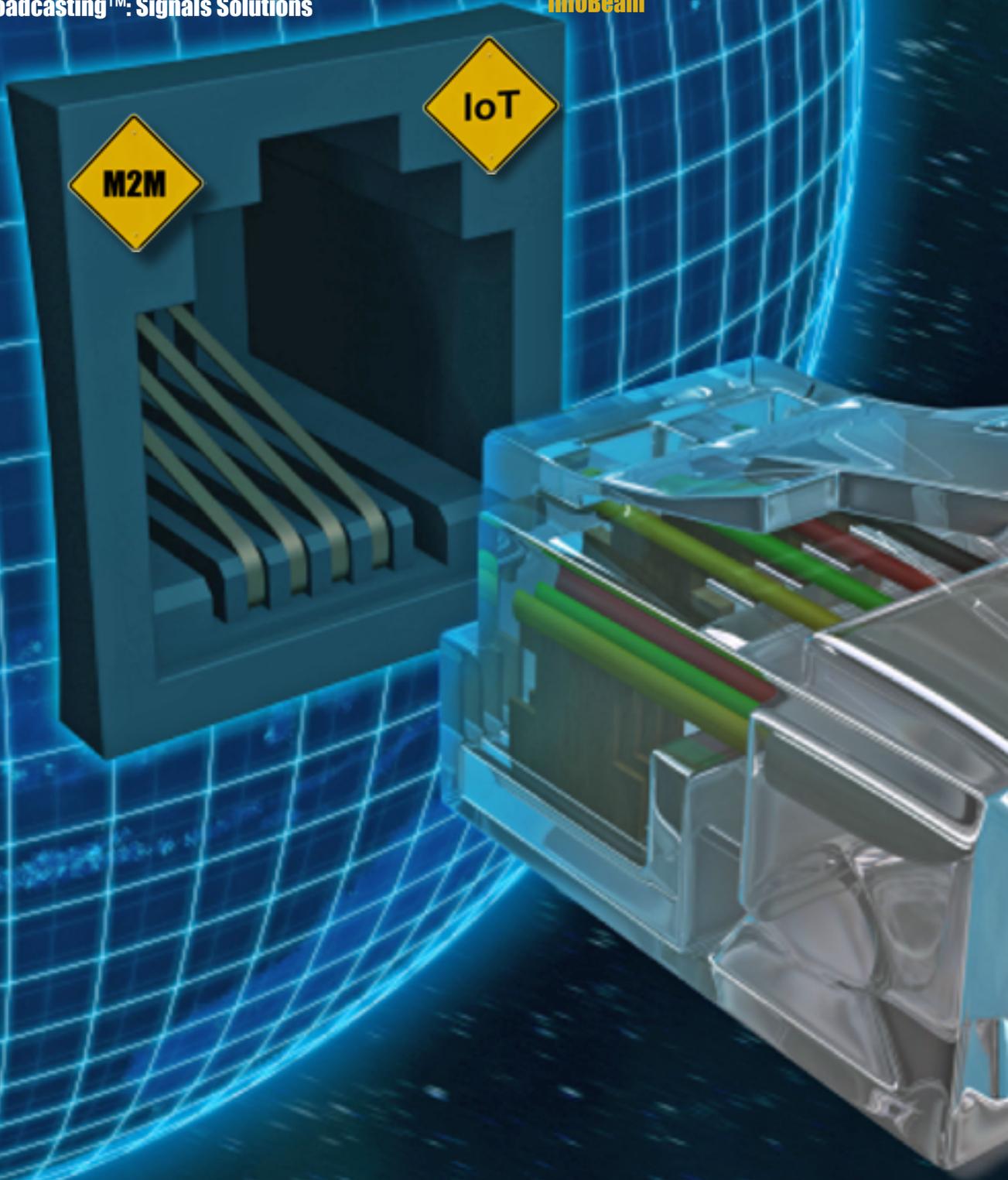


Worldwide Satellite Magazine – January 2016

SatMagazine

SatHealth™: Thuraya + DigiMed
FreeWave Technologies On IoT
Intelligent Designs + ComTIA: Satellites in IoT
Keysight: Satellite Thermal Vacuum Testing
SatBroadcasting™: OTT, IPTV, Streaming
SatBroadcasting™: Signals Solutions

