2A satellites were launched in 2015 and 2016 respectively extending the coverage to include the Americas. These additional satellites completed ABS' three satellite build investment of approximately US\$700M and have ushered in the era of highly capital efficient all-electric satellites.

Today the company operates a 7 satellite fleet serving 93 percent of the world's population, and was recently awarded a telecommunications license in Papua New Guinea. By expanding the reach of satellite both in the sky and on the ground, Mr. Choi has enjoyed entrepreneurial success while helping to raise standards of living across the most populous developing regions of the world.

The Society of Satellite Professionals International works to make the satellite industry one of the world's best at attracting and engaging the talent that powers innovation.



With a network of 4,000 members in 40+ nations, and chapters in the US, UK, India, Japan and Nigeria, the Society is the industry's largest membership organization and manages a portfolio of unique programs.

sspi.org/cpages/hall-of-fame

A Proper Grounding for Virgin Galactic Provided by KSAT



A multi-year contract between Kongsberg Satellite Services (KSAT) and Virgin Galactic will provision the former's Ground Station Services for the LauncherOne small satellite launch service.

KSAT will provide telemetry downlink services and contribute to the successful operation of the LauncherOne orbital smallsat launch system.

KSAT will also provide to Virgin Galactic the service from the firm's global network of ground stations, enabling support of launches from a wide variety of launch locations and to all inclinations.

The integration of LauncherOne-specific support equipment at the KSAT ground stations has already commenced, with the Antarctic station being the first to be configured to receive signals from the LauncherOne vehicle.

Hardware to support Virgin Galactic launches to high inclinations is already installed at the Antarctic station.

Within the scope of the agreement, KSAT will also provide LauncherOne tracking from a new ground station located in Long Beach, California, which is home to the LauncherOne program.

Though LauncherOne mission support will have priority access, this new antenna will also be available for use by existing and future satellite constellations.

This new antenna will also expand the capacity and global footprint of the "KSAT lite" NewSpace Ground Station Network.

KSAT CEO Rolf Skatteboe stated that his firm is very pleased to be entrusted with providing mission critical tracking services for LauncherOne flights, and in this way to contribute to the success of the most innovative launcher development. The agreement further strengthens his company's position as a leading NewSpace Ground Station Service provider.

George T. Whitesides, CEO of Virgin Galactic, added that, because LauncherOne makes use of a 747 as a 'flying launch site' capable of conducting missions from any spaceport with an adequate runway, it was critical for his firm to secure access to an excellent network of ground stations without making an investment with their own global network.

ksat.no/

virgingalactic.com/



Inertial Systems Launch by SBG Systems

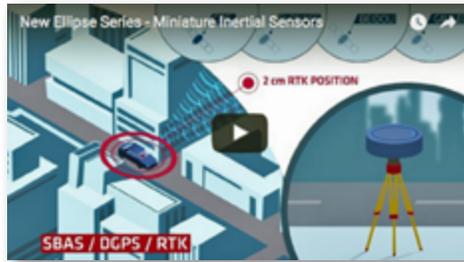
SBG Systems has released a new version of their Ellipse Series line of miniature inertial sensors.

The Ellipse has been greatly improved, showing unmatched performance in attitude measurement while adding Galileo constellation to its GNSS receiver.

After thousands of Ellipse miniature inertial sensors operational on the field, SBG Systems proves again its capability of continuous innovation.

With major improvements, the Ellipse line of miniature inertial sensors strengthens its position as “best combination of innovation, performance, and reliability” while keeping the same form factor and price level.

With low noise gyroscopes and new high performance accelerometers providing superior noise level, the accuracy of every Ellipse models has now improved from 0.2° to 0.1° in roll and pitch.



In addition, the new accelerometers tolerate very high vibration environments (up to 8g). The Ellipse-N model is an all-in-one inertial sensor that embeds a L1 GNSS receiver.

Ellipse-N is already compatible with GPS, GLONASS and BEIDOU constellations. With the addition of GALILEO tracking, Ellipse-N benefits from more satellites, improving the signal robustness in harsh environments.

Ellipse embeds high quality sensors with a greatly improved long-term stability. Sensors are totally integrated in an IP68 enclosure, resistant to dust and water

Every Ellipse sensor is tested and calibrated in temperature and dynamics, to ensure constant behavior in every condition.

Highly robust, Ellipse are guaranteed for two years. This warranty can be now extended up to five years.

And, thanks to a fully backward compatibility design, the new Ellipse series can be used as a drop-in replacement of the previous Ellipse.

No specific action is required in terms of mechanical, electrical or software integration. New Ellipse sensors are available for ordering.

sbg-systems.com/products/miniature-inertial-systems-overview

A Thermal Design Game Changer for Smallsats

Japan's ancient art of paper folding has inspired the design of a potentially trailblazing "smart" radiator that a NASA technologist is now developing to remove or retain heat on small satellites.

Vivek Dwivedi, a technologist at NASA's Goddard Space Flight Center in Greenbelt, Maryland, has teamed with a couple of researchers at Brigham Young University in Utah to advance an unconventional radiator that would fold and unfold, much like the V-groove paper structures created with origami, the art of transforming a flat piece of paper into a finished sculpture. NASA's Center Innovation Fund, or CIF, which supports potentially groundbreaking, high-risk technologies, is funding the effort.



Technologist Vivek Dwivedi, who is standing in front of a sputtering reactor used to deposit vanadium-oxide onto sample substrates for testing, is collaborating with Brigham Young University researchers to develop a radiator ideal for small spacecraft. Photo is courtesy of NASA/W. Hrybyk.

Under the partnership, Brigham Young University assistant professor Brian Iverson and doctoral student Rydge Mulford are advancing the design of a three-dimensional, foldable radiator, while Dwivedi is developing a coating to enhance the radiator's heat-shedding or conservation capabilities. This novel radiator controls the rate of heat loss by performing shape-shifting maneuvers.

The resulting topographical changes could be achieved with temperature-sensitive materials like muscle wire or shape-memory alloys. As temperature-sensitive materials experience a change in temperature — caused by spacecraft electronics or the absorption of heat from the Earth or sun — the radiator could automatically change its shape to either shed or conserve heat.

The deeper the folds or cavities, the greater the absorption, explained Mulford, adding that scientists have investigated the use of cavities to affect heat loss for nearly 100 years, but no one has approached the challenge in quite this way. "Origami allows you to change the depth of these cavities in real time, thereby changing the heat loss from a surface in real time," he said.

The team, however, wants to take the concept one step further.

Brigham Young assistant professor Brian Iverson and doctoral student Rydge Mulford have teamed with NASA technologist Vivek Dwivedi to advance the design of a three-dimensional, foldable radiator, inspired

Dwivedi, meanwhile, is working to advance a highly emissive coating principally made of vanadium oxide, a transition metal oxide. Dwivedi's idea is to then apply the special coating on the origami radiator. He also is investigating its potential use on other spacecraft components, including solar-array panels. In testing, vanadium-oxide has shown that it transitions from a semiconductor to a metal state when it reaches 154 degrees Fahrenheit. The changeover causes an increase in emissivity, Dwivedi said. Because satellites encounter wildly fluctuating temperature changes on orbit, Dwivedi's goal is to lower the transition temperature.

In collaboration with Raymond Adomaitis, a professor at the University of Maryland in College Park, Dwivedi plans to lower the

transition temperature by applying very thin films of silver and titanium to the vanadium-oxide using sputtering and a technique called atomic layer deposition, or ALD.

ALD is performed in a state-of-the-art reactor developed by both Dwivedi and Adomaitis. With ALD, engineers literally can apply atomic-sized layers of different materials onto intricately shaped structures — much like how a cook layers different ingredients to make a pan of lasagna.

"The combination of origami and a vanadium-oxide-based coating would be the first time two different variable emissivity devices have been combined into one structure," Iverson said.

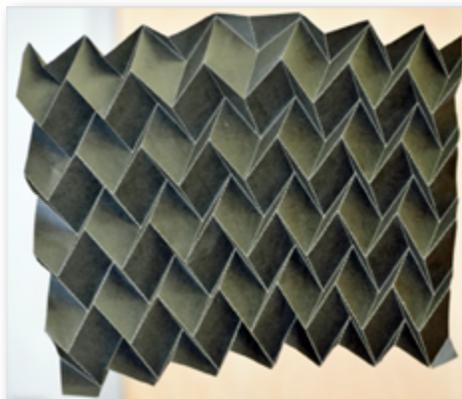
By combining both technologies, the team believes it can create a smaller, more efficient radiator ideal for use on CubeSats, tiny spacecraft that are growing in popularity due to their relatively low cost. Such a radiator, Iverson said, could be easily attached to any spacecraft surface where heat needed to be rejected.

While early in its development, the origami radiator couldn't come too soon, particularly for use on CubeSats. Traditional radiators typically are flat and heavy, not lending themselves to installation on a satellite measuring as little as four inches on a side.

"This approach has the potential to be a game changer in thermal design," Dwivedi said. "Our goal is to replace traditional radiators with dynamic ones, period."

gsfctechnology.gsfc.nasa.gov/

Article by Lori Keesey
NASA's Goddard Space Flight Center



Brigham Young assistant professor Brian Iverson and doctoral student Rydge Mulford have teamed with NASA technologist Vivek Dwivedi to advance the design of a three-dimensional, foldable radiator, inspired by the art of paper folding. Still early in its development, Iverson and Mulford are experimenting with different shapes to determine which configuration would work best as a radiator. Photo is courtesy of Brigham Young University.

SolAero Technologies Building Up for Satellite Solar Panels Biz

SolAero Technologies Corp. (SolAero) has initiated a \$10 million program investment to augment their existing solar panel production capabilities to support the growing market for commercial satellite constellations.

This commitment includes the construction of a new 40,000 square foot facility at its headquarters in Albuquerque, New Mexico.

Once complete, this facility will contain the world's only vertically-integrated, end-to-end satellite solar panel production capability.

The project will create more than 100 new jobs at SolAero and its partners and will represent the leading industry benchmark for space solar power technology.

In June, 2016, SolAero was selected by Airbus OneWeb Satellites (OneWeb) to supply solar panels for the OneWeb constellation of LEO satellites.

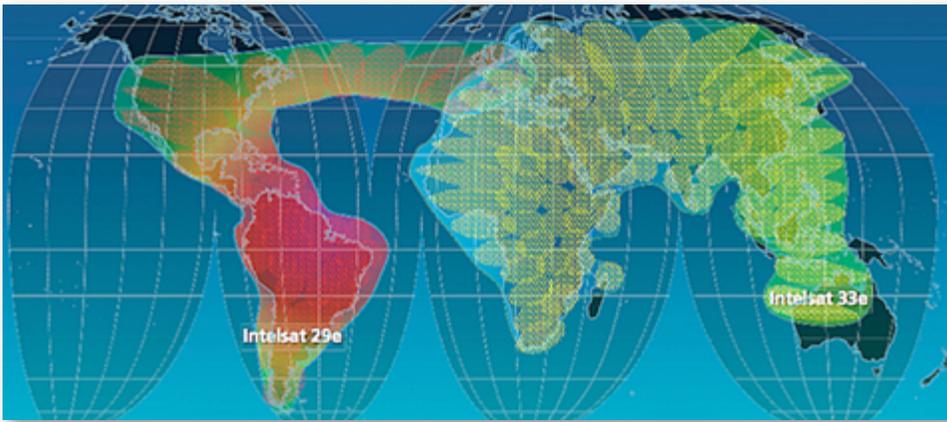


OneWeb plans to create a global gateway by deploying a constellation of LEO satellites that will bring affordable Internet access to the world. SolAero's investment ensures its ability to support OneWeb's objectives, now and in the future, while establishing an unparalleled production capability for satellite solar panels.

SolAero's prior successful experience designing and manufacturing power systems for satellite constellations, such as Sierra Nevada's Orbcomm Generation 2, Orbital ATK's Commercial Resupply Services and SSL's new class of imaging satellites, provides OneWeb with the distinctive heritage SolAero has in meeting the demands of high volume production with demanding cost and schedule targets.

solaerotech.com/

Romantis Secures Services on Intelsat



A twosome will together provide Occasional Use (OU) services to broadcasters in Russia and the CIS region.

Intelsat announced that Romantis has secured services on Intelsat 33e to enhance its Occasional Use (OU) services to broadcasters in Russia and the CIS region.

Intelsat 33e, the second satellite in the Intelsat Epic^{NG} platform, operates at 60 degrees East and delivers high-throughput services for Europe, the Middle East, Africa and Asia.

This satellite enables Romantis to perform better, improve availability and expand coverage for their OU customers operating in this region.

Intelsat 33e's powerful spot beams deliver greater throughput to smaller antennas for Satellite News Gathering (SNG) professionals.

"Intelsat has been an essential part of media services for many years and enabled us to substantially expand our business and respond to our customers' strong demand for premium broadcast services," said Dmitry Belyaev, CEO, Russian subsidiary of Romantis Group.

"We are transitioning our OU services to Intelsat 33e to take advantage of the higher level of service, greater flexibility and expand our service reach over a much greater geographic area. Intelsat 33e enables us to differentiate ourselves from competitors by delivering the high-quality content their viewers demand in a more cost-efficient manner."

"Intelsat Epic^{NG} is delivering on the promise of HTS and will support the growth of broadband providers and media organizations with higher performance, improved economics and simplified access as the media sector continues to evolve," said Jean-Philippe Gillet, Intelsat's Vice President, Europe, Middle East and Africa.

"With Intelsat 29e, we became the first satellite operator to provide next-generation high throughput satellite spot beams to support Occasional Use coverage at the Olympic Games. This same service will now be available across Europe with Intelsat 33e and available as Russia prepares to host global events such as the 2017 FIFA Confederations Cup and the 2018 FIFA World Cup."

SoftBank to Market OneWeb Services

Japanese operator SoftBank, a majority stakeholder in Sprint, will be marketing wholesale satellite backhaul services to mobile companies across the globe.

The role follows SoftBank's \$1 billion investment in the OneWeb satellite project in December of 2016, part of a \$1.2 billion funding round.

OneWeb, whose other backers include Qualcomm, Airbus, Bharti Enterprises, Hughes Network Systems, Intelsat and Virgin, will be an LEO network of 720 smallsats that will connect new base stations in remote areas with very low latency.

Discussions have already started with possible partners in the mobile industry. OneWeb will supply terminals that will deliver

mobile and WiFi signals in the immediate area and connect with the company's satellites 1200 km above the Earth — a distance that means round-trip latency of only 8 ms.

OneWeb CEO, Eric Béranger, stated that the focus will be on remote and unconnected area. There are 55 million US citizens who are unconnected and 61 percent of Asia and the Pacific are unconnected or badly connected.

OneWeb will also be able to provide connections to ships and aircraft. The entry of SoftBank was a very important step for the company—SoftBank will want to market OneWeb services to every part of the world.

The first 10 OneWeb satellites are due for launch in early 2018, with the entire fleet of 720 due to be in service by the close of 2019.

softbank.jp/

oneweb.world

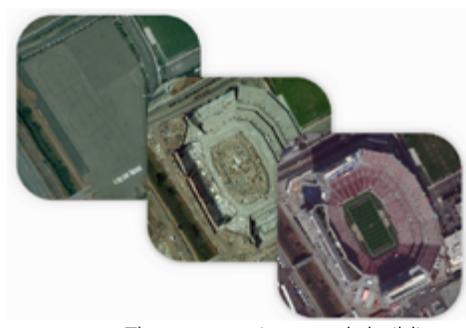


SpaceKnow Garner Additional Millions in Series A Financing

Founded in 2013 in San Francisco, California, SpaceKnow's mission is to provide transparent access and analysis of satellite imagery to the world.

The company has now raised \$4 million in Series A financing, led by BlueYard Capital and previously existing investor, Reflex Capital. This investment brings the company's total funds raised to approximately \$5.5 million. Jason Whitmire, Partner at BlueYard, will join the Board of Directors. The funding will be used to further develop the SpaceKnow Artificial Intelligence software for economic monitoring, increase hiring and scale up its worldwide operations and sales forces in the US, Europe and Asia.

SpaceKnow is now the leading provider of targeted industrial and geographical intelligence and distributes the China Satellite Manufacturing Index™ and the Africa Night Lights Index to all 350,000 subscribers of a premier financial services



company. The company is currently building an indexing artificial intelligence that will scan, understand and describe every square inch of the surface of Earth daily using satellite imagery. SpaceKnow believes this radical initiative will usher in a new era of “accessible transparency” which will increase global prosperity, security and peace.

Integral to the current trajectory of growth for SpaceKnow has been its partnership with DigitalGlobe—Shay Har-Noy, VP and General Manager, Platform at DigitalGlobe, stated that

SpaceKnow is a key element of DigitalGlobe's GBDX ecosystem, where their products and innovation are helping to make analysis of the planet from high resolution imagery accessible to new markets at a scale like never before.

Pavel Machalek, Co-Founder of SpaceKnow, related that his company is hard at work to bring deep learning artificial intelligence-driven transparency obtained from satellite imagery to a wide market and to then build on such success in the finance, defense and construction verticals.

Jason Whitmire, Partner at BlueYard, added that his firm believes SpaceKnow is uniquely positioned to sustainably produce highly specific, unbiased knowledge of socio-economic, environmental and defense trends that paint a fuller picture of the performance of one company, an entire industry or even governments and economies.

spaceknow.com

Dear President Trump: What the Smallsat Industry Needs... A Spaceflight OpEd

By Curt Blake, President, Spaceflight Inc.

With a new administration in Washington, the growing smallsat industry is anxious to see what changes are on the horizon.

As you and your administration get up to speed on the commercial space industry, we'd like to offer some background on the smallsat industry and highlight a critical issue we hope you'll consider: access to international launch vehicles.

This is an incredible time for the American commercial space industry. While there were only a few major private players during the Cold War, now there are a multitude of US companies entering the market, particularly in the small satellite category. These companies want to get satellites on orbit for a wide variety of purposes.

Missions that were once only possible for nation states are now commonplace for private companies, and are fueling innovation and jobs. The missions of these small satellites range from gathering weather data, mining asteroids, imaging global conflicts, conducting medical experiments and more. Smallsats are tools in space to grow businesses on Earth.

These payloads are creating entirely new markets for data, and products are being created by these payloads. They are bringing a resurgence of high-paying technical and manufacturing jobs in the US, as well as creating exciting opportunities for export.

These nascent companies in the smallsat industry have many challenges in getting to space, and thus profitability; however, there is one in particular that I would like to address: the lack of capacity in domestic launches.

Quite simply, there are not enough US launches to meet the demands of the ever-growing number of smallsat companies.

At Spaceflight, we acquire capacity and provide rideshare services on almost every launch vehicle available, including the US-based Falcon 9, the Orbital ATK Antares, Russian Soyuz and Dnepr as well as the Indian PSLV.

We help smallsat companies find and facilitate a launch to the orbit they need—we are launch vehicle agnostic. Even so, there are still not enough launches to meet all of the needs of emerging smallsat companies.

Contrary to popular belief, foreign launches are not less expensive than domestic ones—additional regulations and monitoring fees for international launches add to the cost that is already above US pricing.

Existing US-based launches are still the most cost effective route to space for our customers. While some new players are emerging in this area, none have, as of this writing, flown—many years will pass before they are operational and sufficient to cover the needs of the US market.

Crucial for our industry is that the new administration does nothing to hinder, or limit, access to foreign launches while the US takes the time to develop new launch providers or expand capacity on existing ones.

Your new administration should continue to allow US payloads to launch on international vehicles until there are proven alternatives.

Furthermore, multiple options will create a robust environment for competitive pricing and availability/scheduling, allowing smallsat companies the most efficient options for launch.

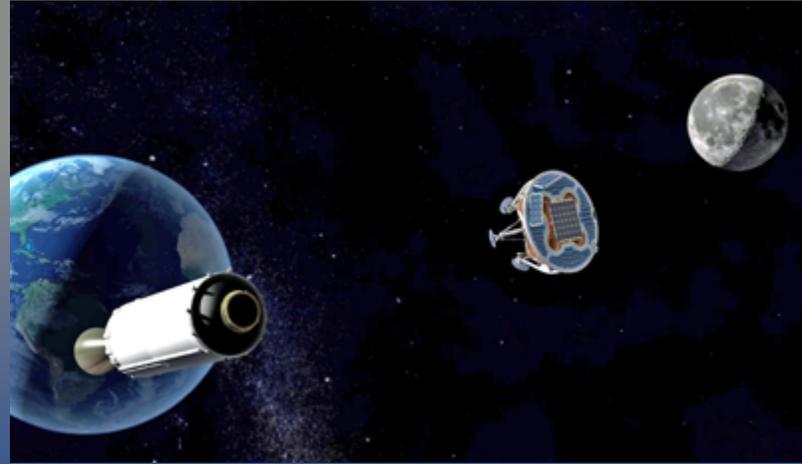


In contrast, insufficient capacity for launch will cause the demise of many promising domestic smallsat companies.

- *The smallsat industry represents the best in American technology and entrepreneurship*
- *Smallsats will help us understand our planet, protect US interests, secure our borders, aid in humanitarian missions, and monitor economic assets around the globe*
- *Smallsats also create high-paying technical and manufacturing jobs, all the while driving innovation.*

We ask the current administration to allow these international launch options that are critical to the smallsat industry and to support the efforts and policies that expand—not restrict—access to space.

Limiting launch options will only hinder or halt the economic growth of this burgeoning American industry.



Curt Blake, president of Spaceflight Inc., has more than 25 years of executive experience in high-growth and tech industries. He previously served as senior vice president and general counsel for Spaceflight, leading efforts to expand its global network of launch service providers while building relationships with key commercial-, civilian- and defense-related customers.

Prior to joining Spaceflight, Blake held a range of senior executive and general counsel roles at Microsoft, Starwave, Corbis and Aldus. He is a current member of the Commercial Spaceflight Federation Board and contributor to numerous smallsat conferences.

www.spaceflight.com



Find Your Islands of Truth in Uncertain Waters... A Newtec Perspective

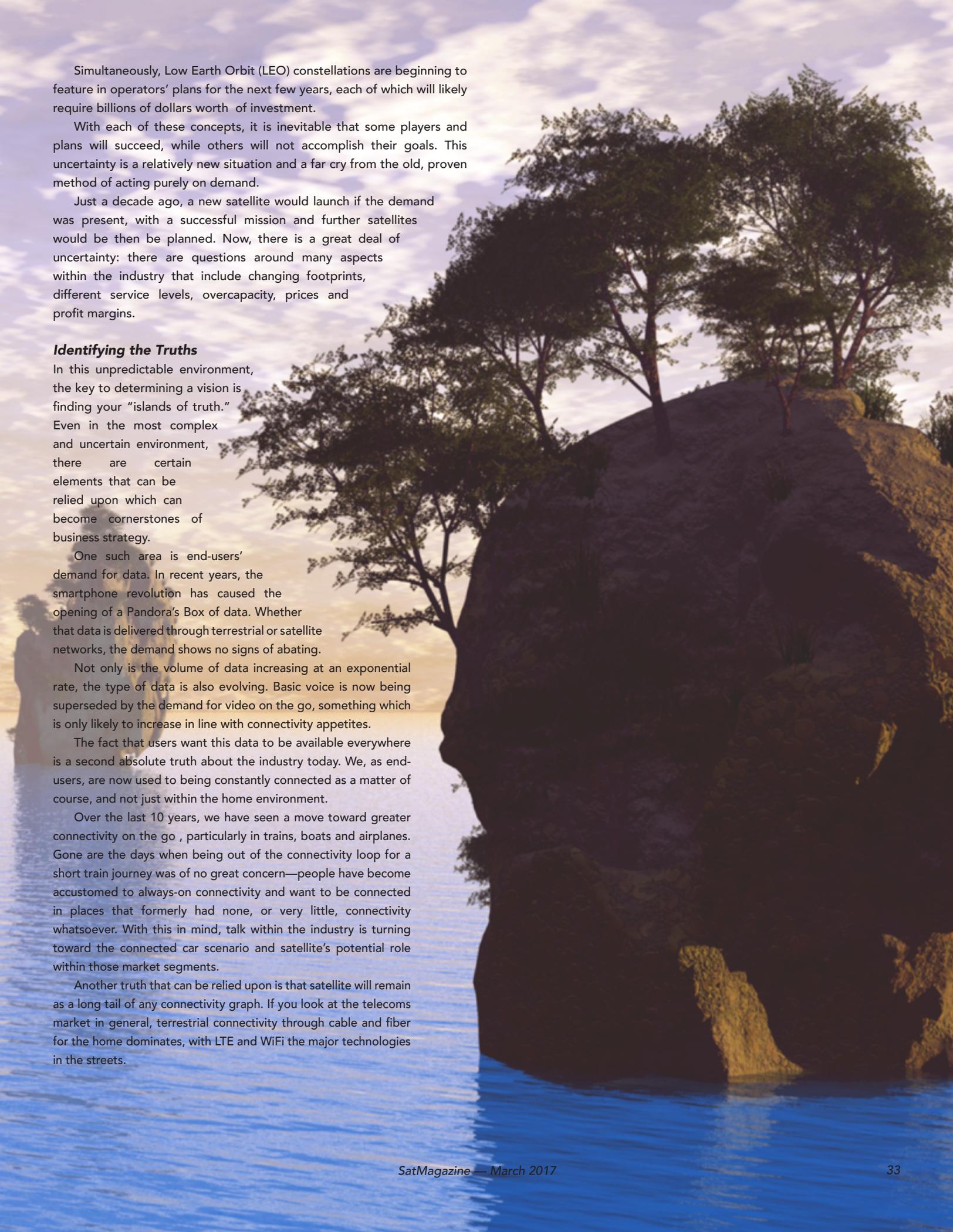
A Talk with Thomas Van den Driessche, Chief Executive Officer, Newtec

After the end of the Cold War, the United States Military coined the acronym VUCA to describe the Volatility, Uncertainty, Complexity and Ambiguity of the world they now

faced, which was forcing them to act differently and take decisions in ways they hadn't had to before—fast-forward a quarter of a century and the term can be used to accurately sum up the current landscape of the satellite industry.