NSR: The State Of Satellite M2M / IoT
SHS: We Don't Talk About Hot Air
To The Benefit Of Belarus
Globalstar: Herd Instinct + M2M
A New View Of Wildlife
InfoBeam



SatMagazine

January 2016

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Advertiser Index

Advantech Wireless.....5	Newtec CY.....2
APT Satellite Company Ltd.....13	NSR (Northern Sky Research).....55
AvL Technologies.....15	Singapore Exhibition Services.....53
Bartington Industries.....21	SmallSat Symposium.....6
Comtech EF Data.....23	Space Innovation Congress.....51
CPI Satcom Products..... cover + 11	SSPI Hall of Fame Dinner (DC).....45
Dubai World Trade Center.....57	Teledyne Paradise Datacom LLC .17
Keysight Technologies.....7	W.B. Walton Enterprises3
NAB.....60	

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Getting The Nod For TELKOM-4

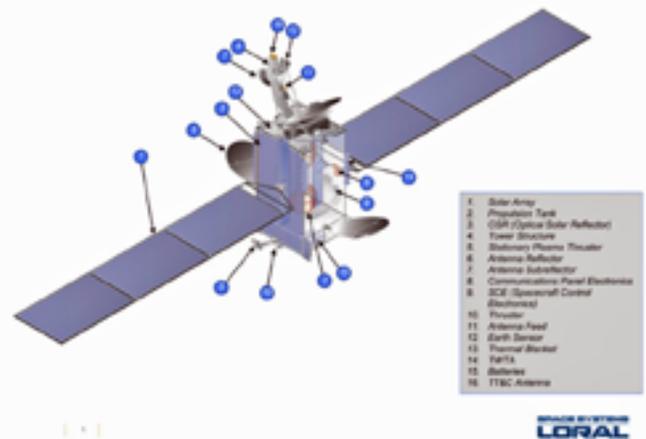
Space Systems Loral (SSL) has been selected to provide a communications satellite to PT Telkom Indonesia (Persero) Tbk, the largest telecommunications and network provider in Indonesia.

SSL was informed last December that the company is the winner of the procurement of the TELKOM-4 satellite, which will be used for fixed satellite services in Indonesia, India, and Southeast Asia. The satellite will be based on the highly reliable SSL 1300 platform, which provides the flexibility to support a broad range of applications and technology advances. It is designed to provide service for 15 years or more.

"Satellite services are particularly important in regions such as Indonesia where the population is spread over thousands of islands," said John Celli, president of SSL. "For SSL, this is the third satellite for Indonesia that we will add to our backlog"

Alex J Sinaga, president director and chief operating officer of Telkom added, "Satellite complements our other technologies, such as submarine cable, as the backbone that connects the islands of Indonesia."

Space Systems/Loral 1300 Satellite Overview



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InfoBeam

Getting The Nod For TELKOM-4.....	4
SpaceX Stands Tall With Historic ORBCOMM OG-2 Launch.....	8
An Electrifying Contract For Airbus D&S	11
Galileo Doubles Up	12
Gilat Gemini Routers Gain Ground With Avanti Communications ..	13
Joining Forces—SpeedCast Int'l + NewCom Int'l.....	14
SSL Built Telstar 18 VANTAGE / Apstar 5C To Debut In 2018	16
Aerojet-Rocketdyne's Thruster Maturation	17
JUICE For ESA To Be Delivered By Airbus D&S	18
KVH Expands + Goes Big With mini-VSAT... Capacity Doubled	20
120th Year Anniversary For Harris Corporation.....	20
Express-AMY1 Expressed To Orbit.....	21
A Good Report Card... + A 10th Anniversary... For ULA	22
AddValue's Data Relay Terminal Aboard The Velox-II Satellite.....	23

Features

Reaping The Benefits + Avoiding The Pitfalls Of IoT	24
by FreeWave Technologies	
SatHealth™: MSS Disaster Relief Operations Are.....	28
A Specialty & An Obligation For Telemedicine Success	
by Amal Ezzeddine	
The Role Of Satellites In The Internet Of Things (IoT)	34
by David Logsdon	
SatBroadcasting™: Signals Solutions Supplied.....	36
by Rainer Lörger	
A New View Of Wildlife	38
by Matt Boker	
Satellite Thermal Vacuum Testing: A Qualified Sensor	40
by Sook-Hua Wong	
We Don't Talk About Hot Air	42
by Surface Heating Systems	
SatBroadcasting™: How Satellite Operators Can Become.....	46
Significant Players In OTT, IPTV + Streaming	
by Richard Frankland	
To The Benefit Of Belarus—BELINTERSAT-1	48
Herd Instinct: How Satellite M2M Will Boost Beef Yields.....	50
by Corry Brennan	
The State Of Satellite M2M / IoT	54
by Alan Crisp	
Finding The Correct SATCOM Solutions	58
by Cedric Mancini	

Smallsats = Huge Potential

For a thorough immersion in the smallsat market segment, consider attending the upcoming, two-day and extremely important SmallSat Symposium.

This highly informative symposium will be conducted on Tuesday, February 23, and Wednesday, February 24, 2016.

This major event will occur at the **Hogan Lovells Conference Center** in Menlo Park, California, and is sponsored by Satnews Publishers and Hogan Lovells.

For further details and to register, please visit www.smallsatshow.com/

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SpaceX Stands Tall With An Historic ORBCOMM OG-2 Satellites Launch

Spirits were sky high at SpaceX as the drama of the firm's latest unfolded live before everyone's eyes. If successful, this would be an historic first... and it was!

The clock was running and in less than an hour, history had been made at Cape Canaveral. As the Falcon 9 soared ever higher, the first stage of the rocket that is normally disposed of was, in fact, able to return to Cape Canaveral's Air Force Station.

About three minutes after liftoff, the Falcon 9's second stage separated in the upper atmosphere and then placed 11 communications satellites, made by the Sierra Nevada Corporation for ORBCOMM, into a 400 kilometer orbit.

The 11 satellites were deployed approximately 20 minutes after liftoff, completing a 17-satellite constellation for ORBCOMM. This mission also marks SpaceX's return-to-flight as well as the firm's first attempt to return the launch vehicle's first stage back on land. The landing of the first stage was a highly successful test objective.

- **ORBCOMM's announcement...**

SpaceX successfully launched the Falcon 9 rocket and deployed all 11 ORBCOMM OG2 satellites in nominal orbits. SpaceX successfully landed the first stage of its Falcon 9 at its Cape Canaveral landing pad.

By landing and recovering the first stage, SpaceX has an opportunity to refurbish and reuse the first stage on future launches. The vehicle's first stage adjusted its trajectory, reentered the atmosphere and performed a soft, precision landing. This marks the first time in history any part of an orbital rocket has achieved a 'land-landing.'



The launch of ORBCOMM's 11 OG-2 satellites. Photo is courtesy of SpaceX.



Nine minutes following the successful launch of ORBCOMM's OG2 communications satellites was the first-ever successful landing of SpaceX's Falcon 9 first stage booster at Landing Zone 1 (formerly Complex 13) at 8:38 p.m. EST December 21, 2015, on Cape Canaveral Air Force Station.

Courtesy photo by Michael Seeley/SpaceFlight Insider.

Kudos arrived quickly after this historic "first" and one of the first received was from the Commercial Spaceflight Federation...

"What went up came right back down making history."

SpaceX accomplished an incredible achievement this evening when the first stage of its upgraded Falcon 9 rocket landed safely on solid ground in Cape Canaveral, Florida.

"It is clear that all of the time and hard work SpaceX spent upgrading the Falcon 9 paid off in this return to flight," said Eric Stallmer, president of the Commercial Spaceflight Federation.

"Through a year of hard lessons learned, SpaceX's December return to flight and successful planned landing of its first stage, just six months after the June mishap, reminds us of this industry's best qualities: agility, innovation and perseverance. I can't wait to see what 2016 has in store for us."

Traditionally, the first stage of a rocket is disposed of after launch, removing an opportunity to reuse valuable hardware. But by landing and recovering the first stage, SpaceX has an opportunity to refurbish and reuse the first stage on future launches.

The Commercial space industry is looking to normalize a business cycle of reusability in an effort to drive down launch costs and make spaceflight more accessible.

Many actors within the commercial space industry are working on making reusability a viable option. Masten Space Systems has been perfecting similar landing techniques for years with their fleet of low-altitude launch vehicles and landers.

In late November, Blue Origin's New Shepherd vehicle touched down after a high-altitude suborbital test flight.

While both the Falcon 9 and New Shepherd used their first stage engines to perform a soft landing, their respective mission objectives, trajectories and technical challenges are different.