The challenges faced by the industry come with positives, but certainly fit the VUCA description. A large number of High Throughput Satellite (HTS) platforms are being launched by operators, creating overlaps in time and geography, which creates inherent uncertainty.



Simultaneously, Low Earth Orbit (LEO) constellations are beginning to feature in operators' plans for the next few years, each of which will likely require billions of dollars worth of investment.

With each of these concepts, it is inevitable that some players and plans will succeed, while others will not accomplish their goals. This uncertainty is a relatively new situation and a far cry from the old, proven method of acting purely on demand.

Just a decade ago, a new satellite would launch if the demand was present, with a successful mission and further satellites would be then be planned. Now, there is a great deal of uncertainty: there are questions around many aspects within the industry that include changing footprints, different service levels, overcapacity, prices and profit margins.

Identifying the Truths

In this unpredictable environment, the key to determining a vision is finding your "islands of truth." Even in the most complex and uncertain environment, there are certain elements that can be relied upon which can become cornerstones of business strategy.

One such area is end-users' demand for data. In recent years, the smartphone revolution has caused the opening of a Pandora's Box of data. Whether that data is delivered through terrestrial or satellite networks, the demand shows no signs of abating.

Not only is the volume of data increasing at an exponential rate, the type of data is also evolving. Basic voice is now being superseded by the demand for video on the go, something which is only likely to increase in line with connectivity appetites.

The fact that users want this data to be available everywhere is a second absolute truth about the industry today. We, as end-users, are now used to being constantly connected as a matter of course, and not just within the home environment.

Over the last 10 years, we have seen a move toward greater connectivity on the go, particularly in trains, boats and airplanes. Gone are the days when being out of the connectivity loop for a short train journey was of no great concern—people have become accustomed to always-on connectivity and want to be connected in places that formerly had none, or very little, connectivity whatsoever. With this in mind, talk within the industry is turning toward the connected car scenario and satellite's potential role within those market segments.

Another truth that can be relied upon is that satellite will remain as a long tail of any connectivity graph. If you look at the telecoms market in general, terrestrial connectivity through cable and fiber for the home dominates, with LTE and WiFi the major technologies in the streets.



Innovation

An important factor to remember with this innovation in space is that it must be matched on the ground. If the ground segment doesn't keep pace with the fast-moving HTS and LEO technologies, we as an industry will never realize the full potential impact of those technologies.

Most of these new innovations are disruptive in some way or other, meaning that innovation must be reflected in the ground segment technology if the premium services they enable are to be successfully delivered.

This is a case of synergy. Taking HTS, as an example, there are gateways and feed beams connecting to multiple satellites—you automatically need a ground segment that matches the denseness of this technology as well as scalable enough to handle 50 or 60 beams. With so many different technologies in the marketplace, operators and service providers need their ground segments to have this synergy with each of them to ensure that they aren't the weak link in the chain.

Reacting to Innovation

Changing customer behaviors have arguably been the biggest driver of these changes. When you look at the specifications of a modem from 10 years ago, for example, they are quite different to the ones we have today because the last decade has seen

a seismic shift in how people consume data. This is indicative of the changes that are happening throughout the satellite market. In more certain times, it was clear what you needed to do to be successful and, once you found your own way of doing it, you could continue quite happily for years.

While there is still the need to optimize costs and possess that mastery of experience, the current environment is more about making the correct decisions in situations that you may not have faced before, using that experience as a guide rather than a roadmap. This uncertainty and volatility can create chaos, but these islands of truth create a sense of order in the storm. On this border between chaos and order is where true innovation can be created.

Thomas would be delighted to receive your comments on this topic: follow Newtec and Thomas on LinkedIn.

newtec.eu

Thomas Van den Driessche holds a Master's degree in electronics and marketing from the University of Ghent. Thomas started out as a Product Manager in the broadcast and AV market and was presented awards several times by leading organizations such as NAB, Infocomm and Vanguard.

Over the past 15 years, he has been active in the broadcast and satellite markets. Thomas Van den Driessche has been with Newtec for nine years and has held various positions. His latest roles included Sales and Business Development Director Europe, the Vice President of Market Strategy and Chief Commercial Officer. In January of 2017, Mr. Van den Driessche was named the CEO of Newtec.

In terms of percentages, this is where the mass market lies, but the long tail completes the remainder of the picture. Satellite shouldn't necessarily be viewed as a competitor for this mass market as it performs a completely different role for an entirely separate demographic.

In areas where the investment in terrestrial infrastructure hasn't been forthcoming because such doesn't fit the mass market approach—remote rural regions, oil rigs, planes and other vehicles—satellite can provide a solution. However, though satellite remains the long tail, the window of opportunity for satellite is constantly moving in conjunction with the ever-moving industry trends.

The 5G Question

Opportunities such as the advent of 5G will be an area where terrestrial connectivity may well require a boost from satellite, providing an example of how the windows of opportunity for the satellite industry are constantly changing. 5G's promise of ubiquitous connectivity can be achieved within dense fiber areas through cabling, antennas and small cells; however, once out of a city, users are missing a link. In that instance, satellite can be used to complete the loop and will be able to maintain that connectivity. If the proposed LEO constellations over the next few years are successful, they will significantly lower the cost of capacity and, in turn, create greater opportunities for satellite within the telecoms industry.

SSL Selected: Space Station Satellite Servicing

A major project has been awarded to Space Systems Loral (SSL) by the US Defense Advanced Research Projects Agency (DARPA)—a space service station for satellites called the Robotic Servicing of Geosynchronous Satellites (RSGS) program. SSL will develop the ability to service and maintain spacecraft and other infrastructure in the geostationary arc.

This will most likely be the foundation of a new business for SSL that will serve both commercial and government operators with repair, upgrade, relocation, and refueling of on orbit assets.

SSL and DARPA will each contribute their expertise to the program. SSL is expected to provide a spacecraft, based on their leading platform, to carry the robotic servicing payload and will manage integration and operation of the spacecraft. DARPA will contribute the robotics technology, expertise, and a government-provided launch. MDA will add a refueling capability to the RSGS program.

The work scope for the DARPA mission will be performed by SSL in its US facilities by its US staff.

When launched, RSGS will have the capability to perform multiple servicing missions for both planned and urgent customer needs, including:

- » High-resolution inspection
- » Refueling
- » Correction of mechanical anomalies
- » Assistance with relocation and other orbital maneuvers
- » installation of attachable payloads, enabling upgrades to existing assets

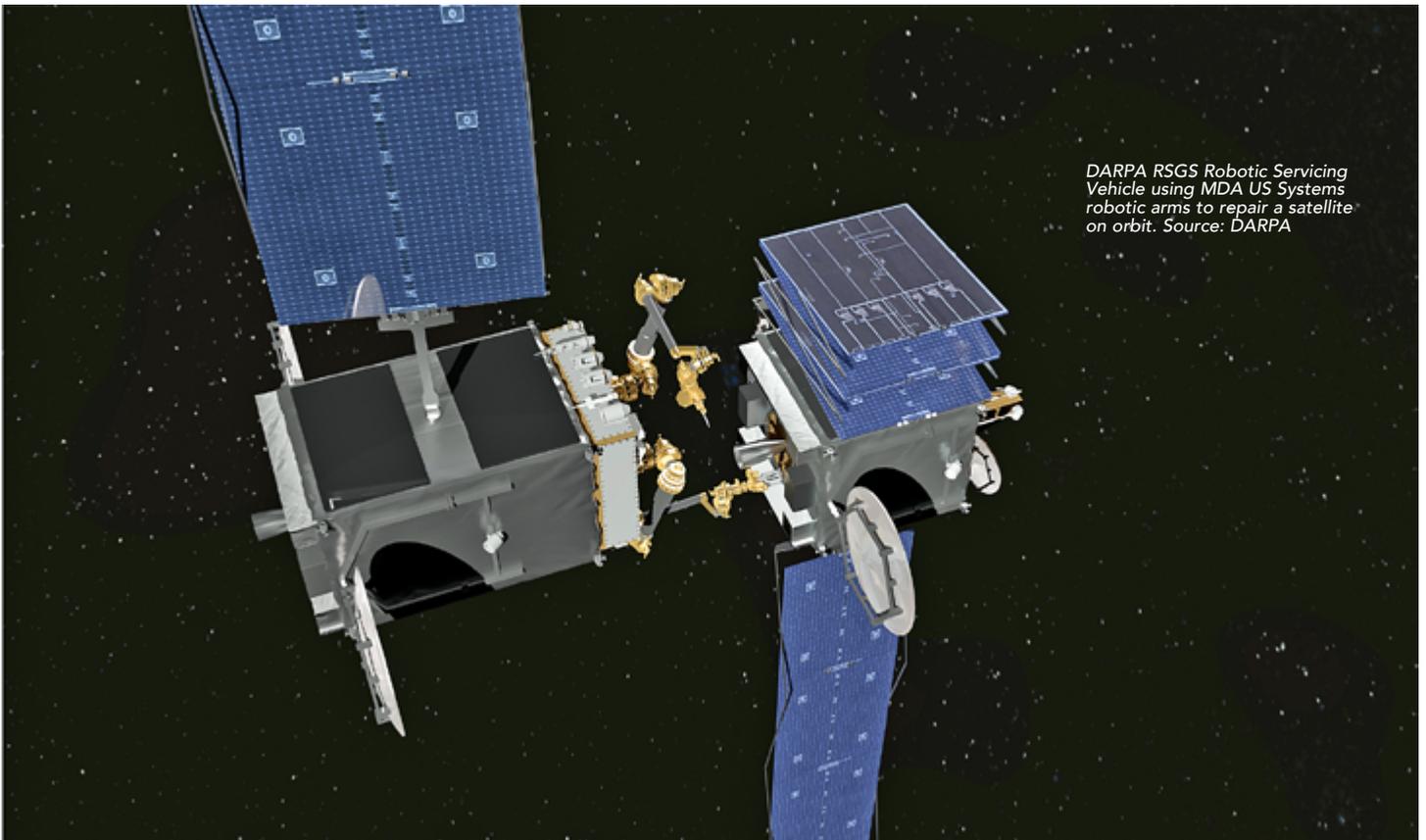
The company will market these services as a commercial business and is already in discussion with several key customers.

Last year SSL announced that the firm is working with the US Naval Research Laboratory (NRL), through MDA US Systems, based in Pasadena California, to design and build robotic arm flight hardware for the RSGS program.

"This will be SSL's first spacecraft contract with the Department of Defense in recent years and it is the third time that we have been selected by the US government for a major program in just two months, following our recent selections for NASA's Restore-L and Psyche missions," said Howard Lance, chief executive officer, SSL MDA Holdings. "It clearly demonstrates the success of our strategy to bring the benefits of our commercial business to a broader audience and to grow our business with US government work."

Steve Oldham, senior vice president, strategic business development, SSL added, *"RSGS's capability will be marketed to both commercial and government satellite operators, providing them with unprecedented flexibility in fleet management and capital deployment. Refueling provides a compelling value proposition and our sophisticated robotic capability will enable new on-orbit applications only available from RSGS."*

sslmda.com



DARPA RSGS Robotic Servicing Vehicle using MDA US Systems robotic arms to repair a satellite on orbit. Source: DARPA

InfoBeam

Thuraya Opens Up in the US

Thuraya Telecommunications Company has opened an office in the United States of America—the office is centrally located between Washington D.C. and Tysons Corner, Virginia, offering close proximity to investors, key government and commercial customers and partners.

Thuraya is headquartered in the United Arab Emirates and has offices in Singapore and this newest address marks a further step in the development of the company's ongoing FUTURA project and next generation constellation plans.

With roaming agreements established in 175 countries, Thuraya is an international operator providing reliable roaming services with 389 agreements worldwide, including AT&T and T-Mobile. Thuraya is already well established in the United States.

The new office brings the American team together, helping to serve a range of customers that includes the Department of Defense, which Thuraya counts among its list of longest standing customers.

The firm's ongoing success is already supported by service providers and partners in the US, which is set to feature prominently in Thuraya's long term multidimensional program of expansion and diversification.

Working in partnership with ViaSat, Thuraya launched M2M services in the USA in 2016 with the introduction of the Thuraya FT2225.

The terminal works on both the Thuraya network and ViaSat mobile satellite services network, leveraging ViaSat's L-band high capacity system.

The Thuraya FT2225 offers efficient bandwidth usage, and low-latency IP networking.

Thuraya's robust IP-based, secure two-way communications M2M network enables real-time M2M and IoT application deployment beyond the confines of traditional cellular networks.

Samer Halawi, Chief Executive Officer of Thuraya, registered the fact that his company has pledged to extend their geographical reach, move into new market sectors and launch new services and devices.

"Opening this US office is an important part of that process, strengthening Thuraya's presence in America," he said. "The company wishes to be as close as possible for partners, customers and investors. Thuraya will become the provider of choice for unified connectivity and will do so through an extensive program of expansion and diversification."

thuraya.com

North America—Leading the Market: A TeamCast Perspective

By Christophe Trolet, Satellite Business Unit Manager, and Mark Polovick, Vice President, Sales, both at TeamCast Inc.

From the early launches of GEO satellites (almost 30 years ago...), the US has adopted satellite communications as a strategic component of the nation's infrastructure.

The latest report from the Satellite Industry Association (SIA) confirms that current satellite operations growth within America is around 10 percent, while for the rest of the world that figure stands at five percent.

Initially, Direct to Home (DTH) services made it possible to broadcast TV signals easily and quickly to millions of people. Soon thereafter, professional TV services took advantage of these satellite transmissions and contribution links emerged, either fixed (studio to studio) or temporary (Satellite News Gathering—SNG).



All these broadcast services continued to evolve and improve: from analog to digital with the mid 90s DVB-S standard, then constantly increasing their useful capacity. The latest achievement is the DVB-S2X standard that was finalized in 2014 and is now being deployed with the release of the first receiver chipsets.

This second generation standard allows increases in the capacity of any transponder by 25 percent, lowers operational costs and gives the satellite industry a new, competitive advantage. Being in first place, worldwide, for satellite TV services, the US market will undoubtedly upgrade its infrastructures toward S2X as new services debut, including 4K program feeds. Today, thousands of TV channels go through satellite, and even larger numbers will be brought to consumers via satellite feeds.

While TV was one of the first services to benefit from satellite distribution, it did not remain so for any length of time. At the close of the 90's, IP communication services through satellite (VSAT) emerged. While they did not take off so rapidly, the benefit of VSATs that established IP networks over wide areas was so formidable that investment became considerable and ongoing technical progress significantly encouraged. With DVB-S2 in 2003, and DVB-S2X in 2014, waveforms have been improving and bitrates increasing.

Satellites are also becoming more powerful: transponder bandwidth has been raised from an early 36 MHz to some 500 MHz, multi-beam High Throughput Satellite (HTS) technology has been introduced and satellite constellations have been launched to new elliptic and LEO orbits. In only a few years, capacity has been increased from a few hundreds of Megabits per second on wide beams to several Gigabits per second on selective beams. The cost of IP links is rapidly dropping and is competitive against ADSL or fiber links. This cost advantage goes with the satellite's strong advantage: a wireless transmission that's capable of reaching any area, quickly, as well as supporting mobility. New services are benefiting from satellite transmissions: in-flight Internet access, IP networks for off-shore oil platforms and ship fleets, and more.

Satellite operators are now heavily investing in new solutions and market alliances are emerging between TV and Internet operators, all of whom are willing to offer new packages to end-users.

Regulatory bodies support this dynamic market by preparing new tools for tomorrow's traffic management. A growing number of satellite carriers are needed to meet today's market demands, and this growth may well saturate available spectrum and create carrier interference. In order to anticipate such difficulties and quickly fix them, the FCC decided to make DVB-CID Carrier Identification compulsory, starting in September of 2017. This regulation requires an ID signal to be embedded within a transmission signal.

To maintain a leading position in this dynamic market, TeamCast is constantly investing in a range of satellite products (modulators, demodulators, monitoring devices) to keep them up-to-date, optimized and adapted to the various US market use-cases. TeamCast has supplied hundreds of VYPER satellite modulators worldwide over the past years and has enjoyed success in equipping DSNG trucks in the US. Two reasons explain the company's successes...

The embedded CID generator makes the VYPER modulator natively compliant with the new FCC requirements for carrier identification

As stated earlier, from September 3, 2017, all DSNG signals must carry an identification signal known as CID, to help negate carrier interference. To comply with this new requirement, DSNG operators must upgrade their truck equipment. They can either add a CID signal generator and associate the resultant signal with their existing modulator, or renew their equipment with an up-to-date modulator possessing a CID signal generator, such as TeamCast's VYPER.

By doing this, they benefit from the latest developments in satellite modulator technology, such as the higher spectral efficiency offered by the DVB-S extensions known as DVB-S2X (low Roll-Off down to five percent, extended set of modes up to 64 APSK, etc.). Additionally, the embedded CID generator makes the complete solution more compact and cost effective than a combination of the two devices. This compactness and cost advantage of VYPER will be further reinforced with the brand new DUAL VYPER product that offers a double DVB-S2X modulator with CID generator in a single 1RU chassis, with the same high performance and aggressive pricing as the single VYPER product—an ideal solution for large DSNG trucks.

Demanding use cases, such as 4K live feeds, benefit from TYGER's unique features

The new TeamCast wideband TYGER offers an unprecedented payload for demanding applications, such as live 4K multi-feed. With a unique RF modulation design going up to 256 APSK, high reliability, high operational flexibility and easy control, TYGER is now the choice for demanding applications, such as live 4K feeds for sport events, music events, award ceremonies, and so on. In example, the Masters Golf Tournament 2016 was shot in 4K and the feeds used TeamCast's modulation gear.

All of TeamCast's products are compliant with the DVB-S2X standard and integrate the management of carrier identification, all according to the DVB-CID standard. TeamCast has also developed a range of monitoring products to help customers comply with the latest FCC requirements.

teamcast.com/

Global Comms Require a Dedicated and Skilled Architect: An SIA Insight

By Tom Stroup, President, Satellite Industry Association (SIA)

Radio waves surround our planet and know no borders—these waves create one of the Earth's most treasured resources—spectrum for both satellite and terrestrial communications services.

The bandwidth for communications is a highly valuable and limited commodity worldwide. This limited supply is met with a nearly insatiable appetite for spectrum around the globe, including in the United States. Radio frequency (RF), also known as spectrum, is used for diverse personal and professional purposes. Applications such as TV and radio broadcasting, global weather monitoring, pipeline control and data acquisition, personal communications, Internet of Things, airborne and shipborne communications, baby monitors, heart monitors, cordless telephones, garage door openers, defense and public safety communications all compete for spectrum.

Architect of the Spectrum

With all of the communications possibilities, there needs to be an “architect” to plan and manage systems so that they are interconnected and interoperable on a global scale. This is where the ITU Radiocommunication Sector (ITU-R) comes into play, as an architect of international radio communications. The ITU-R is the driving force behind international cooperation and regulation that benefits US industry, businesses, citizens and the economy.

Radio communications is a thriving sector of the US economy both in terms of revenues and jobs. The US radio communications industry is worth tens of billions of dollars, according to various expert industry sources. As Internet of Things (IoT), mobile commerce and new uses of the airwaves materialize, the industry is poised for continued sharp growth within the US. This economic growth represents millions of jobs for Americans. Such lucrative development would not be possible without a governing body at the epicenter—the ITU-R.

Just as the Federal Communications Commission (FCC) plays a pivotal role in coordinating radio communications spectrum (TV, radio, wireless, satellite, WiFi, military, radar, two-way radio and more) in the United States, the ITU-R allocates global radio spectrum and satellite orbits. It helps US businesses to witness a globalization of services. The ITU-R makes certain the best technology and industry standards are in place to satisfy the need for interconnected global communications.

The “architect” role of the ITU-R is essential to the United States because, unlike fences and walls, RF waves that carry terrestrial and satellite communications around the world aren't bound by any national border. Satellite communication in particular, being high in the sky, is not constrained by any borders inked on nations' maps—there are no borders in outer space. As such, without the ITU-R's judicious work, global terrestrial and satellite communications would not be operable or reliable. The networks would suffer from undesired interference. Such poor-quality communications would be detrimental to the US communications industry, businesses, our nation's government and its citizens—both on the home front and abroad. The ITU-R's RF frequency allocation, coordination and technical standards ensure international harmonization. This is especially critical for satellite communications where capital-intensive investments are required to plan, coordinate, launch and maintain networks.

Without the organization's involvement, all the effort invested in getting satellite communications off the ground would go to waste if the SATCOM network did not work, if it inherited too much interference or if the system needed more RF spectrum. The same holds true for ground-based networks.

Standards and Spectrum Planning

Standards are the backbone of the communications networks which are so important to US culture and everyday life. Standards promote interoperability and communications systems' interoperability, and they limit RF interference. They also contribute to the efficient use of the Earth's limited spectrum. They help to deliver the reliable communications services that users demand. ITU-R ensures successful standards and spectrum allocation and coordination are in place.

As the radio communications entity which supports spectral efficiency for high-quality voice, video and data, the ITU-R enables communications footprints across the globe. ITU-R is the logical extension of an organization's internal resources and works as a partner and mediator for effective communications. Spectrum planning and coordination is complicated. Doing so on a global scale is even more difficult and constitutes a Herculean feat.

ITU-R's satellite orbit coordination function is essential to US space systems. The organization allocates satellite space segments so that they are planned for orbits at given altitudes so Earth-orbiting satellites don't crash into each other. Its work makes the broadcasting of radio communications services in the sky possible and also keeps signals of competing systems from interfering with each other. The result is clear satellite signals for such applications as TV and radio broadcasting, GPS navigation, communications and defense.

A Century of Expanding Global Communications

ITU-R is the one organization which has been present from the beginning to support US communications companies in their network development and expansion needs. In fact, the group—which governs RF use and satellite orbits—just celebrated 110 years of the ITU Radio Regulations. According to the organization's website, it covers more than 40 different radio communication services and frequencies ranging from 9 kHz to 3000 GHz.

For US businesses, ITU-R is the most valuable player on the communications and satcom team, enabling interoperability, seamless communications and interoperability on a global scale. The group's coordination between governments, regulatory bodies and private entities benefits all. As terabytes of voice, data and images cross thorough the airwaves, the varied communications networks in our country—and in our world—can coexist, thanks to the ITU-R. Global terrestrial and satellite services offer lucrative business opportunities for the communications industry, which has faith in the ITU-R to provide seamless interoperability of systems and frequency coordination. As communications networks and services change and evolve, ITU-R collaborates with public and private sectors to forge solutions for the best global communications—everyone wins.

Wherever US organizations want to deploy services around the globe, ITU-R can get them there. In the role of architect of the wireless spectrum worldwide, ITU-R is a vital partner in helping US businesses to build the world's public and private networks of today and tomorrow.

sia.org

Tom Stroup is president of the Satellite Industry Association (SIA) which represents the commercial satellite industry. Stroup serves as the trade association's lead advocate for regulatory and policy issues of critical importance to SIA's membership, including spectrum and licensing issues, defense and public safety matters, and export control and international trade issues.



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Sailing into Upgraded Comms

A contract extension and upgrade has been signed by Teekay with Marlink for the latter's Sealink VSAT solution—this equipment will be applied across the former's entire shuttle tanker fleet.

With more than 30 years' experience, Teekay is the world's largest owner and operator of shuttle tankers.

The company's success comes from highly trained crews and advanced onboard technology, including dynamic positioning (DP) and offshore loading (OL) systems, which ensure safe and reliable offloading of oil from offshore installations in deep water and harsh weather environments.

Teekay is equally committed to leveraging the power of maritime broadband networks to ensure operational safety and efficiency. The company selected Marlink's reliable, high bandwidth global Sealink VSAT solution for its entire shuttle tanker fleet since 2011.

The latest contract extension and upgrade secures Teekay's ability to benefit from remote operations and support crew welfare, and includes a significant bandwidth increase to support even more connected applications on board.

The increased Sealink VSAT capacity is already live across the Teekay shuttle tanker fleet. In addition, Teekay has chosen the Marlink solution for three new builds.

Teekay will be provided with ample bandwidth for crews to stay in touch with friends and family ashore and a faster, more flexible platform for day-to-day vessel and business operations.



Teekay shuttle tankers will continue to benefit from the already installed on board equipment, including antennas, modems and routers.

Deborah Sloan, Contracts Specialist, Teekay, noted that Sealink VSAT is integral to Teekay's ability to provide efficient vessel operations in support of our global customer base. Marlink's network has proven itself to be both reliable and versatile, competitively meeting the high-end needs of our technology focus on board. Sealink enables Teekay's ships to leverage connected applications that improve operational capabilities, so securing this partnership with Marlink while upgrading the bandwidth is a natural step for the company.

marlink.com/

teekay.com/

Meteosat-8 Rules...

Following a decision of the EUMETSAT Council back in of June 2016, Meteosat-8 replaced Meteosat-7 as the EUMETSAT geostationary satellite observing the Indian Ocean on February 1, 2017.

The first operational image of the Indian Ocean region taken by Meteosat-8. Image is courtesy of EUMETSAT.

The Meteosat-8 satellite belongs to the second generation of Meteosats and is much more capable than the first generation Meteosat-7 and delivers imagery from 12 instead of 3 spectral channels, with higher spatial resolution and with an increased frequency, every 15 instead of every 30 minutes.