As the SpaceX's vehicle was designed to place a constellation of satellites in orbit, the Falcon 9's first stage flew at significantly greater speeds and more than double the altitude of what New Shepherd reached last month.



SpaceX's return from an orbital launch marks the next technical step forward in the march toward the long-term goal of complete reusability.



The U.S. Air Force's 45th Space Wing successfully supported the launch of a Falcon 9 rocket during its mission to place ORBCOMM's OG2



communications

satellites into orbit from Space Launch Complex 40.

"Today clearly placed the exclamation mark on 2015, by closing out another successful year for the Eastern Range in historic fashion," said Brig. Gen. Wayne Monteith, 45th Space Wing commander and launch decision authority. "This was a first for us at Cape Canaveral Air Force Station, and I can't even begin to describe the excitement the team feels right now having been a part of this historic first-stage rocket landing."

Before any spacecraft can launch from CCAFS, a combined team of military, government civilians and contractors from across the 45th SW provide the mission



The first stage booster of the SpaceX Falcon 9 returns to Earth. Photo is courtesy of SpaceX.

assurance to ensure a safe and successful lift-off for their range customers.

Eastern Range instrumentation provides radar tracking, telemetry, communications, command/control sites, camera and optical sites, and other support capabilities such as meteorology. Instrumentation is necessary to safely and successfully conduct civil, commercial, and national security spacelift operations and ballistic missile tests and evaluation.

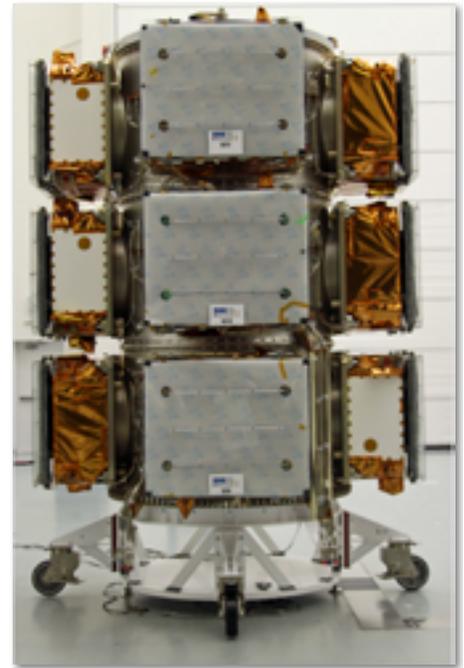
Post on orbit placement, Sierra Nevada Corporation's Space Diagnostics division established that the satellites were all up to snuff, with the satellite's meeting... even exceeding... expected performance standards. The company's statement...

Sierra Nevada Corporation (SNC) has successfully completed the solar array deployment and initial on-orbit checkout phase as planned for all 11 satellites launched for ORBCOMM's Generation 2 (OG2) Mission 2. The communication satellites were launched on December 21, 2015 from Cape Canaveral Air Force Station, Florida, on a dedicated SpaceX Falcon 9 rocket. The launch utilized an innovative configuration of three stacked EELV Secondary Payload Adapter (ESPA) Grande rings to carry the 11 satellites to orbit.

Mark N. Sirangelo, corporate vice president of SNC's Space Systems. "I would like to thank all the members of our spacecraft systems team as well as our payload subcontractor, Boeing, for delivering this next-generation satellite system. We also want to express our appreciation to ORBCOMM for this opportunity to provide these 17 satellites over the past year and two

launches, allowing them to offer their subscribers a more enhanced and efficient network capacity."

SNC is the prime contractor and spacecraft bus manufacturer for OG2, completing all design, manufacturing and integration at SNC's facility in Louisville,



The Sierra Nevada Corporation built OG2 satellites stacked on an ESPA Grande ring. Photo credit SpaceX.

Colorado. Similar to management of the 2014 launch, SNC will provide ORBCOMM on-orbit servicing and operations support from SNC's Satellite Operations Center in Louisville, Colorado, in addition to on-site support at the ORBCOMM Network Control Center in Sterling, Virginia.

"We'd like to thank SNC for their hard work and dedication to making this mission a success," said Marc Eisenberg, ORBCOMM's chief executive officer.