Of the 12 spectral channels, 11 provide measurements with a resolution of 3 km at the sub-satellite point. The twelfth, so-called High Resolution Visible channel, provides measurements with a resolution of 1 km.

In the context of the World Meteorological Organisation's Integrated Global Observation System and in partnership with India, Russia and China, EUMETSAT thereby continues the organization's best effort contribution to observations of the Indian Ocean from geostationary orbit.

The partnership provides more resilient, integrated Indian Ocean Data Coverage (IODC) services with optimum regional coverage, including a joint suite of essential meteorological products made available to all users worldwide.

For optimum synergy with the Indian INSAT-3D satellites located around 82° East and with Meteosat-10 located at 0°, Meteosat-8 operates at 41.5° East, instead of 57.5° East,

The synergy with Meteosat-10 brings additional benefits to EUMETSAT users in Africa and Central and Eastern Europe. The Meteosat-8 image data is delivered in real time over Europe and Africa via EUMETCast, EUMETSAT's flexible dissemination system for environmental data, and are exchanged with IODC partners.

eumetsat.int/



Sealink is available with Intellian and Cobham antennas with a choice of sizes to meet customer needs.

Global Partnership 'Tween SES and Satcom Global

SES S.A. has revealed that Satcom Global, a provider of global satellite communications services to the maritime and land sectors, will become a key partner for SES.

The differentiated mobility solution will form a crucial part of Satcom Global's new Ku-band VSAT service, Aura, providing seamless, reliable and high-speed connectivity to hundreds of maritime, offshore and land customers.

The agreement provides Satcom Global with seamless access to SES's satellite fleet and upcoming next generation hybrid satellites with high throughput payloads.

SES will also provide a robust ground network infrastructure, enabling multi-satellite access and service integration solutions.

SES will provide Satcom Global with an open and scalable VSAT platform that allows flexibility to deliver customizable, always-on broadband connectivity. SES

delivers high-value performance with minimal initial investment cost and enables Satcom Global to scale-up service for customers without delay.

"SES is the ideal partner for Satcom Global. The current footprint, augmented by a series of high throughput beams over the next two years, makes SES the logical choice to support Aura, our global VSAT service offering. The coverage, capacity and flexibility provided by the SES service is the perfect platform for Satcom Global to develop the type of VSAT offering our customers have been waiting for," said Ben Swallow, General Manager, VSAT, at Satcom Global.

Ferdinand Kayser, Chief Commercial Officer at SES, added, *"From providing access to entertainment for crew welfare to driving operational efficiencies, connectivity needs across a wide variety of sectors are growing, and SES aims to help meet that*

demand across the world. Leveraging SES's global satellite fleet, upcoming HTS capacity, and extensive ground infrastructure, Satcom Global will benefit fully from customizable bandwidth and coverage, and ensure efficient utilization of satellite capacity."

satcomglobal.com

ses.com

Inmarsat and Actility Bring IoT to the World of LoRaWAN™

Inmarsat has taken on an extremely large task—the company announced that their LoRaWAN[1]-based network, developed in partnership with Actility (a provider of Low Power Wide Area Networks (LPWAN)), is delivering on the strategy to bring the Internet of Things (IoT) to the world.

Already the early applications in Asset Tracking, Agribusiness and Oil & Gas are helping businesses in remote regions of the world to become more efficient, reduce costs and drive new revenue through IoT-based solutions.

Asset tracking: Tracking the location, movement, health and other key statistics of cattle on a remote ranch in Australia, replacing the manual process of sending an employee to look for cattle that have strayed. An alert is sent out to the ranch manager when an animal is at risk of being lost, is behaving erratically, or is nearing the perimeter of the ranch, enabling the owner to take immediate action.

Agribusiness: Monitoring the water levels in reservoirs and soil moisture at the roots of plants across the breadth of a large, remote palm oil plantation in Malaysia to deliver water to where it is most needed and achieve maximum crop yield. This enables smarter resource management in an area and reduces the amount of land required for production.

Oil & Gas: Remote monitoring of oil platform processes where cellular coverage

is patchy or non-existent to identify potential failure points so that they may be addressed and costly downtime avoided. An upstream production site continuously measures operational parameters and transmits them to a control room where a SCADA system adjusts set-points and provides control settings.

The Inmarsat LoRaWAN network, powered by Actility's ThingPark™ LPWA platform, is the world's first global IoT network that enables customers and partners to cost-effectively bring to market IoT solutions that can be delivered anywhere in the world, to any type of business, with LoRaWAN-based connectivity on the ground and satellite connectivity as the network backbone.

The integrated platform provides an end-to-end solution that transmits site-specific data to applications in the cloud for analysis, delivering insights and supporting decision making, and creating value for the end customer.

"These three early applications are indicative of the industrial IoT market in general: businesses don't need an off-the-shelf IoT solution for Agribusiness or Asset Tracking; they need a specific solution for a specific problem," said Paul Gudonis, President, Inmarsat Enterprise. *"Through our collaboration with Actility, we have the building blocks to tailor solutions for each specific opportunity, no matter where it is in the world."*

Inmarsat and Actility announced last year a partnership that combines Inmarsat's global L-band satellite connectivity platform with Actility's ThingPark IoT management platform to deliver an integrated solution for IoT, linking connectivity, services and IoT devices from a single application and service management point, to connect objects deployed anywhere on the planet.

Actility is also now part of Inmarsat's Certified Applications Provider Program (CAPP), which allows third-party companies to develop applications and solutions that are compatible with Inmarsat's satellite communications network.

"Actility has worked on many large-scale nationwide LPWA network deployments, but this is bigger: we're fantastically excited about being part of the first truly global IoT network in partnership with Inmarsat," said Actility CEO Mike Mulica.

"Our collaboration with Inmarsat allows us to provide customers with an end-to-end solution to connect their assets and fulfill their IoT business needs anywhere in the world. We'll be working alongside Inmarsat every step of the way to help global customers address their specific needs with more efficient, best-fit solutions."

[1] <https://www.thethingsnetwork.org/wiki/LoRaWAN/Home>

inmarsat.com

actility.com



SSTL-US GPS Receiver into NASA's OCO-3

Colorado-based Surrey Satellite Technology US LLC (sst-us.com) has delivered an SGR-20 space GPS receiver to NASA's Jet Propulsion Laboratory to be integrated as part of the pointing control system for NASA's OCO-3 (Orbiting Carbon Observatory—3) mission.

OCO-3 will collect space-based measurements of atmospheric carbon dioxide and solar-induced fluorescence.

Once launched, OCO-3 will be installed and operated on the ISS (International Space Station) Japanese Experiment Module-Exposed Facility (JEM-EF).

Surrey Satellite delivered the receiver to JPL three months ahead of schedule. OCO-3 is scheduled to launch in 2018.

Surrey's SGR-20 is a single frequency, multiple antenna GPS receiver, designed as a spacecraft orbit determination subsystem for small satellite LEO applications.

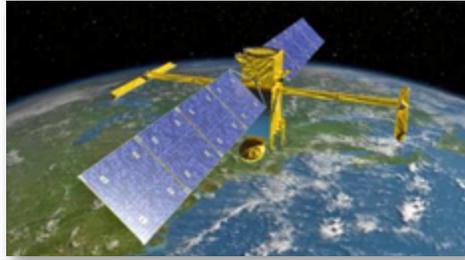
The OCO-3 mission will use the Surrey SGR-20 for positioning information (to an accuracy of better than 20 meters) and velocity data (to an accuracy of better than 0.25 meters per second).

The SGR-20 features four front ends with antennas, allowing more flexibility and redundancy for the selected mission.

According to Eugene Hockenberry, project manager at Surrey Satellite, the SGR-20 receiver is part of a highly proven range of GPS receivers that Surrey Satellite offers.

These receivers are currently active on 24 Surrey satellites and have accumulated more than 700 years of on orbit experience.

With this mission, this is yet another milestone for Surrey: this receiver will be the company's first space hardware onboard the ISS.



sst-us.com/

Risk Reduction for Smallsat Constellations: An AMERGINT Technologies Perspective

By Randy Culver, CEO, AMERGINT Technologies

Small satellites (smallsats) have become mainstream—large scale constellations are a promising next step.

New business ventures are deploying constellations of smallsats that are aggregated and networked to perform remote sensing, image collection and Internet routing.

To date, the number of deployed smallsats in any one constellation range from the single digits to perhaps fifty in number. However, that's about to change. New constellations are targeting tens, hundreds, and in some cases, even thousands of smallsats to meet connectivity, coverage, or revisit rate requirements.

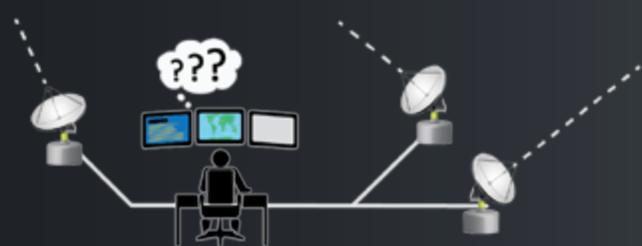
These are exciting times, and perhaps surprisingly, the satellite is not the driving force behind the complexity of these new constellations, but rather the ground system software that must direct the big show.



The business risk to the new venture associated with the spacecraft actually decreases as the constellation is launched and deployed. The satellite design is incrementally refined over time, becoming more and more proven with each production lot of spacecraft.

Conversely, the complexity of the ground software that manages the constellation grows non-linearly for some time as the satellite constellation increases in numbers, settling down only as operations become routine and more automated. It's like managing a company of five and rapidly growing it to a corporation with several hundred employees—what's straightforward at first, quickly becomes complicated, time-consuming, and has the potential for continual and costly do-overs.

Can my software REALLY handle the full constellation?



What happens during multiple anomalies?

What if I lose parts of my ground network?

Constellations transitioning from the prototype phase and going through the rapid buildup phase present a real challenge for the ground software. It is simply not the ideal time to be working through undiscovered issues in the ground software right now when the next several gaggles of satellites are being deployed, one right after another.

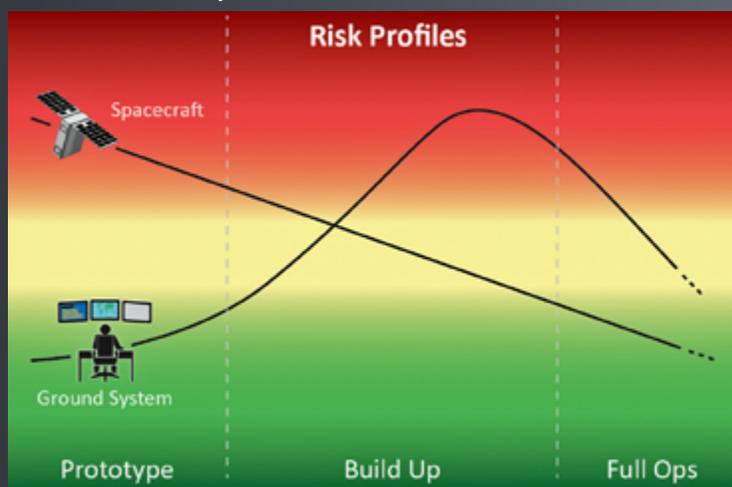
Herein lies one of the key risks for new satellite constellations and system emulation is central to reducing this risk.

Risk Profiles

It's an understatement to say that designing, deploying, and operating a space system employing a dozen, a hundred, or a thousand satellites is complex. There's inherent risk "building up" the number of on orbit smallsats from few to many in a short period of time. The risk profiles for the space segment and the ground segment are remarkably different as a constellation of small satellites is deployed.

Within a satellite constellation, each spacecraft is, more or less, its own ecosystem. Each spacecraft has a self-contained structure, power, attitude control, sensor for data collection, data processing and storage, and communications links.

Smallsats, in their LEO are designed to be autonomous. Scaling from two to 10 and then to a hundred spacecraft is a replication effort. The complexity of each individual spacecraft does not increase with the size and deployment of the constellation.



It's risky to defer full scale testing of ground software, waiting for a majority of the satellites to be in orbit

Constellation Management

The tasks of managing the satellites, their collection of data, and the processing and dissemination of that data falls predominantly on the ground system software. It is this software that becomes increasingly complex as the constellation size is scaled from prototype to full operations. The bigger the constellation, the bigger the task at hand for the software engineers.

Fleet Management Software Orchestrates:

- Payload Tasking
- Contact Planning and Scheduling
- Ground Network Configuration and Monitoring
- Satellite Command, Control, and Anomaly Resolution
- Contact Execution
- Data Processing and Distribution



As every software engineer and every business manager knows, software issues increase as new code is developed, new functions are added, and new interfaces are exercised. The rapid rate of change is what delays the maturity and reliability of software. It is with increased use, and a slowing in the rate of change, that software becomes dependable.

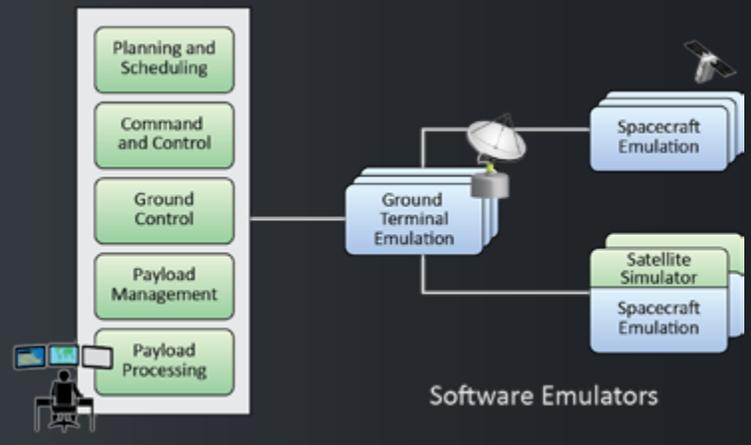
Operational Software Matures With Time

This paradigm is at odds with how a satellite constellation is deployed. The period of greatest change for the ground system software is exactly at the crucial "make-or-break moment" for the new venture, when new spacecraft are rapidly being deployed to fill out the constellation. There could not be a worse time to begin encountering issues in the nearly new ground software that is so central to operating the system.

Enter System Emulation

A system-level emulation is a software-based framework that provides the means to exercise the flight software, ground applications and operations automation long before there are any satellites on orbit. Emulation plays a vital role in validation of the operational system at a point when changes can be more easily made.

The emulation models the satellite data, communications links, and data flows, using separate software emulators to represent the spacecraft, ground terminal equipment, and the ground networks. Each emulator can be easily replicated, allowing for simulation of multiple antenna sites and a full constellation of satellites. As any individual emulation is enhanced, those changes take effect across the entire system. Three tenets are central to the system emulation architecture:



1. *The emulators adapt and evolve from system implementation to system validation and then again from system validation to system operation. Both the scale and the fidelity of the emulation increase at each stage.*
2. *The emulation mimics the planned system. There are two aspects to this. The system emulation performance loads networks and applications. The system emulation also provides an efficient way to simulate errors, exercise corner cases, and run at degraded levels.*

3. *The software-based emulators are built with the interfaces that allow operational components to be swapped in. For example, flight software and satellite simulators connect into the emulation framework. Over time, the system emulation is replaced with the operational system and its satellites, space links, ground networks, and control applications.*

Scaled Fidelity

Incremental co-evolution of the emulation with the ground system avoids the flash-of-lighting approach to software creation. The fidelity of the system emulation is scaled to reflect the maturity of the fleet management applications and the purpose of the testing.

If what's required is simply generating the dynamic data loading from the satellites into the ground network, then replicated copies of a simple spacecraft emulator is all that's required. This emulator mimics contacting the satellite and having the satellite dump its stored payload data before disappearing from view.

Emulation Software Scales In Lock Step

A more complete satellite emulator accepts a limited subset of commands and commutates a state-of-health downlink telemetry stream. It interfaces with a payload simulator that generates a payload data stream.

The emulation software produces a fully formatted downlink, one that mimics the operational downlink. This medium-fidelity application exercises a larger percentage of the ground applications, notably the command and control software and the payload data ingest software.

The highest level of fidelity might connect to the spacecraft factory to fully exercise and validate the command and control software. This version of the spacecraft emulator is simply what's needed to connect the satellite to a wide area network.

Operator training and rehearsals is another use for the system emulation. This, too, scales the fidelity of the emulation as it rolls from software test to training and rehearsals.

Exercising Automation

Building automation into the ground software adds yet another layer of complexity. The automation that's so essential to effectively managing a constellation of satellites takes time to develop and even more time to refine.

Developing automation for an individual satellite, a single contact, or a specific anomaly is difficult enough. Scaling that to hundreds of satellites is a significant challenge, but absolutely critical for efficient operations. Having an end-to-end system emulation to validate the automation is essential and the most cost effective approach.

"Fly like you test" is backwards thinking,

"Test like you're flying" is more accurate

Automating the response to expected behaviors is only a fraction of the task. It is the unexpected and the anomalous conditions that expand and complicate the automation scripts.

With a satellite constellation numbering in the hundreds, there's a problem to be dealt with every single day, and most likely, multiple problems on most days. It's automating these responses and the contingency actions that are central to flying the large constellation with a small staff.

It can be downright difficult to get real satellites and real ground networks to misbehave on demand in order to exercise and test the

automation scripts. They just don't want to break only when you want them to—creating this bad behavior is simple with emulation software. Emulation software can mimic spacecraft anomalies, communications disruptions, contact failures, network bottlenecks, and general failures.

Having separate teams, one creating the automation and one designing the "problems" to test automation, is key. Make this exercise a bit of a cat-and-mouse game.

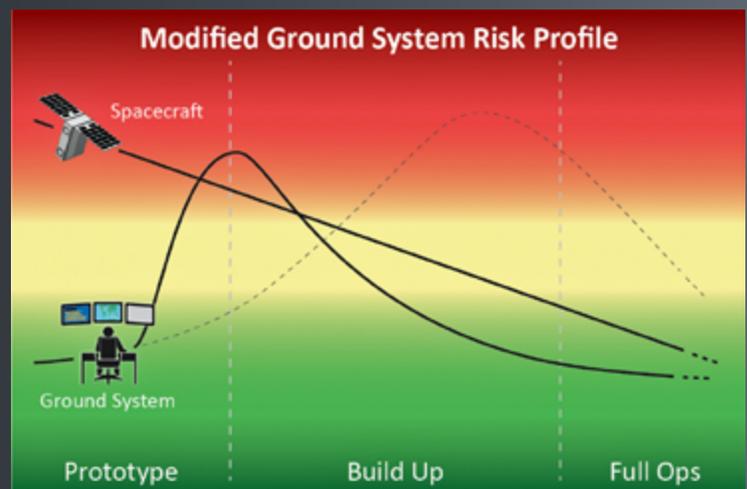
Initially the system emulation team dreams up the problems, implements them in the emulation, and tests the response of the automation software. The engineers developing the automation then get to refine their work.

Emulation software is ideal for testing and re-testing the automation software's response to real problems. Real problems are usually difficult to recreate. The emulation can more easily recreate them, allowing for validation of the updates to operational software. This beats the "crossing your fingers and waiting for the next occurrence in the deployed system" approach to validation of anomaly-response automation.

Emulation Changes The Risk Profile

System emulation changes the risk profile by enabling full-scale test and validation of the ground software in the prototype phase rather than waiting for the deployment and build up phase. In effect, it better aligns the space and ground risk profiles.

This is critical to the success of an emerging small satellite constellation, allowing the new venture to proceed with increased confidence during constellation build-up; that critical moment when the business either provides return on the investment or fails to deliver on its promise.



The Discovery And Elimination Of Risk

Satellite constellations are the next step for smallsats. It's a giant leap for the ground networks and control applications. A well-conceived system emulation ensures the infrastructure and software applications are well grounded before the herd of satellites head for space.

amergint.com

Randy Culver is the CEO of AMERGINT Technologies. AMERGINT products include satellite communications software for modems and ground processing. The company's SOFTLINK™ product enables customers to emulate their future satellite systems and then easily transition from the emulation software to operational satTRAC™ and softFEP™ products.

The End of VSAT Interference: A Kratos Perspective

By Petter Amundsen, General Manager, Kratos Norway

VSAT networks are arguably one of the most challenging satellite environments to manage, especially with respect to interference.

Terminals are often installed in remote locations or on moving vessels and correct installation is essential to minimize operational problems, prevent interference and maintain communications.

The cost of VSAT hardware has dropped significantly over the past two decades, resulting in an increasingly large growth of VSATs in operations. Today, VSAT systems cause approximately 40 percent of all interference, and are responsible for 50 percent of the downtime according to the Satellite Interference Reduction Group (IRG). The pressure on reducing total cost impacts VSAT equipment quality, as well as the installation procedures and installation time.

Satellite network operators no longer supervise or police each VSAT installation to the degree that they did in the past, mainly due to the cost and workload implications of such a procedure. The lack of supervision allows incorrectly installed terminals to be set into operation because of untrained staff, ambiguous assembly options, poor mechanical antenna pointing adjustments, faulty cabling, incorrect mounting of connectors and failure to follow installation procedures.

Even Correct Installation Can Mask Interference

Even in those cases where all of the procedures have been correctly followed, human error may occur, resulting in faulty installation. A fundamental part of the problem is that, even if installed incorrectly, the VSAT generally operates perfectly well, masking interference issues. While within the envelope for normal operations, inaccurate pointing may cause interference problems, disturbing services on the opposite polarization or a neighboring satellite.

Faulty cables can result in GSM or radio retransmission if the terminal is in the vicinity of a GSM or radio base. Even when VSATs are properly installed using trained staff and smart tools, errors can occur at a later time due to equipment failure.



For instance, VSATs on the move or at sea that constantly align the antenna and equipment may break down. Causing satellite interference seldom has severe consequences for the interferer, but the consequences can be significant for the interfered. Thus, satellite operators should have a strong incentive to monitor and police VSAT terminal behavior, for today's interferer could be tomorrow's interfered and likewise, network operators should also be concerned.

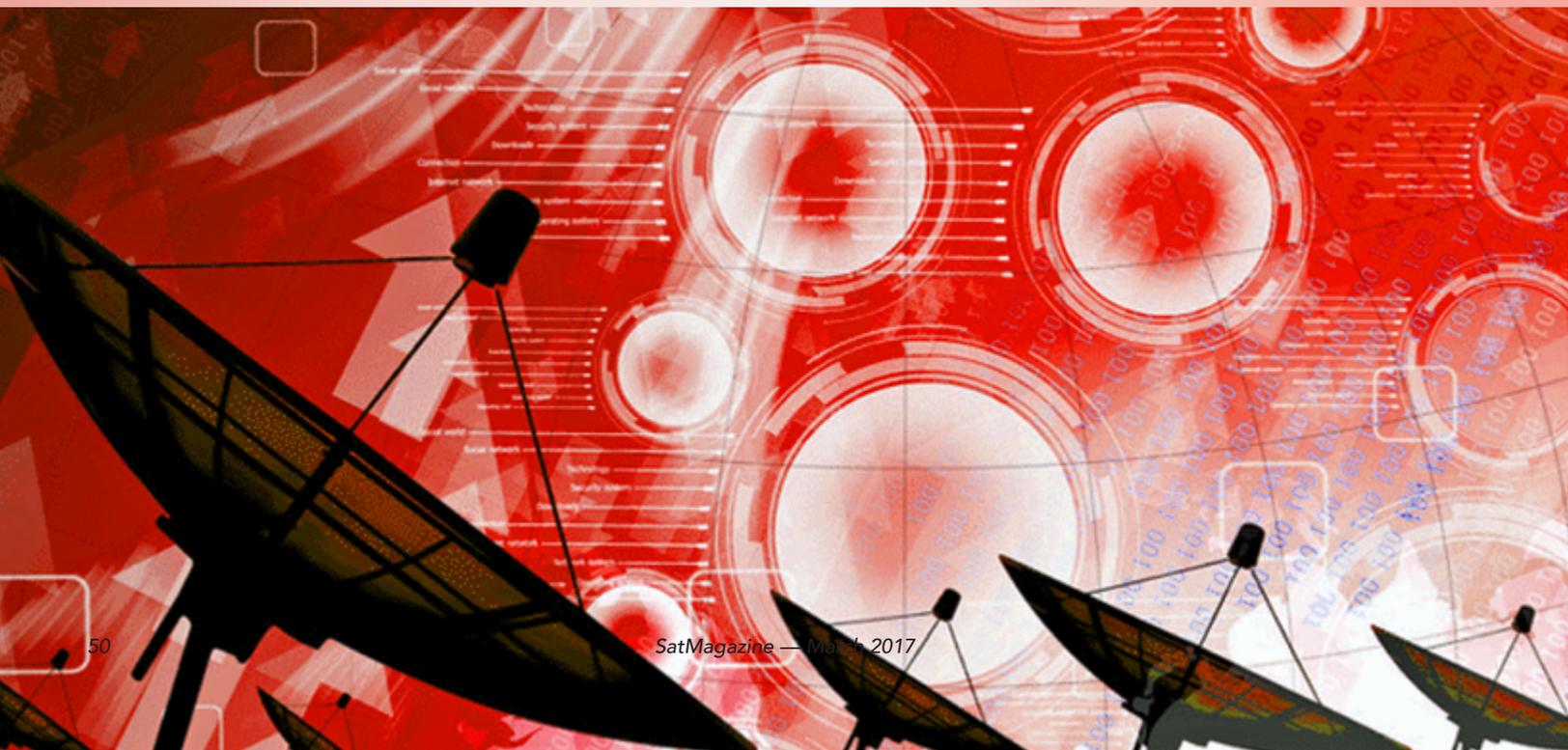
Aside from installation or operator error, a major challenge is that VSAT terminals operate in TDMA mode where many terminals share the same frequencies. This means that in the case of interference caused by one or a few terminals, it has been virtually impossible to determine which terminals are causing the interference, as there was no method to identify the interfering VSAT.

The Need for Open Standard Solution

Therefore, it should not be surprising that VSATs cause the majority of interference events and are by far the most time-consuming interference problem to resolve. This is due to a number of reasons: Optimization of bandwidth and operation at low signal-to-noise ratio (SNR) with minimum energy per user bit has driven technology developments.

Many vendors found proprietary solutions to these challenges and used their solution as a competitive advantage. Additionally, open standards, which have often been instrumental for technology uptake, reduction of cost and benefit of higher volumes have been less prevalent for satellite communications.

Oftentimes the solution has been to isolate terminals in groups or one by one, until the interfering terminal was found. The result was that interference could continue for weeks, months or even years, and resolving this problem is extremely time consuming for operators.



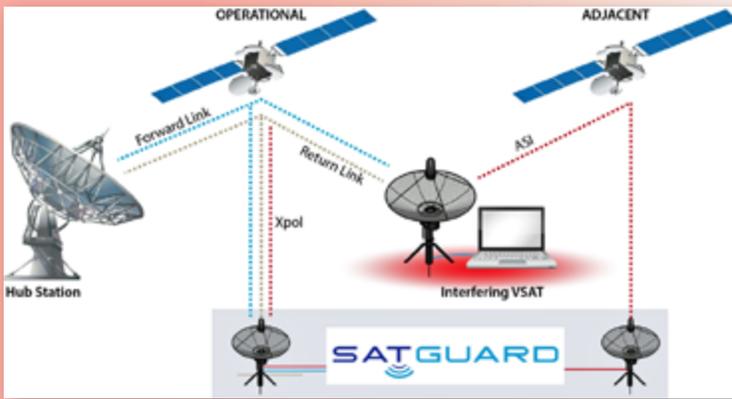
RF vs. VSAT Interference Characterization

Today's signal management tools perform RF characterization, yet provide only limited insight into the VSAT networks with no actionable intelligence to resolve the interference effectively. New capabilities such as SatGuard from Kratos can scan, identify, locate and resolve interfering VSAT terminals in minutes.

SatGuard measures the level of interference for VSAT terminals and can identify the source by the VSAT terminal ID. Similar to a Carrier Identification code (CID) that is installed in a signal, a terminal ID is installed at each VSAT.

This means that adjacent satellite interference (ASI) and cross-polar interference (XPOL) caused by VSAT terminals can now be resolved in matter of minutes by extracting this ID, as opposed to the extended time involved in determining which terminal was interfering with normal operations (see Figure 1 below).

The reason for differentiating between ASI and XPOL is that XPOL signals and information about signals on the XPOL are normally easily available, while ASI is often caused by VSAT networks operating on neighbor satellites operated by competitors, and antennas may not be readily available to monitor the adjacent satellite. Also, operators may be protective in sharing information about services on their satellites.



Terminal ID Extraction

SatGuard automatically and quickly determines the VSAT terminals causing the interference by extracting the terminal ID from the operational link bursts, synchronizing the operational and interfered link, determining the interfering bursts and correlating the information to determine the terminal ID causing the interference.

SatGuard reports the power level in the interfered channel for all terminal IDs. Only the terminals transmitting with a power level exceeding the user-defined threshold are reported as a source of interference.

Additionally, SatGuard operates totally independent of the VSAT network. No interaction with the VSAT hub is required to determine the interfering terminal IDs. SatGuard supports open standard VSAT technologies such as DVB-RCS/RCS2 along with major proprietary VSAT technologies and SatGuard can be adapted to specific VSAT technologies at request.

SES Experience

SES is a good example, having used SatGuard operationally for more than 18 months with systems deployed across its global network. According to Chris Grogan, the Senior Vice President of Customer Service Delivery at SES, said, "Issues caused by MF-TDMA systems contribute to almost 50 percent of all of our interference events. SatGuard has transformed our capability in dealing with these problems and we routinely work with adjacent satellite operators and service providers, giving them specific

terminal information in order to expedite resolution of any problems. We have had cases whereby the time taken from receipt of a complaint, through the analysis and escalation phases to permanent resolution of the problem has taken less than 10 minutes."

New VSAT Monitoring Capabilities

The newly introduced VSAT technology enables comprehensive VSAT monitoring capabilities including: automatic classification of TDMA carriers in real-time, VSAT interference management and geolocation of interfering VSAT terminals by terminal ID.

These features will soon become an integral part of the industry leading Monics® RF Management product suite, including carrier monitoring and interference detection, used by the majority of the of the world's largest satellite operators, service providers and telecommunications providers to monitor over 200 sites in 60 countries around the globe.

Geolocation

Geolocation is often used in cases of interference. Previously, geolocating a VSAT system has been a difficult and time consuming effort. Now, however, SatGuard technology has made VSAT geolocation possible within satID®, Kratos' geolocation product. As well as enabling the precise location of an interference source, geolocating VSAT terminals has a number of additional and important uses:

- Geolocating VSAT terminals allows operators or regulator authorities to verify that the terminals are being used in the licensed geographical locations
- For mobile VSAT terminals it may be useful to verify the location of the terminal

Of course, with VSAT terminals being mobile in nature, the location of those terminals could be changing constantly, so being able to track this on an ongoing basis can ensure all of the aforementioned, as well as solving interference far more quickly.

Optimize Satellite Operations

One of the most effective ways of ensuring an interference free environment is advanced ongoing monitoring. Through active monitoring of VSAT terminal interference levels on regular basis problems can be detected as soon as they occur and before any service interruption or degradation can affect and negatively impact operations and revenues. SatGuard enables ongoing monitoring, which means that VSAT interference becomes manageable in the same way continuous carriers are monitored.

The VSAT interference mitigation capabilities discussed here enable satellite operations to be optimized for maximum business results. With SatGuard, operators can accelerate troubleshooting by Identifying interference caused by VSAT terminals in minutes instead of weeks and months. Additionally, workforce productivity can be optimized and costly staff time spent mitigating VSAT interference events reduced.

The bottom line is improved customer satisfaction via better quality of service (QoS) for your customers and minimization of high contract penalties and SLA credits for you.

NSR Analysis: Not So Fast, SpaceX

By Lluç Palerm-Serra, Senior Analyst, NSR Spain



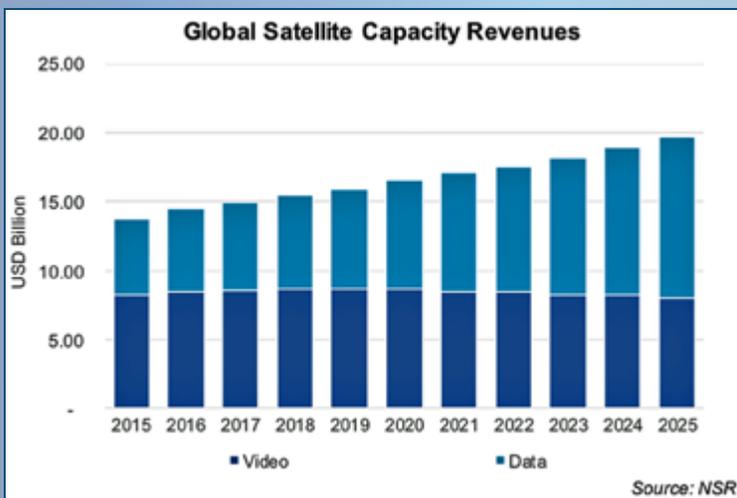
In the prelude of the recent SpaceX successful launch for Iridium, The Wall Street Journal released a story analyzing SpaceX's financials and internal growth projections.

While the historical figures presented seem reasonable, the article included several shocking statements from SpaceX, most notably the forecast of more than \$30 billion annual revenues by 2025 for the nascent satellite Internet constellation project. Are these assumptions realistic? One must not forget that public communications are part of a company's strategy. What, then, are the implications for the satellite industry?

How Much Is \$30 Billion In Revenue?

It is sometimes difficult to assess a number without any appropriate reference—let's start by surrounding this projection with some context. While it is not clear at all what is included in those projections (end-user terminals, satellite raw capacity, end-to-end service...), we could start by comparing them to the industry's capacity revenues.

NSR's **Global Satellite Capacity Supply and Demand, 13th Edition** report assesses satellite capacity revenues to have been \$13.8 billion in 2015 and forecast them to reach \$19.7 billion by 2025. One must consider, however, that a great proportion of these revenues come from video-centric applications, which does not seem to be the target for SpaceX constellations. Even considering end-user terminals and service revenues, SpaceX's projections for its own revenues are higher than previous forecasts for the entire data-centric applications market.



Opening the focus a bit more, at the end of the day, the SATCOM industry is just a part of the greater telecommunications industry. How do SpaceX's projections compare to the size of the greater telecom industry? If the revenue projections were met, SpaceX would enter the Top 20 list of largest telecom operators after just a few years of operations.

Assuming the constellation is launched within the 2019 to 2020 timeframe (let's keep the discussion simple and assume all technical challenges are solved), the SpaceX satellite Internet business would become the fastest enterprise ever to cross the \$1 billion benchmark after entering commercial operations (WSJ article assumes ~\$3 B revs in 2020).

To date, the company that broke the \$1 billion revenues barrier the earliest is Groupon, followed by a number of dotcom companies, all of them requiring more than two years to attain that revenue milestone. While SpaceX can already start working on selling capacity, the scalability of the business model is much more arduous than most dotcom businesses.

Rank	Company	Total revenue (US\$ billion)
1	AT&T	\$146.8 B
2	Verizon Communications	\$131.8 B
3	China Mobile	\$107.8 B
4	Nippon Telegraph & Tel	\$94.2 B
5	Deutsche Telekom	\$76.8 B
6	Softbank	\$74.7 B
7	Vodafone	\$64.5 B
8	América Móvil	\$56.3 B
9	China Telecom	\$52.7 B
10	Telefónica	\$52.4 B
11	Orange	\$44.6 B
12	China Unicom	\$43 B
13	KDDI	\$37.3 B
14	BT Group	\$27.3 B
15	Telecom Italia	\$21.9 B
16	Telstra	\$20.2 B
17	KT Corporation	\$19.7 B
18	CenturyLink	\$17.9 B
19	BCE	\$16.8 B
20	Telenor	\$15.6 B

Source: Forbes, The World's Biggest Public Companies

What Would It Take To Get There?

Now that we have in context the magnitude of the challenge to reach the forecasted level of revenues, it is time to consider what the steps might be to get there. WSJ's article notes that SpaceX expects to attract over 40 million subscribers by 2025.

The largest satellite Internet network today is operated by HughesNet, which has slightly above one million subs after nearly a decade of operation. Combining ViaSat's Exede and HughesNet,

the year with the highest number of new subscribers was in the 300 to 350,000 range, which hints at how difficult it is to build the distribution channels for this kind of service.

Of course, inexpensive, self-installation terminals and a global operation infrastructure could accelerate service take-up, but it appears very difficult to reach the 40M installed base in just five years. Compounding all of the above, one must not forget regulatory barriers, as SpaceX would need to pursue landing rights in each and every country it wants to operate.

While the addressable market for unconnected and under-connected households is still massive—NSR's **VSAT and Broadband Satellite Markets, 15th Edition** report estimates 471 million households could potentially be connected—the majority of those are in low-income countries where it is challenging to close the business case, and where ARPU levels will be very small.

Would a subsidy model work in those locations? Taking as a reference internet.org's experience, after three years of operations, it has 40 million free Internet users. Facebook, (which, by the way, remains under the \$30 billion annual revenue benchmark) generates around \$12 per active user per year. What fraction of this revenue can be diverted to subsidize connectivity? Can this model be sustainable for SpaceX and the party willing to subsidize the connectivity? What scale would be required to generate the expected level of revenue for SpaceX?

Other satellite communications verticals certainly provide meaningful opportunities, but to achieve such volumes, the bulk of the market needs to come from consumer-oriented products (being through direct connectivity or through aggregation points). Verticals, such as aero connectivity, will grow very fast, but even in this scenario the contribution to the total expectations will be small.

In **Aeronautical SatCom Markets, 4th Edition**, NSR forecasts total satellite capacity revenues (for the whole industry) under \$1 billion by 2025

and approaching airframes addressable market saturation. Similar trends could be seen for maritime, with capacity revenues also under \$1 billion by 2025 (MSM4). Other new applications such as High-Frequency Trading might also emerge with new capabilities of LEO constellations, but it seems difficult to see those being the main source of revenues.

The Business Case

If we assume that most of the constellation demand will come from land areas (e.g., total aero and maritime addressable markets are relatively low compared with the revenue projections), that means that ~3/4 of the time, the satellites would be idle/over water.

SpaceX announced capacity of between 17 and 23 Gbps per satellite—taking an average of 20 Gbps, multiplying by the number of satellites, and considering that they are used just 25 percent of the time, we could estimate effective available land-based capacity. Dividing the \$30 billion revenues by this effective available capacity, one gets average capacity pricing in the range of ~110 USD/Mbps/Month.

NSR is aware of contracts for consumer broadband in Europe and Middle East being signed today at under \$200 USD/Mbps/Month. These prices will presumably continue to decline. Will the difference in pricing between architectures be so big to justify such elasticity in capacity requirements and revenues?

Bottom Line

The best way to predict the future is building it—NSR would be pleased to see the satellite industry growing to the levels forecasted by SpaceX, as it would be beneficial for everyone. While it is true that forecasting revenues for such innovative ventures has a significant level of uncertainty, NSR nonetheless believes the \$30 billion revenue projection is too optimistic, no

matter what assumptions are made, and could stoke unrealistic expectations that could undermine the industry's credibility.

One must also consider that SpaceX are masters of strategic communications and have repeatedly made extravagant announcements to push analysts, the financial community, the industry and employees in its favor. It is its CEO managing style, the day after he announced a totally unrealistic schedule and sales target for Tesla's Model 3, auto analysts universally moved their own estimates up satisfying what probably was the original goal, shifting the paradigm.

SpaceX has said quite clearly that the company plans a step deployment of the constellation, starting commercial operations with a "modest" 800 satellite constellation (compared with the 4,420 of the full deployment), which hints at the venture having different growth scenarios with more reasonable assumptions.

When analyzing SpaceX projections, being an investor, a competitor or an industry watcher, one must not fall into this expectations trap. Otherwise, the industry's credibility will be at risk.

nsr.com

Lluc Palerm joined NSR as an analyst in 2015. His primary areas of work are satellite capacity supply and demand as well as applications with a particular focus on emerging opportunities. Mr. Palerm contributes to several multi-client reports while engaging in customized consultancy projects.

Prior to joining NSR, Mr. Palerm worked at Zero2Infinity in technical and business roles. While involved in the startup, he worked in the mission analysis for the company's microsat launcher project and lead the development of a rocket engine prototype that tested successfully. He also contributed to the project's business plan with market research and financial assessment. Lluc undertook fund raising efforts and built the positive relations with customers.

Graduated as an Aerospace Engineer from Universitat Politècnica de Catalunya (2011), he collaborated with one of its research centers developing CFD codes (CTTC). Afterwards, he received a Master in Management from ESADE Business School (2012) specializing in Innovation and Entrepreneurship.

Thriving Biomes for Commercial Satellite Imaging: A Capella Space Perspective

By Payam Banazadeh and William Woods, both Capella Space Co-Founders and CEO and CTO, respectively

The concepts of physical science cover everything that is, and that could be—the simplest theories, when translated into functional reality, emerge as the greatest success stories.

Intensive research studies help identify potential opportunities within technological gaps in a current market channel. This is the one factor that has worked well for the players with recent entries into the global commercial satellite imaging market. There are not one, but multiple examples, to cite regarding the various successes of new entrants into this vibrant industry. They have built an entirely new list of “things-to-do” for current market leaders as well as the end users within the demand channels.

Capella’s Space Advent

Capella Space, a startup based in Palo Alto, California, is now prepared to bank on the advantage of Synthetic Aperture Radar (SAR) imaging technology. The high-fidelity data-loaded images obtained by their satellite will bring a revolutionary aspect into the competitive scenario of the global commercial satellite imaging market.

The launch of the first SAR-enabled satellite, Capella 1, was proposed in late November of 2017. This is an exciting debut for a company that identifies itself as a data provider and uses commercial satellite imaging routes to improvise its service, planning to add clarity (quite literally) with a novel approach.

Capella Space expects to launch a set of satellites that will form a constellation that would send fresh images from around the globe at an interval of every three to four hours. At the equatorial regions, the constellation would obtain fresh captures every 45 minutes. As the company promotes at their infosite, “reliable and persistent data delivered to you from space every hour.”

The quality and fidelity of obtained data improves with each pass over a targeted area. This is because when the satellite traces the same path of flight, it maps the fresh data with that which has already been stored for the same geographical selection.

SAR: Technology Briefing

Synthetic Aperture Radar, or SAR, is an airborne, side-looking radar arrangement for coherent two- or three-dimensional imaging of geographical landscapes. The movement of a radar antenna over a selected region is used to generate high-resolution images.

The basic concept of working rests within the sequential transmission, reflection, collection, and analysis of electromagnetic waves. However, there is a considerable time and coordinate gap between the reflected transmission versus the received signal.



Maritime Domain Awareness



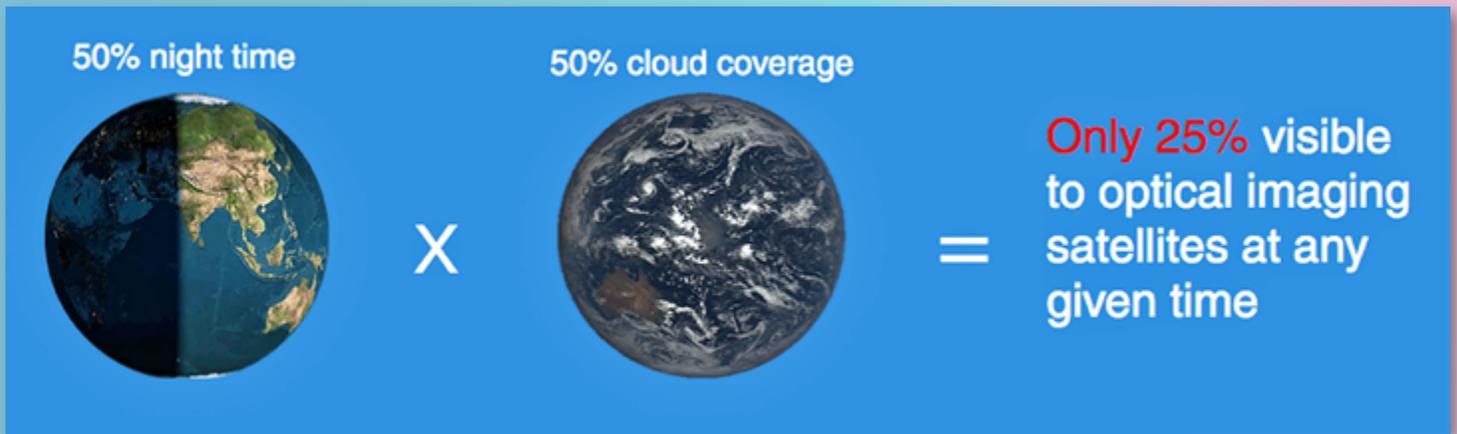
City Planning and Mapping



Patterns of Life



Business Intelligence



Capella Space satellites use SAR to capture images 100 percent of the time.

An ordered set of received signals builds a virtual aperture that is comparatively greater than the physical size of the antenna.

SAR technology ensures that neither weather conditions nor availability of sunlight has any significant impact on the quality or clarity of the imaging. So far, SAR has been a tool used by federal or defense organizations. The alternative employment of SAR for core commercial application by Capella Space opens a different scope of the use of SAR by the commercial satellite imaging industry.

Neither The First, Nor A Solo

Capella Space is certainly not alone as a startup to announce plans to launch commercial imaging satellites this year. There are more than a dozen new entrants lined up with proposed launches—two dozen others have already experience successful launches during 2016.

Their competitive pricing results in a starkly comparative difference between the services offered by the current crop of leading global corporates and the newbies in the industry. The former holds the advantage of precise image quality and high resolution, the latter proves to be an alternative or additional source of updated image and data each day, available at a relatively lower cost.

Eclipsed By Start-ups

Alphabet, Google's parent company, had acquired the Skybox Imaging satellite unit in 2014 and now looks to sell this same division to Planet (earlier Planet Labs)—generating enough investments and sales for an imaging cause is no walk in the park. However, the growing dominance of fresh entrants into the commercial satellite imaging market must be worth noting—how is this possible when other start-ups continue to find the way to success, or even sustainability for the firm, difficult?

Major ecological communities, or biomes, scored each imaging solution through the application and implementation of simplistic tools and technological components, sourcing them from companies where one could find such tools easily and inexpensively. These exercises filter down directed on core business services, all aimed at explorative expansion of usability.

These courses of investigation have allowed the market to experience a wide augmentation in the end application areas. Apart from the large-size enterprises and organizations, thanks to the newbies, the increased affordability index has created opportunities for small- to medium-sized enterprises to offer these services.

Market Regards

According to the latest market intelligence released by **Allied Market Research**, the commercial satellite imaging market is set to achieve \$5,275 million in sales by 2022.

Industry analysts have projected the market to register a net CAGR of 11.5 percent over the forecast period of 2016 to 2022. As per the derivations made by the study, the market looks up to three main impactful factors over the course of their analysis period of 2014 to 2022. These include the increased popularity of location-based services among consumers, expansion of the application segments for satellite imagery services and the introduction of high-resolution aerial imaging service.

One of the primary concerns cited by the report was the comparative difference in the resolution of images generated by aerial and satellite imagery services. The use of innovative components, as well as the lower cost of satellite builds, is expected to sort out this issue over time in the marketplace.

The Capella Space constellation will blanket the entire globe by 2020. Each of the company's images can capture as large as 27,000 km square or as small as 1600 km square. Images will be captured at adjustable resolutions from 1 meter all the way up to 30 meters in different modes for various applications. These satellites will be able to see through the clouds during stormy nights or cloudy days, no matter if in the tropics or in the middle of the ocean. Images will be captured, fully independent of atmospheric conditions.

capellaspace.com/

Payam has extensive experience in designing, building, testing, operating, and managing cubesat projects. Payam has been working on cubesats since 2008 and managed cubesat projects at NASA Jet Propulsion Laboratory (JPL) prior to obtaining his Masters Degree at Stanford University.

Will holds a Ph.D. from Stanford University on Synthetic Radar Imaging (SAR). He has years of signal processing and radar system design experience from his Ph.D. as well as working at multiple NASA centers prior to joining Capella.

National Space Club and Foundation Names Award Recipients

The National Space Club & Foundation has announced their Annual Award Recipients—the Awards are selected by panels of experts from across the aerospace and defense industry, government and academia, and are a testament to the inspiring work of individuals across the United States. The Awards will be presented at the 60th Annual Robert H. Goddard Memorial Dinner, taking place at the Washington Hilton Hotel on Friday, March 10, 2017. The recipients are:

The New Shepard Team will receive the Club's preeminent award, the Dr. Robert H. Goddard Memorial Trophy.

On November 23, 2015, led by Jeff Bezos, Blue Origin's fully reusable New Shepard human spaceflight vehicle made history by becoming the first rocket to ascend above the Karman line and successfully return to Earth for a vertical landing. This ground-breaking mission reached an altitude of 100.5 km (329,839 ft.) and achieved a maximum speed of Mach 3.72, before the rocket booster performed a gentle landing at its launch site, touching down at a speed of a mere 4.4 mph. The same booster made four subsequent flights in 2016 on January 22, April 2, June 19 and October 5, demonstrating reuse. These five New Shepard flights all took place from Blue Origin's private launch site in West Texas.

Evan Peaco, a junior studying Aerospace Engineering at University of Maryland, College Park is the recipient of our nation-wide search and competition for the Goddard Memorial Dinner Keynote Scholarship. Mr. Peaco was selected from among 7080 candidates that submitted applications. The group was narrowed down to 110 students that submitted videos and from that group, six students were chosen for in-skype interviews. Mr. Peaco rose to the top of the competition with his strong academic record and experience in aerospace. His impressive list of honors and accomplishments include being named a National Merit Scholar and receiving the school's prestigious Banneker/Key Scholarship. Mr. Peaco hopes to take his impressive list of achievements and apply them one day towards advancing the world's manned spaceflight capabilities, particularly to Mars or to the Moon.

Dr. John B. Charles, Chief Scientist, of the NASA Human Research Program at Johnson Space Flight Center will be recognized with the Eagle Manned Mission Award. Dr. Charles demonstrated exceptional scientific leadership and international diplomacy in coordinating the multilateral human research science for the International Space Station (ISS) 1-year mission. Dr. Charles was able to facilitate the merger of research from five different Space Agencies into a single, multilateral human research portfolio. His significant efforts fostered cooperation and collaborations between research teams around the world overcoming many challenges in the area of human research, intellectual property, international law and medical privacy. Dr. Charles' efforts paved the way for more integrated international research that will yield beneficial knowledge on the medical, psychological and biomedical challenges long distance explorers may face as they venture beyond LEO.