All OG2 spacecraft are based on SNC's flight-proven SN-100 satellite bus, which can be tailored to support a variety of applications, including communication, Earth observation, weather and space science. The SN-100 is designed for a five-year-minimum life and utilizes a modular payload deck that can be rapidly integrated and tested using highly automated scripts to test all functions. This allows the baseline satellite to be quickly and cost-effectively configured to meet the needs of many customers.

spacex.com

orbcomm.com

sncspace.com

An Electrifying Contract For Airbus D&S

Airbus Defence and Space has been awarded a contract by Inmarsat to design and develop the first two Inmarsat-6 (I-6) mobile communications satellites.

The two I-6 satellites will be based on Airbus Defence and Space's Eurostar E3000e variant platform, which exclusively uses electric propulsion for orbit raising. The satellites will take advantage of the reduction in mass that this electric propulsion technology enables for a dual payload mission, with an exceptionally large next generation digitally processed payload. The contract is valued in the region of \$600 million (550 million euros).

I-6 F1 and F2 will carry a large 9 meter aperture L-band antenna and nine multibeam Ka-band antennas, and feature a high level of flexibility and connectivity. A new generation modular digital processor will provide full routing flexibility over up to 8000 channels and dynamic power allocation to over 200 spot beams in L-band. Ka-band spot beams will be steerable over the full Earth disk, with flexible channel to beam allocation.

The first satellite (I-6 F1) is scheduled for launch in 2020 and its electric propulsion system will enable it to reach geostationary orbit in four to six months, depending on the type of launcher used. It has been designed to remain in service in orbit for more than 15 years.

I-6 F1 is the 50th Eurostar E3000 satellite and the 12th Inmarsat satellite ordered from Airbus Defence and Space. This new contract reinforces Airbus Defence and Space's position as the world's number one in electric propulsion satellites, with six full electric high-capacity telecommunications satellites already sold. The investments made by the company in future platform and payload technologies are supported by the European Space Agency and national agencies, in particular the UK Space Agency and CNES.

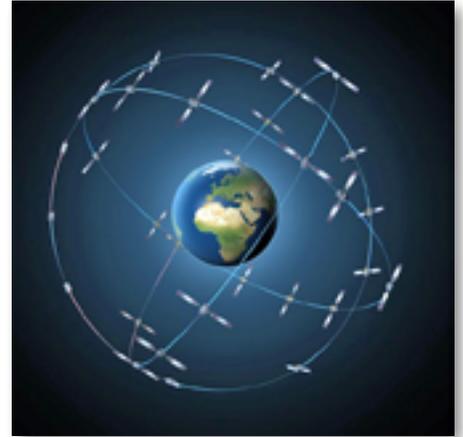
François Auque, Head of Space Systems for Airbus D&S, said, "This mission for our next generation digitally processed payload represents a step change in capability and capacity. The spacecraft will complement and enhance the L-band services offered by the Airbus Defence and Space-built Inmarsat-4 and Alphasat satellites, and embark a Ka-band mission to augment Inmarsat's globally available high-speed broadband service—Global Xpress."

"The Inmarsat-6 constellation confirms our continued commitment to delivering advanced L-band services for decades to come," said Rupert Pearce, CEO of Inmarsat. "The new satellites will provide significantly greater L-band capacity and will be capable of supporting a new generation of more advanced L-band services. The Ka-band co-payload adds depth to the breadth of the unique capabilities of our Global Xpress (GX) constellation, which now spans the world."

Galileo Doubles Up



The liftoff of Galileo satellites 11 and 12 aboard Soyuz VS13, occurring at 11:51 GMT (12:51 CET, 08:51 local time) on Thursday, December 17, 2015. Photo is courtesy of ESA/CNES/ARIANESPACE–Optique Video du CSG-S. Martin.



The complete Galileo constellation will consist of 30 satellites along three orbital planes in medium Earth orbit (including two spares per orbit). The result will be Europe's largest ever fleet of satellites, operating in the new environment of Medium Earth Orbit, providing worldwide navigation coverage. Artistic rendition courtesy of ESA-P. Carril.

The pace of deploying Europe's own satellite navigation system continued to increase with today's launch of the latest pair of Galileo satellites, doubling the number of satellites in space within nine months.

Galileo 11 and 12 lifted off together on December 17, 2015, at 11:51 GMT (12:51 CET, 08:51 local time) atop a Soyuz rocket from French Guiana.