The Juno Mission Team will receive the Nelson B. Jackson Award. On July 4, 2016, the Juno spacecraft entered its first orbit of Jupiter, capturing the first ever images of the giant planet's poles and never before seen cyclones above the planet's cloud tops. Along with high-resolution imagery, Juno's advanced suite of instruments are gathering groundbreaking data on the planet's composition, gravity field, magnetic field, and polar magnetosphere. During its 37 mapping orbits, Juno will fly as close as 2,600 miles above the planet's clouds, before being de-orbited into Jupiter's atmosphere. The Juno Mission Team members include: Dr. Scott Bolton, Principal Investigator, Southwest Research Institute; Rick Nybakken, NASA Jet Propulsion Laboratory; Ed Hirst, NASA Jet Propulsion Laboratory; Dr. Steve Levin, NASA Jet Propulsion Laboratory; Sammy Kayali, NASA Jet Propulsion Laboratory; Phil Morton, NASA Jet Propulsion Laboratory; Dr. Jack Connerney, Goddard Space Flight Center; Tim Gasparrini, Lockheed Martin; Jeff Lewis, Lockheed Martin; Kevin Rudolph, Lockheed Martin; Doug Bernard, NASA Jet Propulsion Laboratory and Jan Chodas, NASA Jet Propulsion Laboratory.

Dr. Daniel T. Lindsey, Federal Research Meteorologist, National Oceanic and Atmospheric Administration/NESDIS will receive the NOAA - David Johnson Award. Dr. Lindsey receives this award for his innovative contributions to the exploitation of satellite imagery, from super rapid-scan imaging to the visualization of simulated cloud and moisture imagery of high impact environmental phenomena ranging from severe local storms to tropical cyclones. His near real-time demonstrations of the capabilities of the new generation of geostationary satellites at the NOAA Testbeds and Proving Grounds is paving the way for the transition of highly valued applications into the forecaster operational environment.

Dr. Marc Rayman, Dawn Deputy Project Manager, Jet Propulsion Laboratory, will receive the Astronautics Engineer Award Dr. Rayman wins this award for his leadership as Chief Engineer of the Dawn development program and flight mission to explore Vesta and Ceres. In July 2011, Dawn orbited Vesta and became the first spacecraft to orbit a body in the main asteroid belt between Mars and Jupiter. With the successful rendezvous in March 2015 with Ceres, Dawn became the first mission to reach a Dwarf Planet. As the first spacecraft to orbit any two solar system destinations, Dawn is the first interplanetary spaceship.

Andy Weir, author, "The Martian" will receive the Press Award in recognition of the significant contribution he made to public awareness of the challenges and rewards of human exploration beyond low Earth orbit. His book, The Martian and the major motion picture based on it, captured the public's imagination and elevated the global discussion about the exploration of our solar system and beyond.

Damon R. Wells, Director, Office of Police and Strategy, National Reconnaissance Office will receive the Dr. Joseph V. Charyk Award. Mr. Damon Wells' leadership assured the resiliency of National Reconnaissance Office (NRO) mission capabilities against all current and projected threats. He led the

effort to define, prioritize, and implement the highest priority resiliency initiatives, from those requiring new research and development to those involving innovating operational concepts. He drove and oversaw multiple exercises and wargames to test NRO architecture resiliency, assuring remaining gaps were identified and addressed. The efforts of Mr. Wells have been fundamental to assuring future NRO mission capability, through all phases of conflict, in support of warfighters and policy makers.

Beth Meade Leavitt, Physics and Astronomy Teacher, Wade Hampton High School

will receive the Space Educator Award for creativity and dedication as a career space educator engaging, inspiring and educating students about the space frontier. She has been teaching at Wade Hampton High School in a variety of science fields since 1999, currently teaching AP and Honors Physics and Principles of Engineering. In addition, she is Director of the FIRST Robotics Club, an after school group that builds real world skills in 3D design, machine tooling, wiring, and programming. Ms. Leavitt has taught numerous scientific workshops both locally and nationally and was a Top Ten Teacher of the Year in 2006. She was a semi-finalist for NASA Educator in Space in 2004 and she is a member of the NASA Network of Educator Astronaut Teachers, NEAT.

Aditi Krishni Shetty, Student, Montgomery Blair High School, Kensington, MD is the winner of the Olin Teague Scholarship

for the continuation of an ongoing effort to use impact basins on Mars to glean information about its early geologic history. Specifically, this project aimed to produce a complete catalog of craters down to 200 kilometers in diameter and can be used to relatively date the 32 largest impact basins on Mars' surface, all greater than 1000km in diameter. Using this method, basins with more superimposed smaller craters are assumed older than those with fewer overlaid impacts. These results help in understanding the geologic events in Earth's celestial neighborhood early on in the solar system's history.

Neale Van Stralen, Aeronautical Engineering Student, Clarkson University, Potsdam, New York, is the winner of the Goddard Memorial Scholarship. Mr. Van Stralen is awarded the scholarship to support his continued education and research into the design of Aerospace Structures necessary for the interplanetary transportation of humans.

Individuals and organizations interested in attending the 60th Annual Robert H. Goddard Memorial Dinner on Friday, March 10, 2017 at the Washington Hilton. More information is available at...

spaceclub.org



Harris Imager Captures First Himawari-9 Satellite Image



NASA and the US National Oceanic and Atmospheric Administration.

According to Eric Webster, the Vice President and General Manager, Harris Environmental Solutions, Himawari-8 has been very helpful in providing greater detail and predicting the paths of several typhoons in the Pacific Ocean.

These innovative Harris imagers also benefit airlines by distinguishing between smoke, sand/dust and volcanic ash, which can interfere with flight operations.

harris.com

The Japan Meteorological Agency (JMA) has released the first images captured by Harris Corporation's Advanced Himawari Imager (AHI) onboard Himawari-9, Japan's newest weather satellite—the imager captured detailed clouds over Japan and the Pacific Ocean.

The Harris-built AHI significantly improves the quality, speed and accuracy of information provided to meteorologists with its higher resolution, 11 additional spectral bands and more rapid scans than older imagers.

The AHI captures images of Japan 12 times faster and the full Earth three times faster than older systems. These features generate many more weather products and much improved video capability compared with older imagers.

Himawari-9 was built by Mitsubishi Electric Corporation and launched November 2, 2016.

The AHI leverages similar technology used for the Harris-built Advanced Baseline Imager onboard the Geostationary Operational Environmental Satellite-16 (GOES-16) weather satellite, launched November 19, 2016, by



Artistic rendition of the Himawari-9 satellite. Image is courtesy of the Japan Meteorological Agency.

SES Makes Waves, Goals and Designs on HDTV

SES S.A. is supporting Luxembourg's initiatives in the domain of maritime business by participating in the Salon Euromaritime, as part of the Luxembourg Maritime Cluster.

Luxembourg's pavilion — organized by the Luxembourg Maritime Administration and the Luxembourg Maritime Cluster, with assistance of the Luxembourg Chamber of Commerce and the Ministry for Sustainable Development and Infrastructure — includes 11 participant companies from the Grand Duchy, all serving the maritime sector. SES will present its maritime connectivity solutions at Luxembourg's pavilion.

Through the leveraging of SES's global satellite fleet, upcoming High Throughput Satellite (HTS) capacity and extensive ground infrastructure, SES helps to meet the growing demand for maritime connectivity across a wide range of sectors, enabling the company's customers to provide access to

entertainment for crew welfare and enhance operational efficiencies. SES also recently introduced their new Maritime+ offering.

Designed for service providers, Maritime+ is a fast and simple way to bring connectivity to any vessel, anywhere, in a truly customizable way, and technology advancements adopted by SES allow these satellite connectivity solutions to be cost-effective.

SES also announced that MXI, the firm's wholly-owned subsidiary, is providing the Israel Premier Football League (IPFL) with its end-to-end MX1 360 service for the live editing of sports content.

MX1 360 is providing the IPFL with a sophisticated, yet simple-to-use, cloud-based media asset management solution, with fast turnaround for live highlights production of multiple weekend games.

All content, highlights and metadata are archived and can be repurposed at a later

point to enable additional monetization opportunities. This makes it easy for the IPFL to deliver high-level highlights of its football matches with data and statistical information, which increases viewer engagement.

Gil Halevi, Head of Digital at IPFL, stated that MX1 360 gives the company full control over sports content, in real time, allowing the firm to manage our broadcast partners and their access to the different content that MX1 produces quickly and effortlessly.

According to Elad Manishviz, the CMO and CBO of sports and events at MX1, with MX1 360, the IPFL is well-equipped to provide highlights of multiple games, on-the-go, for delivery over traditional broadcast or OTT networks.

mx1.com

Executive Spotlight: Mark Rigolle, Chief Executive Officer, LeoSat Enterprises

Mark Rigolle joined LeoSat as CEO in September of 2015. He has more than 22 years of experience in the telecom and satellite sectors.

Between 2004 and 2009 he served as Chief Financial Officer of SES. He was then appointed CEO of O3b Networks, where he successfully raised \$1.2 billion to fund the launch of a MEO constellation of satellites that provide affordable trunking and mobile backhaul capacity in developing countries. In addition, he has acted as advisor to satellite operators and private equity funds, as well as being a co-founder of Kacific, a promising satellite-broadband-to-the-home start-up.

Mark has held various positions in Finance and Business Development at Belgacom and ABN AMRO. He holds a Master's Degree in Economics from the University of Leuven, Belgium.

Mr. Rigolle, would you please tell us about your background and why you decided to pursue your career at LeoSat?

Mark Rigolle

I've been in the telecom sector since 1994 and came to the satellite industry as CFO of SES in 2004. I then became CEO of O3b Networks and we secured the funding to launch an Internet backbone via satellite for regions of the world where there was no access to broadband. I've now been working on the LeoSat project for the past 18 months.

What first drew my attention to this project is that it originated from a real customer need that was not being met by offerings in the market. The founders of the company, Cliff Anders, Chairman, and Phil Marlar, Chief Operating Officer, are two former Schlumberger executives with a long history of working in the oil and gas exploration and cruise-line business.



Cliff in particular lived for 17 years with the data connectivity limitations that geostationary fixed-satellite service capacity poses. When leaving Schlumberger, he knew there was a market in oil and gas for a connectivity solution that is ubiquitous, fast, high-throughput, secured, and fully redundant. The question was: how to design such a system?

A market study was done to validate what Cliff and Phil knew through their experience. Soon they realized there was also a market for enterprises, banks, trading companies, telecom companies, governments, and so on.

As for the technology, they also concluded that satellite was the best one to use. LeoSat Enterprises was then established to launch a new LEO satellite constellation that would be able to provide a truly global, enterprise grade, high-speed and secure data network.

Tell us about the LeoSat project and progress to date.

Mark Rigolle

We are working with Thales Alenia Space to manufacture and launch our constellation of up to 108 Ka-band communications satellites. By 2019, we expect to have our early bird satellites ready. They will have a short lifetime but are mostly there to demonstrate the technology of the inter-satellite link via laser. We also have a few customers lined up who will be using these early birds for commercial service.

By 2020 we are planning to start our real launch of satellites into the constellation. All of them should be on orbit by the end of 2021. We could probably deliver a good coverage with 54 satellites but the idea is to have 78 satellites, as that helps us to have redundancy and more flexibility in avoiding interference with other satellites.



One of the good things about this constellation project is that it's more modular than most other planned systems. We'll be able to start generating revenues once we have populated only one of the six planes.

The next planes and satellites will increase the coverage. So, we shall be capable of generating revenues before the whole constellation is up.

In parallel to that, we are also in the middle of our series A funding, looking to raise \$100 million. In 12 months, we will raise another \$175 million. The total funding requirement is close to \$3.6 billion.

Currently, a number of strategic investors such as FSS GEO satellite operators are interested in investing in our high capacity LEO system as a way to expand their reach and to differentiate their services from others.

How do you intend to differentiate yourself from the competition?

Mark Rigolle

What we are offering has never been designed before, so we are often asked the question—are you a satellite company or a networking company?

We are both. We are a networking company because when we are fully operational we will effectively have 78 MPLS "routers in space" that will completely cover the Earth. Each one of them is connected with the four others surrounding it, resulting in a fully meshed and redundant infrastructure.

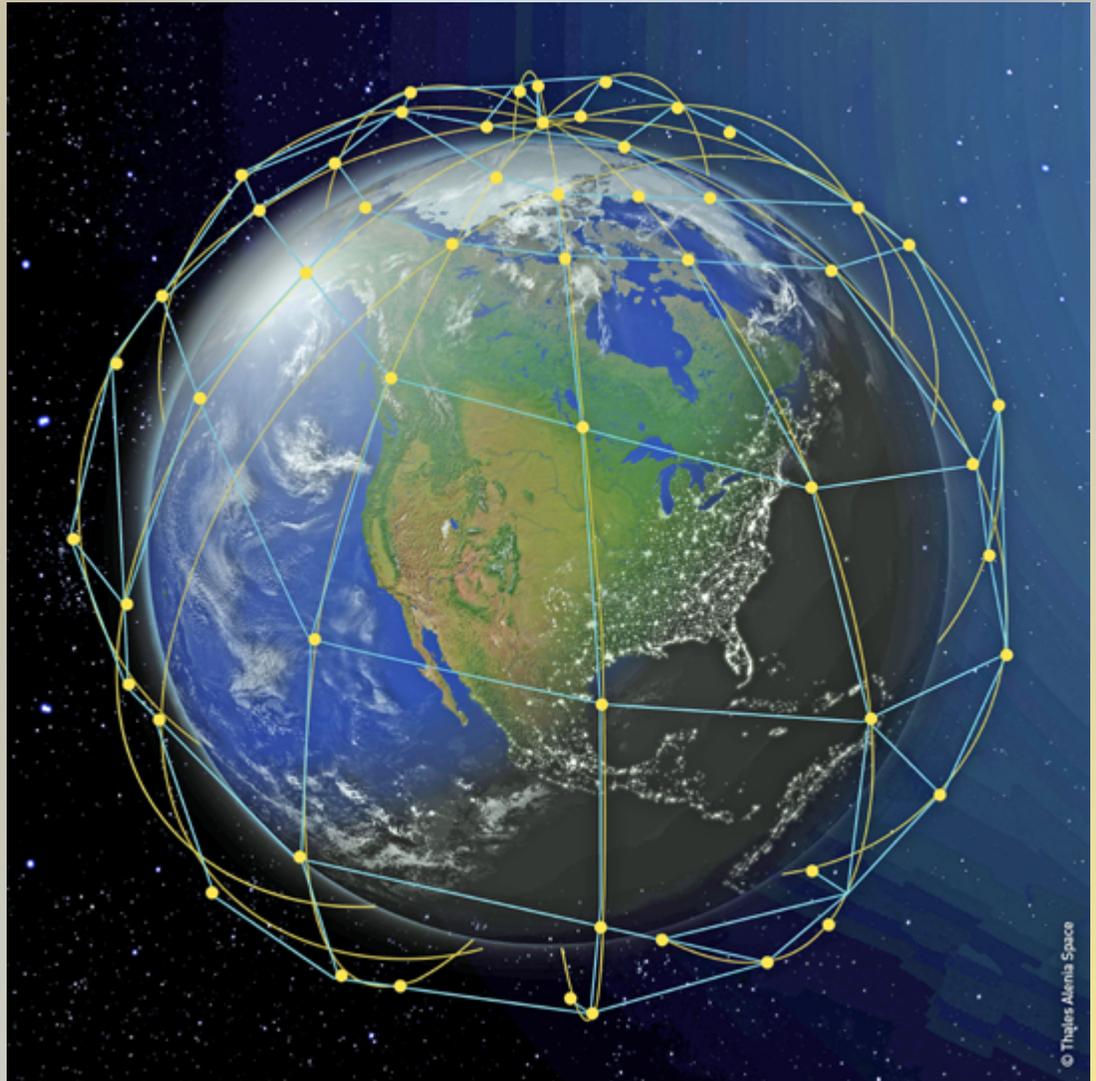
The connections are done by laser, which will have the entire network operate at speeds that are one and a half times faster than when connected to regular fiber. As these routers will be on board spacecraft, we are clearly also a satellite company.

Combining these two technologies we can offer a solution that synergizes and takes benefit from both technologies and makes our offering truly unique.

LeoSat's commercial grade, highly secure data network for point-to-point or point-to-multipoint data solutions, has many advantages:

- *Full global coverage—The LeoSat constellation will use polar orbits and with that will provide full global coverage from pole to pole*
- *Global point-to-point connectivity with no terrestrial touch points in-between—The LeoSat satellites are interconnected through optical links. Once uplinked to the constellation, data will travel from satellite to satellite until it reaches its downlink destination.*

- *High throughput—LeoSat will offer up to 1.6 Gbps of full-duplex connectivity per link, and 5.2 Gbps where needed*
- *Flexible network configuration— links can be combined into star or mesh networks to suit multiple enterprise connectivity scenarios.*
- *Low latency—Because of LeoSat's low Earth orbit, Earth to space latency directly under each satellite will be less than 20ms. LeoSat will be particularly fast on longer distances. Current fiber latency on the New York to Tokyo route is 250 ms—on the LeoSat network, this will be reduced to below 130 ms*



Artistic rendition of the LeoSat constellation. Image is courtesy of Thales Alenia Space.

- *Deterministic latency—one unique attribute of the constellation is that latency can be calculated down to the millisecond for any given period*
- *Highly secure network—The system will provide end-to-end encryption on one network with no interconnection*

What sectors are interested in LeoSat and do you already have customers?

Mark Rigolle

The LeoSat system comes with a unique set of features and benefits, combinations of which are of interest to the below vertical markets:

- Enterprise-to-enterprise communications services
- Internet and cellular backhaul services, especially in rural and isolated areas
- Government services
- Oil-field services and operations
- Maritime communications services

We are getting significant interest from a wide range of sectors and this continues to grow as customers discover more areas for deployment of our services. The general feedback that we are receiving is that in combining satellite and network technology, we have entered exciting new territory which comes with great opportunities for our customers. Ultimately, it is about instant infrastructure from anywhere to everywhere.

For example, Telecom operators, particularly the regional ones, are interested in our global reach and see an opportunity to terminate their customers' traffic anywhere on the globe without having to go through any third-party networks, reducing costs and implementation time.

In the military sector, the high security of our system and our ability to work with mobile sites with fiber-like throughput capabilities is of interest. Also, our polar orbits and therefore our ability to cover the entire Earth is considered a unique proposition.

We recently attended the Arctic Frontiers conference where LeoSat was recognized as having the optimal solution to the challenges of connectivity in the Arctic Regions. We are also seeing interest in LeoSat for data-intensive research activities such as those of the National Science Foundation, which manages the US Antarctic Program.

The oil & gas sector needs better command and control capabilities in their efforts to further automate rigs using robot technology. And companies in this sector are very appreciative of our low latency capabilities, as are the various companies in the financial sector.

We are delighted to have already contracted our first customer, who has requested to remain anonymous for the moment. We've also received three memorandums of understandings (MoUs) with potential customers who should confirm their involvement at a later stage of the project.

We continue to secure valuable partnerships with strategic service providers, most recently signing an agreement with the Globalsat Group, the leading Pan-American mobile satellite service provider, delivering voice and data, M2M/IoT solutions and next-generation connectivity for mobile applications in the energy, government, defence, media, mining, banking, NGOs and tourism markets.

What will the next five years look like for the satellite industry and for LeoSat?

Mark Rigolle

The world in general is increasingly inter-connected, cloud-based and data driven. This is a unique opportunity for the satellite industry in general and for LeoSat's LEO solution in particular.

Bandwidth requirements will continue to rise with the demand for always-on connectivity and businesses will increasingly look at how technology can improve connectivity and operational efficiency. The availability of data, a new generation of technologies such as IoT and M2M, and a cultural shift toward data-driven decision making and automation continue to drive demand for big data, analytics technology and a fast and resilient communications network.

The question is how can traditional satellite networks respond to this increasing dependency on big data and cyber security?

LeoSat's unique global network architecture—effectively an MPLS network in space—starts to become a reality with the first launches in 2020, enabling voice, video and cloud-based applications for enterprise and government communications helping to drive forward efficiencies and ensuring optimized connectivity.

Sectors such as maritime, government, oil & gas, enterprise and Internet and cellular backhaul services will benefit from a network that is not only completely secure and reliable, but delivers data faster than any other terrestrial or satellite network.

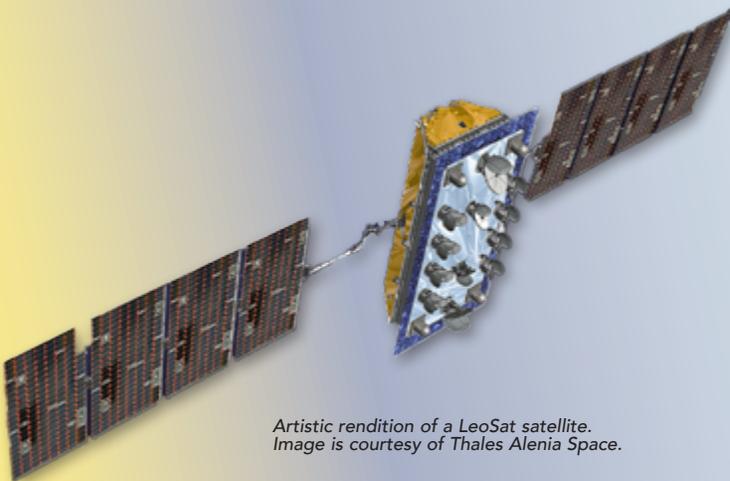
Combining the speed of fiber with the ubiquity of satellite means LeoSat is creating a new communications paradigm, shifting the perception of satellites from a last resort option to a first choice for data transportation.

With this in mind, we look forward to seeing the current trend in the satellite industry continue, where GEO operators are partnering with LEO operators to complement and expand their service offerings.

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Artistic rendition of a LeoSat satellite. Image is courtesy of Thales Alenia Space.



Healing the Sick via Satellite: SSPI—Satellites Make A Better World



Poverty and distance are the enemies of health.

In the rich world, high-quality medical care is usually a short drive away, because there are three physicians available, on average, to serve every 1,000 people.

In South Africa, however, there are 0.8 doctors per 1,000, even though it is one of Africa's most prosperous countries. In one of the region's poorest countries that is not racked by war, Tanzania, the average is only 0.3 doctors per 1,000 population.

Not even rich-world citizens are immune from the curse of distance. Whether in rural counties or remote mines and wellheads, people can find themselves far from help when help is needed the most. That is why health systems around the world turn to satellite to extend the reach of medicine and to defeat threats to public health before they become catastrophes.

Have Mercy

In the early 1980s, a ship called the *Anastasis* set sail from the United States for the coast of Africa. This was a hospital ship, staffed by volunteer doctors, nurses and medical technicians, who donated their services wherever the ship touched land.

Over time, the three vessels of the charity, Mercy Ships, have conducted thousands of life-saving, often life-changing surgeries and medical procedures. Satellite has played a supporting role in nearly every one.

"For surgeries in particular, there are two key areas—lab and radiology—that depend on a connection with satellite," Mercy Ships' programs design director Michelle Bullington said in a magazine article.

"In our lab, we use it to help with diagnoses from a remote location back to the US. All of the scans from our radiology department are read remotely."

Mercy Ships is hardly the only nonprofit using ships to deliver medical care. A Bangladeshi charity, FRIENDSHIP, operates its own fleet of floating hospitals. They use SATMED, an e-health platform developed by satellite operator SES, working with European NGOs, which is funded by the Luxembourg government. In addition to communications, SATMED provides software tools from electronic medical records and tele-radiology to e-learning.

Telemedicine at the Extremes

This remote delivery of care, consultation and training is called telemedicine—and it is having a huge and growing impact on people's lives. According to a study of a single telemedicine network by the American Telemedicine Association, medical consultations between rural hospitals and metropolitan medical centers saved more than 850 lives over a four-year period.

Review of medical orders by hospital-trained pharmacists at the medical center prevented more than 11,450 serious drug interactions and allergic reactions. Improved oversight of acute care for the most seriously ill saved 28,500 days in the intensive care unit and reduced costs by \$44 million.





Thirteen thousand feet above sea level in the Himalayan Mountains, Apollo Hospitals has brought telemedicine to the top of the world, in a government-assisted project called Himachal Pradesh Telehealth Services. The location is so remote that a helicopter was needed to ferry in the equipment, and the Apollo team's first job was to clear 20 feet of snow and ice from around the local clinic so they could establish the satellite terminal.

They equipped the clinic with a two-way video link and remote diagnostic kit for measuring vital signs. This equipment was put to the test a few days ahead of the scheduled opening when two local people suffered heart attacks.

Consulting remotely with emergency doctors in Chennai, India, the telemedicine team was able to rapidly stabilize the patients and prescribe the next necessary steps. Since then, hundreds more have had consultations with faraway doctors who would otherwise have never set eyes on the residents of Himachal Pradesh.

Ships at sea, oil platforms and remote mining sites also face extreme isolation. To meet their needs, George Washington University (GWU) teamed with software developer Diginonymous to develop Digi+Doc. This software gives users voice and video access to more than 500 physicians and specialists at the GWU Medical Facility.

VSee, a private company, provides telemedicine support for two Shell oil platforms off the Nigerian coast, which allows the single medic on duty to bring aboard the expertise of multiple physicians. (*The VSee system is also in use aboard the International Space Station for everything from medical consults to school presentations.*)

The grandfather of satellite telemedicine is surely the International Radiomedical Centre in Rome. Using the simple tools of telephone and email via satellite, it has cared for more than 50,000 maritime patients since being founded in 1935.

Fighting Disease Outbreaks

When the Ebola disease broke out in West Africa, NetHope, a consortium of humanitarian organizations, coordinated a strong response from satellite companies. The nonprofit deployed hundreds of satellite terminals from Thuraya, Inmarsat and Eutelsat to Ghana, Liberia and Guinea—SES brought the SatMed platform to Sierra Leone. These systems provided voice, email, videoconferencing and digital services to educate emergency responders, spread best practices, identify gaps and coordinate response.



A different satellite technology holds out hope for stopping epidemics before they begin. Insects are responsible for spreading many diseases, and climate change, trade and travel are constantly driving insect populations to new areas.

A consortium of Belgian companies, supported by the European Space Agency, has developed a software and services package called Vecmap. It improves how field researchers gather data and how public health authorities use it.

The work begins with field researchers placing insect traps and checking them periodically to identify, count and test the insect found therein. They enter data into the smartphone app, which also captures exact GPS coordinates, and Vecmap pools the information to map high-risk areas on a satellite images.

This is invaluable information for public health officials working to prevent the next epidemic. Field researchers also helps to find those traps in the field as well as to select new target areas, which are the most time-consuming and costly part of data-gathering.

Health is the greatest gift. Wherever poverty or distance denies that gift to the world's people, satellite brings a healing hand and hope for a better life.

*Produced for SatMagazine by the
Society of Satellite Professionals International:
betersatelliteworld.com*

Notes

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Gilat's VSATs to Provide Internet to Tricolor TV and Eutelsat Nets

A two-way Internet access service has been launched as the result of Tricolor TV, a Russian Direct-to-Home (DTH) satellite TV provider and Eutelsat Networks satellite Internet operator.

This two-way Internet access service has been launched with broadband consumer VSATs from Gilat Satellite Networks Ltd. whose residential terminal kits are sold and serviced by NoLimit Electronics (NLE) a distributors of electronic and related products in Russia.

The two-way "satellite Internet" service was launched in September 2016, and provides consumer and professional subscribers Internet access with speeds of up to 40 Mbps downstream and 12 Mbps upstream.

In order to connect to the service, it requires the installation of receiving equipment, Gilat's Gemini broadband VSAT terminal, which can be self-installed and supports automatic service activation.



SkyEdge II-c Scorpio VSAT-in-a-box.

Later this year, NLE is planning to offer Gilat's Scorpio VSAT, an innovative VSAT-in-a-Box, all outdoor solution, which further simplifies self-install, maintenance and easy roof mounting.

Satellite capacity is provided by Eutelsat's Express AMU1/EUTELSAT 36C high throughput satellite, which delivers continuous coverage throughout Western Russia. The Eutelsat service is enabled by Gilat's scalable multi-application X-Architecture for SkyEdge II-c.

Alexey Karpov, Director of Sales and Subscriber Service at Tricolor TV said,

"Satellite Internet' services is a modern, technological product that provides subscribers with access to high speed Internet even in regions where the use of alternative access methods to the network are difficult. By working together with Eutelsat Networks, and with Gilat's broadband consumer VSATs, we can offer Russian customers high-quality and affordable broadband access to the Internet."

Alexander Klimov, General Manager Russia at Gilat, added, *"We commend Tricolor TV on the commercial launch of their groundbreaking two-way broadband service for the consumer market. We are proud to be part of this endeavor and look forward to continued close cooperation with our partners at Eutelsat and NLE in the growing Russian communications market."*

gilat.com/

Intelsat Epic^{NG} To Improve B'band for Europe and Africa

Intelsat S.A. and Quantis Global have signed an agreement to enhance and expand the Quantis network using services provided by Intelsat Epic^{NG} HTS and IntelsatOne Flex services, bringing higher performing broadband services across Europe and North Africa.

Quantis, part of Euronet Wireless Telecom SA (MAB: EWT), will incorporate services from two Intelsat Epic^{NG} satellites—Intelsat 33e and Intelsat 37e—and use Intelsat's managed services offering, IntelsatOne Flex for Enterprise, which delivers high-quality, global, enterprise-grade, wholesale Mbps service.

The network leverages Intelsat teleports and will serve NGOs, enterprise, embassies, the O&G sector, and maritime customers in Europe, the Middle East and Africa.

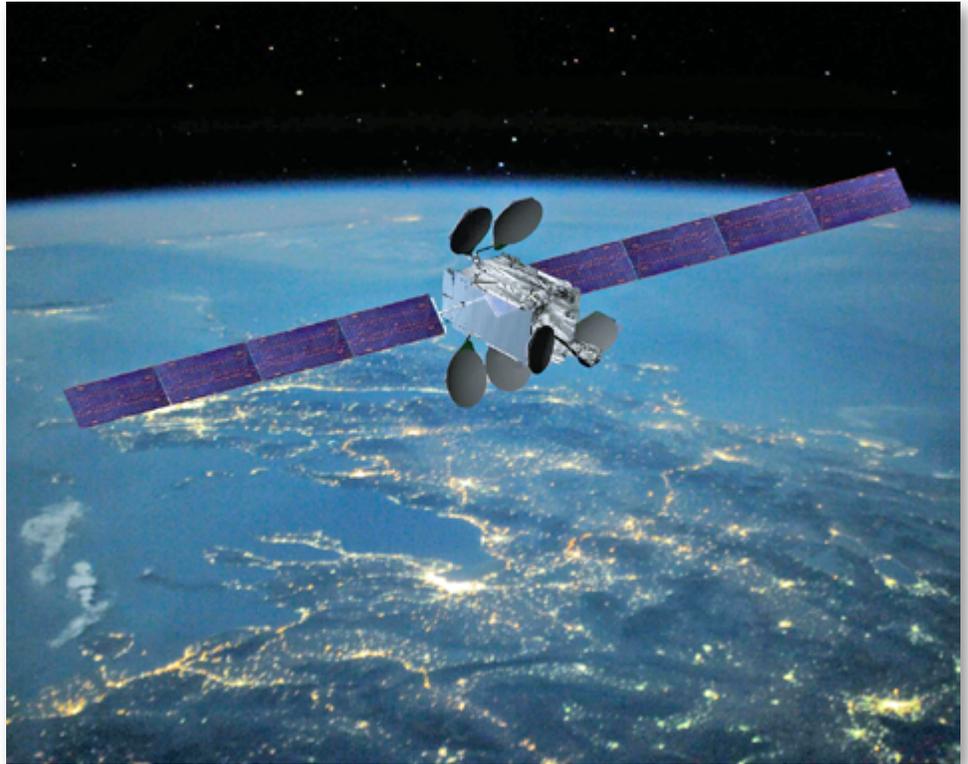
Intelsat launched the first two satellites in the Intelsat Epic^{NG} platform in 2016.

Intelsat 29e serves the Americas, and Intelsat 33e began operations over Europe, the Middle East, Africa and Asia on January 29th. Intelsat 37e is scheduled to begin service in 2018.

The flexibility of Intelsat Epic^{NG}'s open architecture and backward-compatible design enables service providers like Quantis to seamlessly transition to Intelsat Epic^{NG} and immediately realize efficiency improvements, a signature of this high-throughput platform.

Aquilino Antuña, CEO of Quantis, affirmed that his firm added high-throughput services in order to meet the growing needs of their existing customers, as well as to position the company for new, revenue-generating services that require higher throughput HTS.

After reviewing many options, it was clear that Intelsat Epic^{NG} and IntelsatOne Flex offered the best path to immediately deliver more bandwidth and cost-efficient commercial solutions to Quantis'



Artistic rendition of the Intelsat 33e satellite.

blue-chip corporate, NGO and maritime customers.

The global footprint of the Intelsat solution also means the company will be able to support their growth strategies in the countries where they currently operate as well as quickly respond to new market opportunities anywhere in the world.

Jean-Philippe Gillet, Intelsat's Vice President, Europe, Middle East and Africa, added that this managed service accelerates time to market and allows service providers to be more responsive to end users all the while expanding their network with a robust and easily scalable broadband infrastructure.

Additional Intelsat Epic^{NG}:
[intelsat.com/global-network/satellites/epicng/](https://www.intelsat.com/global-network/satellites/epicng/)

Additional information regarding IntelsatOne Flex for Enterprise:
[intelsat.com/intelsatone-flex/enterprise/](https://www.intelsat.com/intelsatone-flex/enterprise/)
[quantis-global.com/](https://www.quantis-global.com/)



Automation Enhances Satellite Fleet Operations: A Telesat Perspective

By Steve Reid, Satellite Engineering Manager, Telesat

In 2007, Telesat merged with Loral Skynet, a US company with a strong technical background tied to the achievements of AT&T Skynet, Bell Labs and the Telstar program.

The satellite fleets of both Telesat and Skynet were combined and became part of Telesat's existing operations. The increased workload of the expanded fleet, which was to be managed without additional staffing, highlighted the need to improve operational efficiency through innovation.

Telesat satellites are controlled using real-time systems (RTS) from several different providers. Although each of these systems have basic plotting and charting capabilities, Telesat uses its own proprietary scalable data management (SDM) system for the historical retrieval and real-time charting of telemetry data. SDM ingests the processed telemetry from each RTS and, through use of various in-house developed tools, enables the data to be accessed for analysis. While these tools offer flexibility for investigations and simple retrievals, they do not lend themselves to automation.

With limited capabilities for automated analysis of telemetry data, Telesat's satellite engineers were continually being challenged to remain up-to-date with the trending requirements of the expanded on orbit fleet. Data gathered from all onboard subsystems, such as Attitude Control, Power, Communications, Propulsion, and Thermal had to be monitored on a continuous basis to determine if the health or performance of the system is deviating from expectations.

Historically, the manual trending and analysis of the subsystem data was performed mainly through visual assessment of data retrieved from SDM or, if more detailed examination was required, the data would be imported into programs such as Microsoft Excel for plotting and further analysis. Manipulating the data in Excel was time-consuming, tedious and required analysis expertise from senior level engineers. Additionally, Excel had limitations with the amount of data it could handle and the results could not be easily automated for evaluation of trending patterns.

Efficiency and Innovation

Telesat sought a more efficient, innovative solution to monitor and study the thousands of data channels received from the firm's growing satellite

fleet and improve the company's capabilities for automated trending while also maintaining staff levels.

To meet the expanding needs for fleet analytics, Telesat turned to OriginLab, a publisher of data analysis and graphing software. Telesat developed a custom interface to allow OriginLab's Origin 9 software to request data over specified time intervals from Telesat's SDM system.

Following a period of development, a new web-based system called STARS (Satellite Telemetry Analysis and Reporting System) was implemented throughout the company's satellite control operations. Here's a brief summary of how it works:

- *Once the data is brought into Origin, it is analyzed and the results are automatically published to STARS in the form of static plots or more dynamic plots using JavaScript. Through simple navigation within the STARS interface, Telesat engineers can now immediately evaluate satellite performance data on any spacecraft within the company's fleet.*
- *Most analyses are performed on a daily or weekly basis. However, Telesat has the ability to conduct analyses at five minute intervals or less, if required by the engineers.*
- *As part of the analysis process, Origin can automatically issue an email notification in the event any specified analysis parameter violates a pre-determined performance threshold, as specified by the engineer. If there is variance from established norms, an email is automatically sent to Telesat engineers with details on the out-of-spec condition. Out-of-spec conditions can also be viewed and quickly addressed on a dashboard where real-time data is being plotted.*

The Benefits

By implementing Origin 9, Telesat was able to improve operations and gain the following benefits:





- **Streamlined, efficient operations:** Telesat engineers can quickly respond to out-of-spec conditions for a particular analysis when notified through the visual, real-time data dashboard via the website or through a separate email. With this added visibility and awareness, engineers are able to immediately investigate the exact issue rather than manually looking through entire datasets. Engineers are now more efficient in responding and focusing on notifications about a potential on-board non-conformance.
- **Improved resource allocation:** The reduction of the time-consuming, manual tasks tied to the trending of subsystem telemetry data enables and empowers engineers to focus on other areas of operations. Telesat operations personnel now have the ability to look for new areas of improvement as the company strives to enhance its fleet operations through innovation.
- **Ability to maintain staff levels and control costs:** Although Telesat took on the operations of an additional satellite fleet following its merger, the company was able to maintain staffing levels by automating and optimizing the analysis tasks. In one particular case, Telesat performed an audit and found that Origin had been able to reduce approximately 75 man-hours per month on one of the more complex spacecraft that requires a lot of analyses running in the background. These types of time savings translate into significant cost benefits.

- **Capability to leverage existing code and analysis data:** Once Telesat's engineers have generated the code and information for one satellite bus type (general model on which multiple-production satellite spacecraft are often based), it's very easy to duplicate it for another spacecraft from the same manufacturer that has an identical design. In many cases the analysis framework can also be ported over to a spacecraft from a different manufacturer because many of the techniques are the same.

Steve Reid, satellite engineering manager, Telesat, said, "By utilizing Origin, we've been able to save not only time, but we've addressed a longstanding challenge to effectively manage and standardize the trending and analysis of telemetry data across our in-orbit fleet. As a result, the satellites that we control are better monitored and managed by our engineers, allowing us to enhance our focus on core operations with a view to further improving overall efficiencies. By doing so, we will continue to provide the best support for our customers. It's been a game changer for us. In fact, given the flexibility of the system we've developed, its capabilities could be of benefit to any application where there is a requirement to trend and analyze large sets of streaming data."

The Future

Due to the success from using Origin, Telesat has already begun using the capability for additional initiatives. For example, Telesat recently developed new techniques for streamlining and enhancing the in-orbit testing of satellite payloads based off analytic results processed through the Origin software.

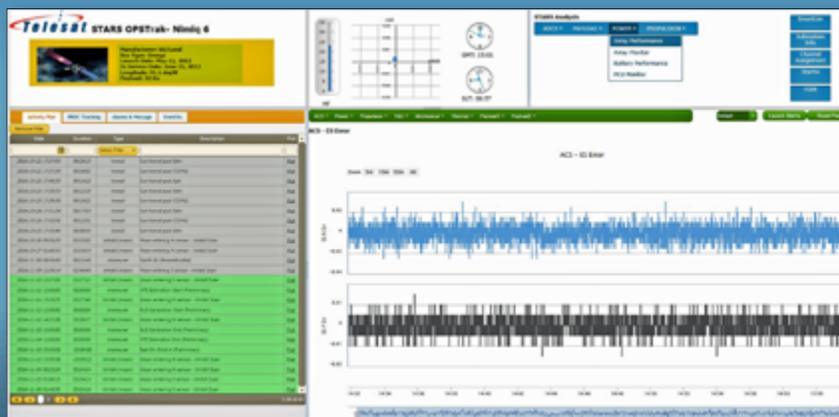
In another case, Telesat used Origin to develop a system that manages and auto-generates telemetry check limits for its real-time systems that has further enhanced operations.

Moving forward, Telesat is looking for more ways to apply the benefits of Origin in other areas of the firm's businesses.

telesat.com/

originlab.com/

Telesat is a leading owner and global operator of geostationary communication satellites, providing reliable and secure satellite-delivered communications solutions worldwide to broadcast, telecom, corporate and government customers. Established more than 45 years ago and headquartered in Ottawa, Canada, Telesat's state-of-the-art fleet consists of 15 satellites plus the Canadian payload on ViaSat-1 with two new GEO satellites under construction. An additional two prototype satellites are under construction and will be deployed in low earth orbit (LEO). Telesat also manages the operations of additional satellites for third parties.



SATCOM 2017 to 2020: Choosing for Change A Norsat International Perspective

By Daniel Lopez, Product Manager, Norsat International

2017 has continued the dynamic industry trajectory of the preceding years.

Commercial customers harnessing the opportunities of SATCOM-enabled communication to adapt their business models and fight for market share... military operators exploiting the competing benefits of both proprietary and commercial networks... government services expanding their service offering as well as their reach...

What markets should SATCOM business leaders be focusing upon in order for their products and services to remain relevant and grow? It starts with an understanding of the areas in the target markets that are experiencing change.

The Battle of the Bands

To understand the likely trajectory of SATCOM over the next three to five years, understanding satellite frequency band utilization is critical, by both commercial and military users. The current preeminence of C- and Ku-band, which are the commercial staple bands of choice, are facing a unique challenge from Ka-band, one that is still evolving. Nonetheless, Ka- will almost certainly grow into and remain a significant bandwidth alternative.

Why Ka-? The answer lies both in the nature of the C- and Ku-bands' usage as well as Ka-band's performance advantages. Because of their commercial prominence since the 70s and 80s, respectively, their large constellations of satellites have provided near complete global coverage. Paradoxically, all that coverage enabled a utilization that, over the years, has seriously outstripped supply of bandwidth, leaving the satellite industry to initiate developments in Ka-band.

Apart from the obvious advantage of virtually untapped capacity, C- and Ka-band offers SATCOM operators significant advantages. The shorter wavelengths of the higher Ka-band frequencies enable much higher gain characteristics—almost four times as much as Ku-.

Additionally, the higher frequency enables the use of much smaller reflectors—up to a quarter the size. Not surprisingly, the merit of smaller (and, therefore, lighter) antennae has translated into high adoption by military and similar high-mobility operators, where pounds and inches make or break a specification.

Notwithstanding these advantages, Ka-band adoption is not straight forward. Capacity is somewhat still an artificial benefit to the extent that the constellation of Ka- satellites is minute when compared to C- and Ku-satellites.

Additionally, both C- and Ku-bands' rain fade performance being superior to Ka-'s means that the future of commercial SATCOM band utilization will remain a proposition for C-, Ku- and Ka-bands.

What about X-band? Traditionally, the exclusive band of choice for defence operators, X-band has also evolved into a commercial band option. As military bandwidth requirements decreased in the wake of drawdowns in large-scale deployments in the Iraqi and Afghan theaters, X-band suppliers have sought ways of converting excess capacity into opportunity.

Projects such as the 2016 partnership between Hughes, Airbus and Skynet are premised on making excess X-band capacity available to non-military and commercial operators. In each case, the previous distinctions in "commercial/civilian" versus "military" applications—and their associated bands—continue to be blurred over time.

WGS: Military-Only, But Not the Only Choice

Defense operators present an interesting case study for understanding the dynamic nature both of today's band utilization—and more broadly—industry-specific constellations.

Within the NATO community, the Wideband Global (WGS) constellation of satellites was developed exclusively for the militaries of the US, Canada, and several member states. WGS' role was to give dedicated bandwidth for operational requirements for applications ranging from C3 (communications, command and control) to reconnaissance and surveillance, as well as to certain US non-military government users.

From the first three Block I WGS satellites launched between 2007 and 2009, through to the five additional satellites launched as part of the Block II program from 2012 to 2016, the network yields significant bandwidth improvement over the Defence Satellite Communication System (DSCS) that is being replaced.

Does this mean "Mission Accomplished" for WGS partner users?

Yes and no. To achieve access to the WGS network, only WGS certified terminals can be used by prospective operators. The cost of developing and certifying to WGS standards is an expensive as well as lengthy process.

For example, ARSTRAT, the US body which certifies for WGS, requires the participation of a willing sponsor customer (or country, if not in the US). That, alone, has been an entry barrier to numerous terminal manufactures. Correspondingly, the cost of said WGS-certified terminals and their time-to-market presents another disadvantage to a prospective military customer.

The terminal itself is not the only factor that figures into the operational requirements of a defense procurement. Additionally, there is the usability of the WGS network itself.

Accessing WGS airtime takes longer and is more complex administratively, in contrast to accessing commercial networks—in some cases, end users end up not even qualifying for use of the network. When shortest time-to-comms and maximum timing flexibility of establishing SATCOM data links trump the security and bandwidth available from WGS, commercial networks present a compelling option, if not an outright alternative, to certain military SATCOM requirements.

Lighter Versus Easier

Diverging propositions are also increasingly common where size and weight are concerned. For example, in fixed terminals, there is less incentive to use smaller and lighter components as the antennae itself is often driving the size and weight of the terminal, whereas for mobile satellite terminals, the lighter the terminal, the better, all other factors being equal.

Even within the mobile category, does that fact always hold true? The answer is that where there is a significant ease of use requirement, customers will often trade lower size and weight for the benefits of ease of use features, such as auto-acquire.

Following the pattern of increasingly intuitive interfaces and the pervasiveness of "smart" features in virtually every single communications device, terminal manufacturers are increasingly making the operation of satellite terminals a user-friendly experience.





Features such as simple touch-screen interfaces and “single-button” start features shorten the time to get a live link up as well as reduce the need for in-depth user training.

With purchase price differentials of up to 20 percent between manual and auto acquire terminals, ease of use can be traded off versus continuous costly operator training, especially if there’s frequent user rotation and/or reassignment.

As an example, Norsat’s own military-focused GlobeTrekker™ 2.0 combines multiple ease-of-use features that include intelligent LinkControl™ automated satellite acquisition, as well as one-touch interface, all in a rugged, military-grade, modular component architecture. Packaged in 3 or 4 IATA-sized carry cases, this unit contrasts with the ultra-portable, lightweight manual acquire Norsat Journey Manpack™, which can be packed down to 1 IATA case but has no integrated pointing tools. Each brings a different proposition to cover a wide range of military operational applications.

More Options for Integration

With the enormous array of possible customer permutations for bands, types of terminals, applications, and so on, successful terminal and component equipment suppliers are most successful meeting highly variable customer needs by building multi-functionality into the design. A good example is how terminal Management and Control (M&C) has evolved. Traditionally, terminal access was typically centered around mainstay protocols such as RS-232, and progressing more recently, to include RS-485 serial interfaces.

However, with increasing demands for functionality, such as remote access or operation within a Network Management System (NMS), then the Ethernet protocol is a requirement. Terminal and component suppliers typically offer M&C designs that have functionality for all three already included. As Ethernet offers faster local user M&C communications as well as more effective scaling, the requirement for Ethernet is rapidly becoming universal.

Going further, as fiber optic infrastructure becomes increasingly commonplace, more component manufacturers are offering fiber optic interface units for deployments where there is a need for more than 100 meters between the indoor and outdoor units. Is that enough to meet the ever-growing



demand from an ever-widening list of customer applications? The answer is no—particularly where military and/or airborne applications are concerned.

For example, a standard Block Upconverter (BUC) will typically require extensive modifications to meet a host of stringent compliance standards. Under the auspices of MIL-STD-810G or DO-160, environmental factors such as higher temperature, higher altitude, humidity, shock, and vibration each have testing prerequisites that must be met before the BUC can be approved for use in certain military airborne applications.

Emissions, particularly from connectors, are evaluated under MIL-STD-461F. Ensuring components meet these tests is a costly and time-consuming process, but critical to addressing the rigors of SATCOM-on-the-move (SOTM) and airborne integration requirements.

For example, the Norsat ATOM™ line of BUCs and SSPAs were designed specifically with these specification requirements in mind; however, they may not be the least expensive products in the market.

Remain Flexible or Get Left Behind

Between now and 2020, important changes will occur in many industry verticals as a result of the harnessing of the opportunities of satellite-enabled communications. From WiFi on commercial flights to higher levels of battlefield data availability to broadband access in rural schools in developing countries, the result will inevitably be more connectivity.

More importantly, though, is what enables that connectivity: flexibility, both in design and in operation. Successful providers of SATCOM products and services will have tied their relevance in the market to the understanding that customers will demand the ability to choose networks, they will seek alternatives in how their equipment and supporting systems interact, and they will seek options and customizations regarding specific functionality.

Not surprisingly, those requirements will evolve over time, as well.

www.norsat.com

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NASA's New Horizon Getting its Burn On



Artist's impression of NASA's New Horizons spacecraft conducting a flyby study of its next target – 2014 MU69, a Kuiper Belt object orbiting a billion miles beyond Pluto – on January 1, 2019. Image is courtesy of NASA/JHUAPL/SWRI/Steve Gribben.

NASA's New Horizons spacecraft completed a short propulsive maneuver to refine its track toward a New Year's Day 2019 flyby of 2014 MU69, a Kuiper Belt object (KBO) some four billion miles (6.4 billion kilometers) from Earth.

Telemetry confirming that the engine burn went as planned reached the New Horizons mission operations center at the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland, via NASA's Deep Space Network stations in Goldstone, California and Canberra, Australia.

The radio signals carrying the data traveled over 3.5 billion miles (5.6 billion kilometers) and took more than five hours to reach Earth at the speed of light.

Operating by timed commands stored on its computer, New Horizons fired its thrusters for just 44 seconds, adjusting its velocity by about 44 centimeters per second, or a little less than one mile per hour.

It was the first trajectory maneuver since the team conducted a set of four maneuvers in the fall of 2015 that put the spacecraft on a course for its rendezvous with MU69 on January 1, 2019.

"One mile per hour may not sound like much," said mission Principal Investigator Alan Stern, of the Southwest Research

Institute in Boulder, Colorado, "but over the next 23 months, as we approach MU69, that maneuver will add up to an aim point refinement of almost six thousand miles (10,000 kilometers)."

New Horizons Mission Design Lead Yanping Guo, of APL, said Wednesday's burn adjusts for what the team has learned since 2015 from new Hubble Space Telescope measurements of MU69's orbit, as well as the spacecraft's own location.

After the burn the spacecraft transitioned out of a so-called "three-axis stabilized mode," the operating mode that allowed New Horizons to make new telescopic observations of six KBOs over the following week.

These science observations will reveal new information on the shapes, surface properties and satellite systems of these objects, in ways that can't be done from Earth. Images from these studies will be transmitted to Earth in the coming weeks.

nasa.gov/mission_pages/newhorizons/main/index.html

Record for Live Event Telecasts

Global Eagle Entertainment Inc. set a record in 2016 for the number of hours of live event telecasts to cruise ship passengers around the world on its MTN-TV Special Events Channel.

Exceeding its prior record by more than 400 hours, MTN-TV delivered nearly 700 events and 2,627 hours of live televised sports, entertainment and specials in 2016. MTN-TV is currently available on 27 cruise lines and more than 135 ships.

The expanded special events coverage is part of an overall strategy to increase program offerings on MTN-TV.