This sixth Galileo launch was a textbook operation: all Soyuz stages performed as planned, culminating in the Fregat upper stage deploying the twin satellites into orbit close to 23 500 km altitude, around 3 hours and 48 minutes after liftoff.

"With today's launch, Europe has doubled the number of its Galileo satellites in orbit in just nine months," said Jan Woerner, Director General of ESA. "Along with the ground stations put in place around the globe, this brings Galileo's completion within reach. Initial Galileo services are scheduled to begin within next year, which proves the importance of this wise investment."

"The excellent performance of these satellites, as measured on the ground, allows Europe to join the club of the worldwide providers of satellite navigation services," said Didier Faivre, ESA's Director of Galileo and Navigation-related Activities. "Production, testing and launch of the remaining satellites are now proceeding on a steady basis according to plan."

"Then, after the summer break in 2016, the tempo of deployment will increase further with the first of three customized Ariane 5 launchers that will carry four rather than two satellites into orbit each time."

December of 2015 observed the 10th anniversary of the launch of Europe's very first navigation satellite: GIOVE-A, on December 28, 2005.

GIOVE-A secured the frequencies that had been set aside for Galileo, gathered data on the medium-altitude orbit environment and flight-tested hardware for the working system. 30-satellite Galileo constellation.

Galileo is the EU's own global satellite navigation system, consisting of 30 satellites and their ground infrastructure.

The definition, development and In-Orbit Validation phases were carried out by ESA, and co-funded by ESA and the European Commission. This phase created a miniconstellation of four satellites and a reduced ground segment set-up to validate the overall concept.

The Full Operational Capability phase is fully funded by the European Commission.

The Commission and ESA have signed a delegation agreement by which ESA acts as design and procurement agent on behalf of the Commission.

Learn more about Galileo at:
esa.int/Our_Activities/Navigation

Gilat Gemini Routers Gain Ground With Avanti Communications



Gilat Satellite Networks Ltd. announces that Avanti Communications Group plc is deploying Gilat VSATs to provide the fastest available broadband Internet access to rural households throughout the UK.

Avanti has been contracted by the 'Broadband Delivery UK' government initiative, which subsidizes the deployment of broadband to meet UK national connectivity objectives.

Gilat Satellite Network's SkyEdgeII-c Gemini. Gilat is supplying its Gemini compact, high-performance satellite routers, which are designed for cost-effective residential use, as they are super-fast and easy to self-install.

"We selected Gilat equipment because it adds a new dimension to our portfolio.

"At 30Mb per second, it is the fastest product in the market at a consumer price point," said Matthew O'Connor, Chief Operating Officer of Avanti Communications.

"The Avanti deal is significant for us because it addresses two of our growth engines at the same time: High-Throughput Satellite and Broadband Internet in rural areas," said Dov Baharav, Gilat's interim CEO and Chairman of the Board.

"We are delighted to have been selected for this project and we are looking forward to close cooperation with Avanti."

www.gilat.com/SkyEdge-II-c-Gemini

Joining Forces—SpeedCast International + NewCom International

SpeedCast International Limited (“SpeedCast”) has signed a definitive agreement for the acquisition of NewCom International (“NewCom”), a SATCOM service provider specializing in the South and Central American regions—the acquisition opens a new growth frontier for SpeedCast in a region where satellite is widely used and SpeedCast did not, until this acquisition, have a direct presence.

This acquisition will strengthen SpeedCast’s capabilities to serve and support its customers globally, including in the important and growing South American market.

NewCom has more than 25 years of experience providing integrated satellite and terrestrial communications and engineering solutions throughout the South and Central American regions, the Caribbean, Mexico and Africa, where it has been leading the way and has built a reputation for the quality and innovation of its services.

The company—which focuses on fast, cost-efficient delivery of the customized end-to-end solutions its customers require—specializes in the design, implementation, operations and management of critical integrated voice, video, data, content and security solutions.

NewCom is similarly diversified as SpeedCast, serving all key verticals including government, telecom, oil & gas, maritime, NGOs, aviation and mining.

Based in Miami, Florida, USA, NewCom has two state-of-the-art teleports in Miami, Florida and Lima, Peru, which provide strategic infrastructure to service its customer base throughout the Americas.

NewCom has experienced staff spread across the Americas including Miami, Peru, Columbia and Mexico, and has developed a variety of turnkey education, telemedicine, disaster recovery and remote office solutions to meet the demands of these fast-developing regions.