In addition to increasing the number of programs on the Special Events Channel, Global Eagle is launching up to 20 new MTN-TV channels this year, including emerging market content from China and Australia.

It also has acquired rights to more than 10,000 hours of international sporting events, including live telecasts from the International Cricket Council, Lagardère Sports and Premiership Rugby.

In addition to special event programming, cruise lines have used the Special Events Channel for their own projects, such as broadcasting live a christening ceremony of a new ship to other vessels in their fleet.

MTN-TV general manager Bill Witiak indicated that as the international demographics of cruise line guests have changed over the past few years, so has his firm's programming.

The MTN-TV Special Events Channel now offers a bigger, more globally diverse mix of live entertainment award shows, international sporting events and even live opera—when on a cruise, passengers don't want to miss your favorite sports team or other events coverage and should expect the same quality of experience at sea that you get in their homes.

geemedia.com



On-Demand LEO Constellation

Until now communications with Low Earth Orbit (LEO) satellites has only been available when the satellite is within sight of an Earth station, making this limited connectivity available only on a rigid time schedule based on the particular LEO satellite's orbit, and the geographic placement of the Earth stations.

Addvalue Innovation Pte Ltd ("Addvalue") and Inmarsat have signed a Memorandum of Understanding (MoU) to offer a data relay service to meet the communications needs of the Low Earth Orbit (LEO) satellite market.

The new service is designed to address this issue, and will be based on Addvalue's Inter-Satellite Data Relay System ("IDRS") terminal and Inmarsat's Geosynchronous Earth Orbit (GEO) I-4 satellite-based Broadband Global Area Network (BGAN) network.

The agreement will be finalized soon, as the real-time links will enhance the operational efficiency of LEO satellites. Under the proposed agreement, Addvalue and Inmarsat will take the IDRS service to market, providing commercial, on-demand, 24/7 two-way IP-based data services for in-orbit LEO satellite missions. Addvalue's IDRS is an innovative new service that addresses a long standing constraint confronting the operation of LEO satellites.

Currently there are 12 satellites in geosynchronous orbit, which means their position appears to be fixed when viewed from the Earth. Satellites are positioned to transmit radio beams in two global configurations, covering the oceans and the major landmasses providing seamless worldwide communications coverage, except in the extreme polar regions.

Dr. Colin Chan Kum Lok, Chairman and CEO of Addvalue, remarked, *"Basing this service on Inmarsat's I-4 GEO satellite constellation, which is already in orbit and fully operational, significantly reduces the cost and time to market for IDRS. We are pleased to note that the commercial model we are working on will grant Addvalue exclusive air time distribution rights for the Addvalue IDRS service."*

Andy Start, President, Inmarsat Global Government, welcomes the opportunity that this IDRS solution provides for Inmarsat's GEO satellites to help solve a problem that has plagued the LEO satellite industry. *"It is very exciting that Addvalue and Inmarsat are able to offer a solution that will enable real-time command and control and data transfer for LEO satellites via our trusted GEO constellation. The successful in-orbit testing has been a ringing endorsement of both the Addvalue IDRS terminal and our satellite constellation. We look forward to working together with our technology partner Addvalue to promote this solution to LEO operators across the globe."*

Andy further noted that Inmarsat's US Government unit is similarly looking forward to working with Addvalue on agreements to bring this service to that market.

addvaluetech.com

inmarsat.com

InfoBeam

WorldView-4 is Up and Capturing

The WorldView-4 satellite, operated by Earth imagery company DigitalGlobe, Inc., has successfully completed on orbit testing and calibration.

The satellite started to serve the company's first direct access customer on February 1—additional direct access customers will be added to WorldView-4 service throughout 2017.

WorldView-4, launched on November 11, 2016, becomes the fifth active satellite in DigitalGlobe's constellation.

The satellite's performance meets the industry-leading quality standards of the WorldView fleet and joins WorldView-3 as the world's only commercial satellites capable of achieving 30 cm native resolution.

Imagery with this level of detail enables users to reliably read street markings, distinguish between cars, trucks, and vans, and confidently understand activities of significance, as demonstrated by a recent SkyTruth analysis that used WorldView-3 imagery to document the likely transshipment of fish by Southeast Asian vessels in the Indian Ocean.

WorldView-4 tasking and archive orders are expected to be made available to all DigitalGlobe customers in the second half of 2017.



The satellite more than doubles DigitalGlobe's capacity to collect 30 cm imagery, enhancing the company's ability to meet the most demanding commercial use cases, such as complementing aerial imagery collection strategies, and enabling the creation of high-quality, imagery-derived products, such as high-resolution 3D models and near-seamless, country-scale basemaps.

"Meeting our commitment to delivering WorldView-4 access on time for our customers is a tremendous achievement," said Tim Hascall, DigitalGlobe EVP and Chief Operations Officer.

worldview4.digitalglobe.com/

Cloud Free Mosaics from MDA Information Systems

MDA Information Systems LLC (MDA), a firm that provides geospatial and advanced information solutions to government and commercial customers, has released their NATURALVUE™ 2.0 which, according to the company, is the only global, commercially available, cloud-free, seamless mosaic using current imagery.

All the land masses of the Earth, except for portions of Antarctica, were acquired with new Landsat 8 imagery, making this the only commercially available up-to-date global mosaic.

NATURALVUE™ 2.0 is 99.99 percent cloud free, with improved positional accuracy, color fidelity and enhanced spatial resolution.



NATURALVUE™ 2.0 global coverage provides a seamless basemap for geospatial and web-based mapping applications, military/defense logistics, GIS backdrops, flight simulation, cartographic mapping and 3-D visualization, and GPS tracking.

mdaus.com/products/naturalvue%20AE-2002e0

Angola's First Satellite Could Launch this Year



José Carvalho da Rocha, the Minister of Telecommunications and Information Technologies for Angola, has stated that his nation's first satellite — Angosat1 — will be launched into orbit during the third quarter of this year.

During a visit to the Centre for Satellite Control, located in the municipality of Cacuaco in Luanda, Angola, the minister said that both the satellite and the control center are ready for this first mission, *"but the technicians who will receive and decode the signals that Angosat1 will emit are currently in training."*

The Director of the Satellite Control Centre, Mário João, said 45 technicians who will take control of Angosat1 satellite are undergoing training, particularly in the areas of planning, analysis and supervisory shifts.

With Angosat1 in orbit, said Rocha, rather than acquiring bandwidth from regional satellites, his nation will be able to do so from the Angolan satellite, *"with payment in local currency."*

Cited by the Angolan news agency Angop, the minister recalled that the lifetime of a satellite is about 15 years.

However, prior to the demise of Angosat1, another new satellite will be commissioned.

Angosat1 will be Angola's first communications satellite and the spacecraft was ordered from a Russian consortium that includes RSC (Rocket Space Corporation) Energia, Telecom-Projecto 5 and Rosoboronexport, which heads the group.

Article source: macauhub

The Stars are Bright in Africa

Several African students have won the DStv Eutelsat Star Awards.

The awards were presented by Eutelsat in Nigeria where some very bright minds were revealed—students throughout this area of the world are eagerly studying space technology to enter this pan-African competition.

This is the sixth edition of DStv Eutelsat Star Awards that encourages young African students aged 14 to 19 to explore innovative thinking in science and space technology.

The enthusiasm continues to increase and this sixth edition shows sustained interest and attracted more than 1,000 entries from 20 countries.

Levels of accuracy, creativity and originality were judged to be higher than ever before for this contest, in both the essay and poster categories.

Entrants to the essay category were inspired to envision the role played by satellite technology in Africa's future.



- » **Essay Winner**—Leoul Mesfin from Ethiopia, judges were impressed with his analysis of continental and country specific needs and for closely developing the topic. He wins a trip to Paris and a launch site to witness a rocket launch a satellite into orbit.
- » **Essay Runner-Up**—Davids Bwana from Tanzania
- » **Poster Winner**—Emmanuel Ochenjele from Nigeria, for his depiction of a constellation of diverse satellites all

contributing towards the advancement of solutions to challenges such as global warming, conservation of biodiversity and stable energy supply. His award is a visit to Eutelsat in Paris and a satellite factory to see how satellites operate.

- » **Poster Runner-up**—Aobakwe Letamo from Botswana.

The four winning schools attended by the award winners and runners-up were also rewarded with a DStv installation, including dish, TV set, PVR decoder, as well as free access to the DStv Education Bouquet.

The winners were announced in the presence of the Hon. Permanent Secretary, his Excellency Sunny Echono, representing the Minister of Communication Technology. The next edition will open for entries later this year.

dstvstarawards.com

New Chief Strategy Officer at Thaicom

Thaicom Public Company Limited announces a new appointment of satellite industry veteran Dr. Supoj Chinveeraphan as its Chief Strategy Officer (CSO). Plans are to grow Thaicom as an Asian brand, inclusive of marketplace strategy, market positioning, partnerships, and operations.

Supoj Chinveeraphan recently joined Thaicom after holding a number of high-ranking positions within the telecommunications industry, including the role of Director and General Manager of IPSTAR Australia and New Zealand from 2009 to 2015.

With more than 20 years of professional experience in operations, sales, marketing and business development, Dr. Chinveeraphan has an impressive track record of leading companies to increased productivity and developing satellite services for the telecommunications industry.



Paiboon Panuwattanawong, CEO Thaicom, commented on Dr. Chinveeraphan's appointment, *"Dr. Chinveeraphan combines a wealth of experience in all areas of the satellite industry. As Thaicom continues to expand, Dr. Chinveeraphan's business savvy and industry experience driving business and brand strategy will only accelerate our momentum. He will help us push new strategic initiatives and pursue new business*

development opportunities. I am certain Dr. Chinveeraphan will be a great asset for Thaicom to stay ahead of the curve."

"I look forward to steering Thaicom's growth agenda and helping bring strategic initiatives to fruition," said Dr. Chinveeraphan. "The satellite industry is on the verge of change and so we have to develop our business and operations expertly to stay competitive. I could not be more excited to head Thaicom's strategic direction at this time as we aim to pursue new business development opportunities across Thaicom's markets," said the company's new CSO.

Dr. Supoj Chinveeraphan holds a Bachelor degree in Engineering from Chulalongkorn University, Thailand, and a Masters degree from Tokyo Institute of Technology, where he also earned his PhD at the Department of Intelligence Science.

thaicom.net/en

The Teleport Theory of Things: An STN Perspective

By Mitja Lovsin, Senior Director, STN

The world is changing—fast—and one of the biggest and most notable changes in mankind's recent history has been the way in which we communicate.

Looking back just 10 years, the pace of change has been nothing short of dramatic and with this evolution has arrived a group of end users who really know what they want.

Consumer and enterprise customers are more demanding than ever before and they want to be connected 24 hours a day, 7 days a week, 365 days a year, no matter where in the world they are located—on land, sea or in the air. The scale of this demand is really becoming evident and it's huge.

As a teleport operator, STN is at the forefront of the satellite industry and is constantly monitoring the trends, drivers and the markets that affect the sector. The North American market is one of the leading and most developed markets in the world and is responsible for setting guidelines and trends for other regions.

What happens in North America sooner or later happens elsewhere—this article is certainly relevant not only to the North American market but also will eventually apply to the rest of the world.

Let's take the mobile phone as an example. This trend took off in North America in the early 1980s through the Advanced Mobile Phones System, or AMPS. People of a certain age will remember the bulky, heavy (and downright expensive) mobile phones of the past. Yet no matter how expensive they were to run, or how cumbersome they were, it was a simple pleasure to pay for a crackly call because it allowed the user access to connectivity outside of four walls. It was a different experience.

Today, the mobile phone is experiencing an inexorable rise in popularity which has swept the entire planet. It is our reliance upon these kind of networks that has made connectivity indispensable.

Mobile phones and digital devices are no longer a luxury but a necessity, not only to businesses but to everyday life. The loss of a 4G network for even just a few seconds cannot be tolerated—its means the loss of immediate access to calls, texts, emails, social media and even television connections. From large corporations to small and medium enterprises, interruptions to 4G and Internet access could mean a loss of profits.

However, it's not just the mobile phone phenomenon that is creating further demand for connectivity in the North American market. The Internet of Things (IoT) is the inter-networking of physical devices.

This could apply to domestic appliances such as cookers, central heating, refrigerators. It also applies to vehicles, buildings and other items that are embedded with electronics, software and network connectivity that enable these objects to collect and exchange data.

This evolution in monitoring is set to take the consumer and enterprise sector by storm and will require increased Internet capacity. While much of this can be satisfied through terrestrial networks such as fiber, WiFi and 4G, in many cases, satellite is the only connectivity option.

These technological advances are incredible but there is a sinister side that is not directly related to satellite or teleports and must be effectively mitigated—that is cyber crime and cyber security. There have already been some significant incidents where cyber crime has plagued businesses and users.

Cyber security's importance cannot be underestimated and must be embraced by all technological sectors, not only the satellite industry. The incidents of cyber crime will only increase and must be tackled before additional harm can be done to users of technology, such as the hacking of car controls while the vehicle is being driven. The consequences could be disastrous.

The Role of Satellites

The insatiable need for connectivity is, without doubt, the key driver for the satellite industry and especially applies to developed markets such as North America. Innovation within the satellite sector has been ramped up as the industry determines out how best to compete in this new world order.

The advent of HTS constellations in LEO, MEO and GEO is pushing the industry forward. New technologies and capacities are bringing about more efficient modulation schemes which deliver more bits per hertz and newly developed phased array antennas and other technology that enables efficient satellite reception on-the-move.

Today, as previously mentioned, connectivity needs are ubiquitous. People want to stay connected whether they are conducting business on a long haul flight, keeping in touch with loved ones during a Caribbean cruise or accessing social media whilst commuting to work on a train or bus.





made. The traditional TV will most probably and eventually fade out, but this is not likely to happen anytime soon.

What About the Future for Teleports?

For any teleport to prosper in the future, there are two elements that need to happen. The first is increasing the diversity in markets that will present the opportunity for steady growth over the coming years. This means companies that have focused heavily on the North American market in the past will have to look to replace some, if not most, of their revenues in other parts of the globe.

South America, for example, offers a great deal of opportunity and is a huge and emerging market with lots of potential for exponential growth in future years. Teleport operators will need to diversify and look past their own backyard to find new opportunities in emerging markets. If they remain in the current operating environment, they will not survive.

The implementation of add-on services will also be important in the future. Customers want fully managed services from a single provider. Hybrid solutions can enable operators to deliver traditional satellite solutions as well as the delivery of OTT services—it's all about being flexible and offering customers a variety of choices.

The second approach must be to look to the future. Operators must predict the services that will be in most demand and look out for particular connectivity trends they can capitalize on in the years ahead. This is challenging, as most of the services are being offered by satellite operators themselves. This raises concerns for companies such as STN, but is a challenge that must be accepted in order to survive in today's highly competitive environment.

Will the satellite industry still exist 20 years down the line? Will the need for traditional linear TV simply disappear? Will future generations even know what a TV set looks like? Will we have to leave the house at all to shop, work, socialize and entertain?

These questions are impossible to answer at the moment. However, what can be said is this—STN is more than ready to accept the challenges that have been tossed to the satellite industry and is prepared to reassess the way in which the teleport does business, to examine ways to complement other technologies and then to play to STN's unique strengths.

There are many differing opinions as to which direction the satellite industry should take and there are challenging times ahead. However, this kind of evolution is what makes business fun and STN is ready for it.

Bring on the future!

stn.eu

As a Senior Director, Mitja Lovsin is responsible for the performance and development strategy of STN, including all aspects of global commercial sales and personnel structure.

With more than 12 years in the satellite industry, Mitja has gained a strong insight into the business and has adapted his professional experience from previously held senior positions to further enhance the company's profile and advancement into new and existing regions.

STN provides world-class broadcasting and transmission services to TV companies, video entertainment platforms and service providers located across the globe. The company owns and operates a state-of-the-art satellite teleport based in Slovenia which was named Independent Teleport Operator of the Year 2016 by the World Teleport Association (WTA).

STN offers a broad portfolio of media services including uplink, playout, encryption, multicast and channel localization services, enabling a wide range of customers, from start-up channels to blue-chip global media leaders, to rapidly and efficiently deploy quality services. With its advantageous geographical position reaching all commercial and popular satellite orbital positions, STN helps its customers attract and engage new audiences and expand into new markets by leveraging high-quality capacity on a wide and continuously expanding range of spacecraft. STN services enable coverage over multiple regions to provide a worldwide reach, STN has PoPs in a growing number of key broadcast centers around the globe, links to major European data centers, and connectivity with worldwide fiber networks.

Therefore, antennas must be able to track the movement of any satellite in the sky without the need for any mechanical, moving parts. To remain competitive, transportation companies will have to install new technology to keep up with these trends and to enable their customers to stay connected.

This is where satellite technology comes into its own—satellite has its own, unique features that terrestrial technologies simply cannot compete with. Nothing is stronger when it comes to multi-casting and its ability to connect remote areas and this capability is critical if connectivity is ever to be ubiquitous.

The satellite industry must play to these strengths to compete in the changing connectivity environment. It must remain relevant in this fast-moving world. To a large extent, this is a jump into the unknown. For example, no one truly knows what the impact of HTS and new LEO constellations will be, yet these movements are also extremely exciting and challenging. If the satellite industry can do one thing, it the ability rise to new challenges.

Broadcast and Media

For the broadcast and media technology segment, end user demands are also evolving quickly—it has become almost too difficult to maintain the pace of new developments. The evolution of new technology such as OTT has created challenges for companies such as STN, but also many new opportunities.

Media and broadcast remains a growth story for STN yet the fact remains that traditional broadcasting over satellite is in decline across the North American market. Does STN fear that its markets will gradually disappear? Absolutely not. For the foreseeable future, over the next 10 to 15 years, satellite will remain a highly relevant and effective means of broadcasting.

In terms of the evolution of the market, does STN see big changes ahead? Yes, most definitely. However, what is important is how these changes are handled and whether a business is willing to create opportunity out of change. It's not always easy to accomplish this feat, but despite recent developments, there are still many opportunities to do good business and the satellite industry can continue to grow and develop.

In recent years, there has been a major shift in traditional linear TV, especially with younger generations—the 'digital natives.' However, there are still a most significant number of viewers who enjoy the tradition of sitting in front of a TV set to watch their favorite shows.

With the emergence of Ultra HD and well established and widespread HD quality in demand across all of the mature and developed markets, as in North America, there is plenty of work to be addressed and money to be

The Next-Generation WAN Fabric A PCPC Direct Tech Focus

The movement of data across satellite communications has traditionally been low bandwidth with high latency and very low efficiency. In addition the cost per MHz of satellite bandwidth is very expensive. A satellite transponder can cost from \$1.0M to \$1.5M per year.

In this article, a solution is demonstrated that increases the effective bandwidth while increasing utilization. In the company's lab and over live satellite, greater than 4bits/Hz Spectral Efficiency has been achieved, with link utilization consistently over 90 percent and, in some cases, as high as 96 percent.

The combination of increased Spectral Efficiency, while at the same time increasing the overall throughput, will dramatically reduce the effective cost per Mb of bandwidth and increasing ROI. Depending on the existing environment, this solution will increase effective bandwidth efficiency by a factor of five times and, in some cases, even higher.

Test Environments

There were two separate environments used during the testing. The first test used a latency injector to simulate the delay of satellite communications. Used was a 540 milliseconds latency to simulate a Geostationary Satellite (GEO) and 200 milliseconds was used to simulate a Low Earth Orbit (LEO) satellite.

The second environment employed real satellite communications to move data between two systems. There were two critical pieces of equipment used in these tests. They were the OmegaWAN solution in conjunction with the NovelSat NS3000 modem. The performance achieved in the live satellite test could be achieved using other satellite modems; however, for maximum performance over satellite, the Novelsat S3000 is recommended.

OmegaWAN

The OmegaWAN platform uses an RDMA based parallel file system and Bay Microsystems proprietary packet and transport processing technology, along with enhanced buffering and end-to-end flow control to reliably extend native InfiniBand over metro and wide area networks spanning from just a few miles to thousands of miles.

This allows OmegaWAN to provide seamless InfiniBand range extension over a variety of network infrastructures, thereby enabling IT managers to maintain protocol continuity beyond a single site to virtually anywhere around the globe without the need to modify existing applications or local InfiniBand network.

The OmegaWAN platform is designed to work with all native InfiniBand protocols by merging disparate subnets into a single unified InfiniBand fabric allowing applications to maintain high performance Remote Direct Memory Access (RDMA) transfers between data centers. This provides near line rate performance over virtually any distance and latency, accomplished by using OmegaWAN's fully optimized packet processing architecture with ultra-low port-to-port latency providing efficient, providing unencumbered cut-through data transfers without introducing any noticeable latency that could degrade application performance.

NovelSat NS3000

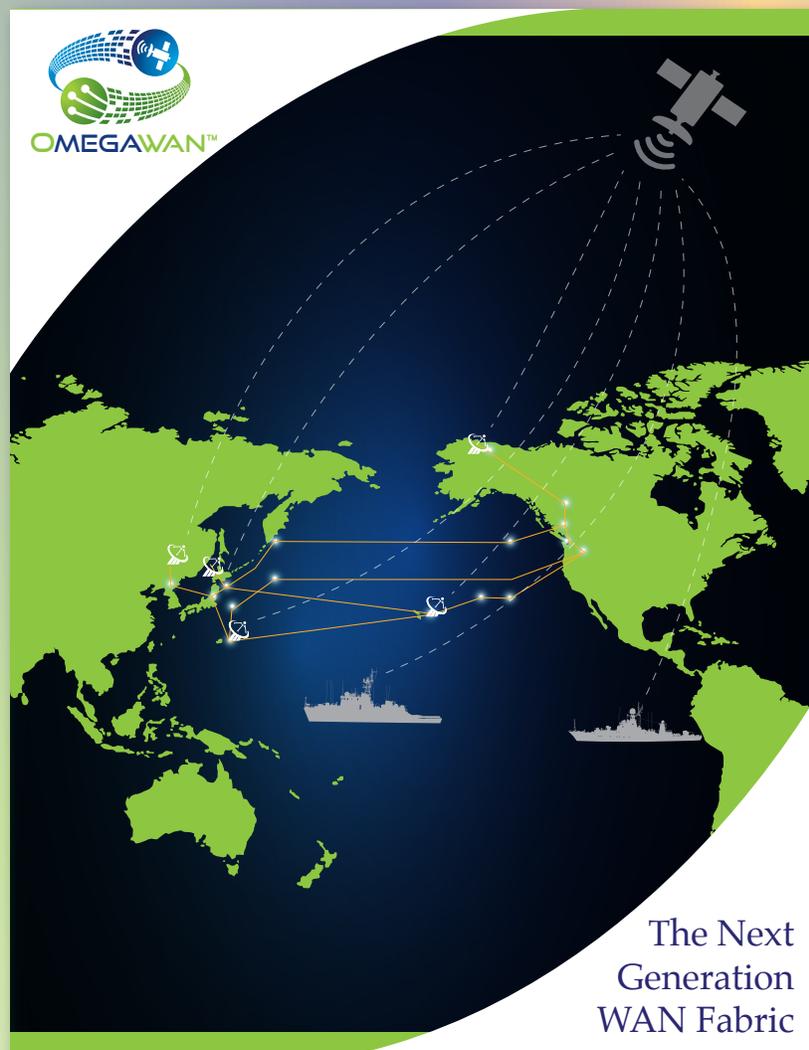
The NovelSat NS3000 Professional High-Data Rate Satellite Modem is one of the fastest, most bandwidth-efficient satellite modems. This translates into marked cost reduction for both point-to-point and point-to-multi point satellite links.

The NS3000 Modem delivers scalable data transmission rates of 100 Kbps up to 850 Mbps (bi-directional 425 Mbps) using (carrier-echo-cancellation). The NS3000 is a member of the NovelSat Professional Satellite Modem series, which also includes the NovelSat NS300.

Combining both a modulator and demodulator in a single unit, the NS3000 Modem is flexible enough to support all types of applications—from the smallest links to the world's largest pipes. Ideal for satellite-based cellular backhaul as well as high data rate IP trunking applications where lack of infrastructure and challenging geography makes wire links impractical.

Lab Setup

The lab setup had all of the necessary equipment needed to simulate satellite connectivity for moving data between two systems, including latency. OmegaWAN is Linux based running an IBM Spectrum Scale file system on high-speed solid state drives.



SSD's were used to insure that the server's local storage did not contribute negatively on performance.

Spectrum Scale has a very simple configuration with no special tunings. Both servers had a QDR Infiniband (IB) adapter, which was used for data transport between the servers. The OmegaWAN system is configured to accept an IB connection on the LAN side and its WAN side is a 1GbE connection.

The 1GbE WAN connection of both OmegaWAN systems would normally be attached to the satellite modem; however, for the lab test, a Linux based server was used that acted as a bridge network device between the two NovelSat Modems and was configured to inject latency equivalent to typical satellite delays.

In addition to the IB LAN side connection, there was also a 1GbE LAN connection from each system. Although this test focused on moving data across the IB network, the two servers were also able to communicate via their 1GbE connections.

Satellite Test Setup

The actual satellite tests used the exact same equipment as the lab setup with the exception of the Linux Bridge used to insert latency. The NovelSat modems were connected to the necessary SATCOM equipment.

Satellite testing was performed from SDN Global's Atlanta, Georgia, Teleport. The antenna used for testing was a 5.5 meter Scientific Atlantic Ku-band with a 100 Watt Advantech SSPA. The K21 and K22 transponders on the SES1 satellite located at 101 degrees West provided the satellite connectivity. For simplicity, the same antenna was used for both remote and hub. During the test no more than 50 percent of the SSPA's power was used.

Test Results

The testing was performed under a variety of different settings. The key variables were the Mod Code, FEC, and MSPS settings on the NovelSat modems. The OmegaWAN system required no special tuning for the test. However, there was a shaping parameter (used to limit the maximum throughput out of the WAN side connection) that was used to overcome the lack of Pause Frame (IEEE 802.3x) support on the NovelSat modem. Note that support for Pause Frames would be available on the modems in the future. The testing was done by reading a series of large files (256 MB, 1 GB or 10 GB) files located on the Spectrum Scale Server from the Spectrum Scale Client.

The Spectrum Scale tool, gpfsperf, was used to perform the data movement and provide the performance numbers. Each data point reported below was an average of several tests. The measured latency during the tests was 506 to 523 ms.

The following table contains several of the tests that were performed: The analysis of the data should be looked at from two perspectives. The first would be to look at what the OmegaWAN system provides and the second would be what the NS3000 is providing.

Quite clear is that the OmegaWAN Solution can maintain very high utilization from the lowest bandwidth all the way to the highest. Also note that the OmegaWAN system could scale up to 40Gbs. In addition, due to the use of the shaping parameter, the tests could not fully use the available Bitrate of the modem, *i.e.*, compare the Bitrate and shaping columns.

This issue will be addressed in the future when Pause Frames are implemented in the NS3000, which will yield slightly higher throughput. The NS3000 supports advanced coding (32APSK and 64APSK) and Forward Error Checking settings.

The tests were able to achieve greater than 4Bits/Hz using 64APSK. To be fair, several of the Bits/Hz measurements are not as high as they should have been. This number is based on the Transfer Rate and due to the applied Shaping the Transfer Rate was reduced. The test results from the lab testing were used to predict what the actual test results would be. The lab test results will not be included in this article.

Transfer Rate	Util.	Shaping	Modem Settings					
			Mode Code	FEC	M 1 MSPS	M 2 MSPS	Bitrate Mb/s	Bits/Hz
18.5442	93	20	64APSK	3/4	8.57	8.57	37	2.16
18.6001	93	20	64APSK	4/5	8.57	8.57	33	2.17
18.5457	93	20	64APSK	2/3	8.57	8.57	33	2.16
55.6129	93	60	32APSK	9/10	8.57	14.28	62	3.89
68.9305	96	72	64APSK	5/6	8.57	16.66	78	4.14
69.4756	96	72	64APSK	5/6	8.57	16.66	78	4.17
92.463	96	96	32APSK	9/10	2.85	26.25	100	3.52
92.1072	96	96	32APSK	9/10	2.85	26.25	100	3.51
92.4687	96	96	64APSK	4/5	2.85	26.25	96	3.52
99.957	96	104	32APSK	9/10	2.85	27.3	120	3.66
106.946	95	112	64APSK	4/5	2.85	27.3	120	3.92

In Closing...

The combination of OmegaWAN and the NovelSat NS3000 proves to be a highly efficient solution for moving large volumes of data across a satellite connection. Each device adds a separate, but critical piece of the solution.

The OmegaWAN platform provides maximum utilization of the available bandwidth. This utilization is consistently greater than 90 percent and was measured as high as 96 percent.

The NS3000 provides very high Bits/Hz, in excess of 4 Bits/Hz through the use of advanced Modulation Coding and Error Correction.

Notes

1. The OmegaWAN solution used for this test was outfitted with IBM Spectrum Scale. There are other RDMA based Parallel Files systems available for use. Spectrum Scale offered a simple solution for this application.

Cloud Constellations... A New Way to Do Data Centers: A Cloud Constellation Corporation Perspective

By Scott Sobhani, Chief Executive Officer and Co-Founder, Cloud Constellation Corporation

The continuing onslaught of rapid technological advancements demands new solutions for data storage and transport.

Data centers have come a long way since the first giant mainframes of the '60s, which had to be housed in their own rooms due to their size and the noise and heat they generated. These early computers were so expensive—running into the millions of dollars—that only universities and government agencies owned them; multiple organizations rented and shared them.

From megacomputers came the microcomputers of the '80s. Personal computing was born and yesterday's equipment made way for the new servers, which possessed a much smaller footprint, creating a leaner data center.

As computers no longer cost millions of dollars, organizations could assemble banks of servers into rooms, which grew progressively larger. What started as single-room environments became dedicated buildings with thousands of servers.

The next great leap forward in data centers was born of the Internet and the innovations that were developed in software delivery. They led to the Cloud as the need to easily share software and services, not only with remote offices, but also with a growing mobile user base—this grew by epic proportions. This worked for a few years until hackers became smarter and the protection of private and customer data became a board-level concern.

Hybrid cloud offerings have evolved over the past five years to solve these challenges, with the promise of protecting and managing critical data on private, on-premises infrastructure and providing organizations with the

ability to host customer-facing applications in the Cloud. Unfortunately, hacks to the application layer, IoT and DDoS attacks continue to plague today's corporate networks.

As a result, cyber security has become an industry so immense that there seems to be a new security solution added to the network stack every day.

Many Hazards to Data Security

Legitimate concerns over the risk of data breaches and the need to keep data secure and private, whether personal or organizational, has led to worldwide jurisdictional restrictions and stringent laws regarding how data is moved between countries. What's worse is that nations have the legal right to monitor, copy, save and try to decrypt any data as it passes through their jurisdictional boundaries.

What many are unaware of is that any data that passes across Internet lines, whether public or private, requires a public address header for routing encrypted packets to the proper network. This provides ample opportunity for surreptitious targeting and decryption of sensitive data. It seems that no matter what new restrictions are enforced, data remains unsafe.

Another cyber security hazard comes from leaky Internet and leased lines. Today's cloud environments run across hybrid public and private networks using IT controls that are not protective enough to stay ahead of real-time cyber security threats.



Sensitive data can be exposed to acts of industrial or political espionage through unauthorized access to enterprise computers, passwords and cloud storage on public and private networks.

Sadly, the system created with the intention of enabling people to freely communicate around the world is being surreptitiously exploited in a way that prevents exactly that from occurring. The Internet was intended as a sustainable tool for bringing the world closer together, but it has rapidly become divided by a quagmire of protectionism—the reverse of promoting global information sharing. Clearly, a change is in order.

Planet-Compromising Energy Consumption

The number of data centers in the United States continues to increase—according to the Department of Energy’s Lawrence Berkeley National Laboratory; the total server installed base is projected to increase by 40 percent from 2010 to 2020. Though they are becoming much more energy efficient, they still account for almost two percent of total US electricity consumption.

Multiply this one example by all the data centers rising up around the world, consuming a disproportionate amount of energy that results in a huge carbon footprint. The negative impact on the planet is significant.

Ian Bitterlin, Britain’s foremost data center expert and a visiting professor at the University of Leeds, recently commented, *“If we carry on the way we have been, it would become unsustainable—this level of data center growth is not sustainable beyond the next 10 to 15 years. The question is, what are we going to do about it?”*

A Hybrid Cloud in Space

The current dilemma calls for a shift in thinking. Instead of looking to the Earth for places to store and move our data, we should be looking to the sky.

Imagine a world without borders, where data flows freely without limitation. Where there are no jurisdictional barriers interfering with the exchange of information or ideas. A world where the sharing of information can travel across the globe in less than a second.

This is a world where information is secure, safely traveling above and beyond the Internet and all leased lines. This is a new way of conceptualizing data transport and storage—and it is possible.

What makes it possible is a set of new technologies that now provide an independent, space-based network infrastructure for cloud service providers and their enterprise and government customers to experience secure storage and provisioning of sensitive data around the world.

By placing data on satellites that are accessible from everywhere via ultra-secure dedicated terminals, many of today’s data transport challenges will be solved. This will provide a safe haven for mission-critical sensitive data, a place without interruption or exposure to any surreptitious elements or unintended network jurisdictions.

An infrastructure of this kind enables government entities, large enterprises and providers to take advantage of a new way to store and transport data.

Even better, this model saves money as well as carbon emissions. As a result, cloud service providers will be able to offer better services at a third of the cost of doing business today because they will not have to add CapEx and OpEx for expansion.

Major corporations who deal with mission-critical data, whether in healthcare or pharmaceutical, military or financial, will achieve major market differentiation while reducing their carbon footprint globally. CSPs and their customers don’t have to keep investing in more infrastructure and paying huge electricity bills.

Restoring the Dream of Unified Communications

Organizations today face multiple serious threats regarding global communications. The Internet is no longer a place where information can be securely stored and transmitted, which means that an alternative must be found. A space-based network, free of the many jurisdictional, regulatory and security issues the Internet faces, will enable data to flow freely around the world again.

The new space-based technologies will create a safer, faster communications experience for organizations of all kinds across the globe.



Scott Sobhani, CEO and co-founder of Cloud Constellation Corp. and the SpaceBelt Information Ultra-Highway, is an experienced telecom executive with over 25 years in executive management positions, most recently as VP for business development and commercial affairs at International Telecom Advisory Group (ITAG).

Previous positions include CEO of TalkBox, VP & GM at Lockheed Martin, and VP, GM & senior economist at Hughes Electronics Corporation.

Mr. Sobhani was responsible for closing more than \$2.3 billion in competitive new business orders for satellite spacecraft systems, mobile network equipment and rocket launch vehicles. He co-authored “Sky Cloud Autonomous Electronic Data Storage and Information Delivery Network System”, “Space-Based Electronic Data Storage and Network System” and “Intermediary Satellite Network for Cross-Strapping and Local Network Decongestion” (each of which are patent pending).

Scott has an MBA from the University of Southern California, and a bachelor’s degree from the University of California, Los Angeles.

Metered Maritime VSAT from Globecomm

With the focus of increased efficiency and flexibility for the maritime communications market, Globecomm is providing metered plans for its clients.

To create a truly customized plan, in addition to the typical 5GB core bundle for the ship's main business, customers can have one plan while the crew can access a separate bundle over a dedicated LAN, or use the VSAT service on a pay-as-you-go basis.

Because the data that each user group consumes is visible separately, management can keep costs and accounting separate for these groups and identify costs for additional services with split billing and exact allocation.

Globecomm Maritime has built this service so that the crew can access a separate bundle over a dedicated LAN or use the VOIP services are also provided OTT as standard with separate bandwidth for two simultaneous voice calls, so the bandwidth used for voice calling is not counted against the ship's core bundle.



A further OTT LAN could be established to provide automated M2M devices and services such as ECDIS updates or engine performance monitoring.

If users find they need additional bandwidth, this can quickly be added to any chosen network using Globecomm's fully-managed global VSAT network, based on iDirect Evolution hub modem technology.

Globecomm Maritime has introduced metered VSAT plans that include a range of data bundles as well as two Voice over IP (VoIP) lines, a Nimbus Smartbox and the option for Over-The-Top (OTT) provisioning of additional services.

Globecomm's metered plans include the Nimbus Smartbox service, with entry plans starting at 5GB for \$595 per month giving access to the global coverage area. Users subscribing to these plans will be able to burst data up to 3Mbps of bandwidth as a download speed.

<http://globecomm.com>

The North American Market from the HPA Perspective: A CPI Satcom Products Focus

By Doug Slaton, Marketing Product Manager, CPI Satcom Products

The North American market for ground-based satellite uplink equipment continues to be strong due both to new satellite projects and new technology being introduced.

As new High Throughput Satellites (HTS) are being developed and implemented into Geosynchronous Orbit (GEO) and Low Earth Orbit systems (LEO), the need for new and improved ground-station amplifiers has also grown... and the amplifier industry has responded.

One such satellite program is OneWeb, which plans to provide Internet access to millions of unserved people around the globe as well as to provide instant access to emergency first responders and to provide in-flight and mobile ground connectivity. OneWeb plans to launch more than 600 satellites¹ into LEO, which will uplink from the ground station in Ka-band and then broadcast in Ku-band. Two other programs, using GEO satellites, are the HNS Jupiter and the ViaSat satellite systems. These satellites will vastly increase the world's satellite bandwidth for broadband and other applications and they presently will operate at Ka-band.

Manufacturers of HPAs have generally been ahead of the technology demands of these systems; however, the market is always seeking amplifiers with more bandwidth and higher RF power in compact, reliable and cost-effective outdoor packages for uplinking to its satellites. Satellite systems have to be competitive with ground based fiber optic networks since they handle much of the same type of traffic.

CPI Satcom Products has developed a broad product line of Ka-band HPAs featuring many combinations of output power, bandwidth, and market leading features that are based on TWTA, GaN solid state ("BUCs") and klystrons.

Features of particular interest to the North American market, as well as others, include CPI's patented LifeExtender™ technology and the ability to cool amplifiers using liquid systems rather than forced air. LifeExtender technology adjusts the traveling wave tube (TWT) cathode heater voltage over time in order to optimize the supply of barium, which is the source of electrons in the tube.

This method extends the life of the tube by as much as 50 percent versus traditional HPA operation. The desire to liquid cool amplifiers is the result of the requirements for more power and bandwidth in higher frequency bands, which has pushed HPA installations outdoors and closer

to antennas in an effort to avoid long waveguide runs that sap signal strength.

The resulting thermal dissipation of several types of amplifiers in enclosed antenna hubs has become a technical challenge, which has been answered with the introduction of liquid cooling into the HPAs. Liquid cooling, which was in vogue for years before fans and conduction methods arrived on the scene, also reduces the ambient noise and size of HPAs.

While such a system necessitates complete liquid-cooling systems and filters, the tradeoffs for some can be worth it. CPI has recently taken orders for and has shipped HPAs requiring liquid cooling. This feature is available on several of the company's existing products.

In the search for ever more bandwidth, there have been at least 15² US companies investigating the feasibility of uplinking in the V-band (46 to 56 GHz) allocation. Another high-frequency band, Q band at 36 to 46 GHz, is already being used for some government satellite communications applications. Many have already expressed strong intent to invest in these new systems, including well-known names such as Boeing, OneWeb, Iridium, and O3b³. The vast majority of these systems will be worldwide in scope. For uplink infrastructure providers, providing high power at these frequencies will be an even bigger challenge than Ka-band has been. Rain fade is even more prevalent at these frequency levels, and the RF components required are pushing state-of-the-art. The RF power levels required will eventually need to exceed 250 watts.

The HPA industry, including CPI with its leading amplifier and tube development, is working hard to be ready when these systems will be required, possibly as early as 2018.



cpii.com/satcom

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500/550 W Ka-band TWTA with liquid cooling configuration. Liquid intake and discharge connectors are on the bottom. As fans are not required in this configuration, the amplifier is smaller than air-cooled amplifiers.

CPI's LifePredictor, shown here in the lower left corner of a CPI HPA's touchscreen display, is one of the many innovations CPI has introduced to meet market demand. LifePredictor works in tandem with LifeExtender technology to increase TWT life by as much as 50 percent.

The Early Days of SATCOM: A Radford Remembrance

By Tony Radford, Contributing Author

Just finished reading a LinkedIn article that listed three points to consider when contemplating SATCOM as a career path. While the points did have merit, I couldn't help but flash back to the way things were long ago and ponder the contrast between what new entrants face nowadays and what we faced back then.

When I came to the party in the '70s, there were very few players in the industry—if you could even call it an industry. Since commercial applications were virtually non-existent, the term 'satellite' was far from being the household word that it is today.

The big three TV Networks were still taping their programs and sending them to their affiliate stations via UPS, cable TV was in its infancy and a home-sat terminal that was only available from the Nieman-Marcus catalog would set you back \$10,000.

Entertainment programming was limited to RCA's SATCOM-1 satellite, which carried 24 C-band transponders, each capable of transmitting a single analog TV channel. SATCOM-II was in service, but it was dedicated to specialty programming, such as beaming *I Love Lucy* and *The Andy Griffith Show* to our troops deployed overseas.

The limited availability of transponders meant that the growth potential for the broadcast-via-satellite market would be unrecognizable unless something changed.

I'll never forget the day RCA announced they were launching SATCOM-III that, like SATCOM-I, would be dedicated to the transmission of entertainment programming for cable TV operators.

I was working for Scientific Atlanta's CATV Division at the time and that announcement caused the demand for our products to literally explode.

We had to put on two additional shifts just to handle the flood of orders for the antennas and head-end equipment they would need to take advantage of the new bird. Our 'Finished Goods' stockroom looked like the final scene in *Raiders of the Lost Arc*.

Unfortunately, the celebration was short lived, for amidst rabid anticipation, SATCOM III slipped into an elliptical orbit and never made it to its dedicated parking spot. Instead, the spectacular 'clean-room contrivance' that embodied the hopes and dreams of a fledgling industry became nothing more than space debris. Needless to say, the commensurate flood of order cancellations left us with two years worth of inventory and prompted the firm's reversion to a single-shift operation.

After a tepid lull of industrial stagnation, SATCOM III-R was successfully placed into service. That was followed by a rash of successive launches that were sorely needed to quench the demand for broadcast towers that were 22,000 miles tall.

In no time at all, we were shipping more than \$1 billion in CATV products, much to the delight of a nationwide pool of anxiously awaiting couch potatoes.

I consider the 1980s to be the Renaissance Era of satellite communications. It was during the '80s that the market really seemed to take off. I was traveling 300 days out of the year building Earth stations everywhere. NBC, CBS and ABC simultaneously launched corporate-wide satellite networks to replace the brown trucks.

Super stations, sports networks, 24-hour news and 'round the clock' movies became readily available to millions of city dwellers. Hotels and apartment complexes across the country were wired for satellite.

Rabbit ears with little aluminum-foil bow-ties were replaced with set top converters and the hours previously dedicated to societal past times such as camping, fishing and neighborhood sports would now be logged as seat time on couches and recliners by a burgeoning audience, hungry for effortless entertainment.





Soon, inexpensive home systems came to the market—ensuring that even those who existed beyond the reach of cable distribution could join the ranks of sedentary spectators.

What a fantastic period it was for us Earth station antenna aficionados who reveled in the mystique of this new technology. The spectacle of SATCOM was alien to the average Joe—exacerbated by the fact that satellites of the day had weak footprints.

This meant that dishes had to be huge and complex (at least by today's standards). They struggled to grasp the idea that a giant bowl could somehow collect television signals from an electronic gizmo suspended tens of thousands of miles out into space—black magic and we were the wizards of conveyance.

The rapid growth in demand for satellites as a means for content distribution drove the need for additional launches to the point that birds were being parked right next to each other. This placed a major burden on antenna manufacturers as the signal beams between the Earth stations and the satellites had to be narrowed so as to hit only one satellite at a time. Techniques used in antenna manufacturing required a complete overhaul.

Even with satellites parked within two degrees of each other, the demand for transponders continued to outstrip capacity. It became necessary to transcend the boundaries of C-band and use other portions of the frequency spectrum—out came the slide rules and Ku-band became the next roadmap destination for pretty much every SATCOM product manufacturer.

Of course, all of that additional spectrum came at a price. Dishes had to be even smoother to work at Ku-band, so a theodolite had to be added to our tool kits to precisely align the reflector panels. Narrower beams brought the need for higher tracking accuracy.

And then the rains came. Uplink Power Control and waveguide dehydrators became critical components of Earth station architecture.

About the time frequency issues were squared away and things seemed to settle down, the 'digital transformation' arrived. Analog video exciters became digital modulators, S/N was replaced with Eb/No, multiplexers turned SCPC into MCPC and bandwidth utilization became the predominant goal for manufacturers and users alike.

With each new launch, satellites were becoming more powerful and more sensitive, so dishes started shrinking. Big concrete foundations were replaced with pipe mounts installed with a pair of post-hole diggers and a bag of Sakrete. What used to take industrial cranes, rigging and safety belts now could be done with a half-inch wrench and a screwdriver. It was awful.

But, again—we adapted. As technology changed all around us and imposed its intrusive grip on an industry that's so dependent upon 'spectral efficiency,' we reinvented ourselves accordingly.

Our products evolved. TWTAs became SSPAs and LNAs became LNBs. Elliptiguide, once the backbone of every satellite uplink, was removed, stripped of its insulation, melted down and fashioned into cookware and those little bracelets that cure arthritis—only to be replaced with cheap coax that you could purchase from Radio Shack.

A few more years would pass before we were hit with another technological tidal wave that injected itself into the process—this went by the name of 'Internet Protocol.' In short order, the migration from a dozen different interfaces to a common standard would ensue. Old school veterans that were masters of RS 250C had to make way for the packet-hacks that were Cisco-certified.

The trials and tribulations that face the SATCOM newbies of today have taken a totally different form. Back then, newbies didn't even know what SATCOM was until they were already in too deep.

The only folks you could ask for direction wore thick glasses and pocket protectors. Even if you could get them to talk, they were hard to understand.



It was a world of black magic—coarse and crude, yet complex and precise. ‘Standards’ were few and many trails were yet to be blazed.

Fast forward 35 years. The SATCOM of today is far different. There are ‘standards’ for everything. Components are smaller and lighter. Most of the installation work is done indoors—not out on the pad. Heavy test instruments have been replaced with hand-held monitors and iPhone apps. Today, you can use the same tools to build an Earth station that you used to assemble your kid’s bike.

Perhaps the most impactful ontogeny was the adoption of IP as a common transport medium for virtually all forms of content, whether it be voice, video or data. The fact that each of these forms had to be handled differently was a major source of the complexity and commensurate challenge imposed on the pioneers of satellite communications.

Today, the SATCOM Industry is more civilized and sophisticated, not unlike any other trade within the telecommunications domain. Still, there are a few trails left to blaze. The challenges imposed by the new LEO and MEO platforms will keep the SATCOM community on its toes for a while and Ka-band will give way to Q-band as the hunger for space-based services grows. After all, there are still a few billion who haven’t yet signed up for LinkedIn or Facebook.

Having spent most of my life here, I can’t say that SATCOM is a bad place to be, but I can say that it’s nothing like it was back in the good old days.

Tony Radford, a 38 year veteran of the Satellite Communications Industry, has served as VP Sales & Marketing for Paradise Datacom since 2004.

Tony’s book, “Satcom Guide for the Technically Challenged,” is available at: https://www.amazon.com/Satcom-Guide-Technically-Challenged-Radford/dp/0966545133/ref=sr_1_1?ie=UTF8&qid=1486639504&sr=8-1&keywords=satcom+guide+for+the+technically+challenged

Banking On Reliability in Afghanistan: A SpeedCast Focus

By Fysal Gill, Senior Director, Sales, SpeedCast Group



The first Internet Service Provider (ISP) in Afghanistan was NEDA Telecommunications (NEDA), which was founded in 2003 and initiated their service for that country, starting with dial-up and moving swiftly into wireless broadband services.

NEDA quickly established itself as the leading ISP in Afghanistan with a presence in most major cities and with aggressive plans to roll out additional services and coverage in the future.

As the preferred ISP for most of the banks and ministries in Afghanistan's Capital City of Kabul, NEDA was approached by the Government of Afghanistan to provide them with an upgraded, private communications network for the country's ministries. The Government of Afghanistan was running on a SCPC-based network, which provided connectivity but was ultimately too expensive and outside of the available budget. The Government of Afghanistan is funded by donor agencies such as The World Bank and the United Nations Organization. As such, the government required a cost effective network solution which would also provide top-quality security.

Due to the cultural challenges in the region, NEDA also required a satellite service provider partner with a recognized, successful track record of experience in the Middle East and Asia (MENA).

Coming Onboard

NEDA chose to partner with SpeedCast—the firm has been serving Internet Service Providers and the private sectors in the Middle East during the last decade, providing connectivity and value added services to the region. SpeedCast installed a new satellite network which provides a secure, private network for one of the ministries of the Afghanistan government.

The new satellite network provided by SpeedCast has more than 50 sites to deliver the required connectivity and service levels to all of the sub-ministries, including the different departments and banks that need to be connected to the main Ministry of Finance.

SpeedCast designed the new private network to aim at providing reliable and secured connection that allows improved efficiency and productivity by extending connection coverage for the Government. The network is also cost-effective and scalable, allowing for upgrades to be easily made for future technological developments.

As the relationship has developed, SpeedCast continues to work with NEDA to develop the Government of Afghanistan's communications network. SpeedCast is working with NEDA to ensure that the government always has the most cost effective and secure network to help facilitate the smooth running of the country.

An Outcome of Results

Through the provisioning of their VSAT satellite solutions and also leveraging their decades of experience, SpeedCast has successfully helped the Government of Afghanistan install the first iDirect base private network in Kabul. This is a major achievement for the Afghanistan, as this is the first private communications network owned by the government.

Through SpeedCast's partnership with NEDA, the Government of Afghanistan now has a state-of-the-art, secure network through which data can be transferred using the latest VSAT satellite services.



This deployment demonstrates SpeedCast's commitment to enable their partners to provide high-quality VSAT services to connect users in the Middle East and the rest of the world.

speedcast.com

Fysal Gill has 11 years of association with SpeedCast Group and currently heads sales for Central and South Asia. By profession, he is an expert business developer for Emerging Markets in key verticals related to the fields of IT and satellite communications and holds a Master Degree in IT & Communications along with 20 years of professional industry experience.

Fysal is a Certified Private Equity Specialist and a member of the International Academy of Business and Financial Management (IABFM) and has participated in the launch of renowned startups, multinational companies and has contributed in driving these entities to become billion-dollar businesses within a few years.

Fysal has attended numerous forums as guest of honor, speaker and judge, including ITCN Pakistan, MAJU (Entrepreneurial and Innovation Forum), and All Pakistan Young Entrepreneurial & Innovation Summit YLES. He has attended numerous exhibitions, summits, conferences and training days relating to key verticals in IT, telecoms and satellite communications in Hong Kong, Singapore, UAE, USA, Turkey, Europe and Central Asia.