With NewCom’s acquisition, such will benefit SpeedCast’s existing customer base across multiple verticals, as the company leverages NewCom’s infrastructure and local presence to gain in operational flexibility and redundancy and enhance its support and logistics capabilities.

This will also opens up a new growth avenue for the Group into the major and growing South American market, through an already well-established and well-managed business with strong growth potential.

Last, but not least, NewCom strengthens SpeedCast’s presence and infrastructure in North America, with a major office and teleport in Miami, a key hub for the yachting, cruise and government market segments, an office in Mexico, and a strong management team that will further strengthen SpeedCast Americas’ organization.

SpeedCast will partner with NewCom’s experienced management team and employees to continue to provide best-in-class services to NewCom’s customers.

This acquisition follows the establishment of SpeedCast’s presence in the Americas in 2014 with the opening of the firm’s Houston office, and a further expansion into Washington DC in 2015.

SpeedCast expects to complete the transaction by the second quarter of 2016, subject to regulatory approvals. SpeedCast was represented in the transaction by Goodwin Procter LLP.

“I am thrilled to see NewCom joining the SpeedCast group as it is a well-recognized organization with a strong market position in South and Central America, a major and growing region for satellite services. NewCom fills a gap in our capabilities and we can now state that we are truly global and capable of serving our customers wherever they are,” said Pierre-Jean Beylier, CEO of SpeedCast.

“There is a real growth opportunity for SpeedCast in the Americas that we will now be able to better realize. With NewCom’s infrastructure, local presence, relationships and experience, combined with SpeedCast’s strengths, we are well positioned to deliver innovative and value creating solutions to customers in the Americas.”

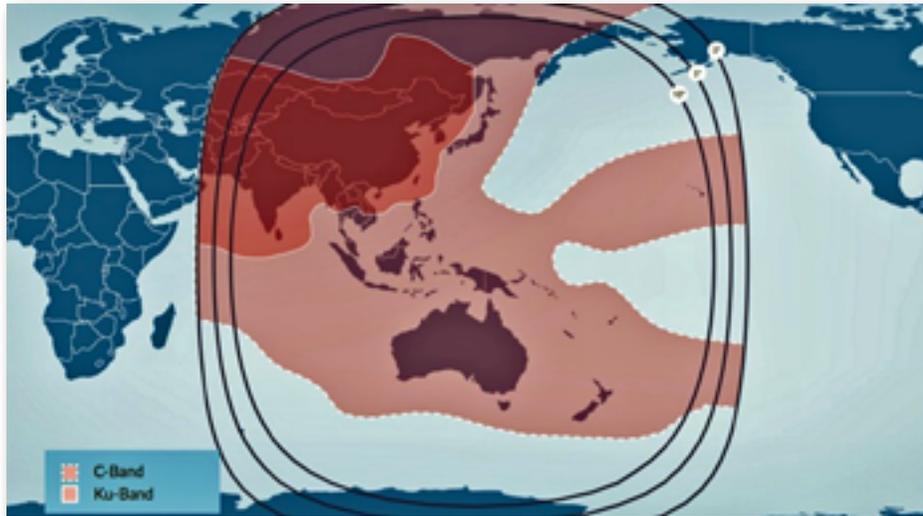
“At NewCom, we are committed to delivering the best service and solutions to the customers we serve, and joining SpeedCast strengthens our abilities on all fronts,” said Jaime Dickinson, CEO of NewCom.

“With SpeedCast’s extensive experience and infrastructure, we believe that NewCom will have the opportunity to drive further growth and advance our commitment to provide best-in-class services in the Americas, and in particular in the remote areas of South and Central America.”

speedcast.com/

newcominternational.com/

SSL Built Telstar 18 VANTAGE / Apstar 5C To Debut In 2018



Coverage that will be afforded by the new Telstar 18 Vantage/Apstar-5C satellite. Image is courtesy of Telesat.

Space Systems Loral (SSL) has been selected to provide an advanced communications satellite to Telesat, one of the world's top satellite operators.

The new satellite called Telstar 18 VANTAGE / Apstar 5C will operate from 138 degrees East and significantly expand Telesat's capacity over the Asia Pacific region through a combination of broad regional beams and high throughput spot-beams.

"This is the second satellite contract that Telesat has awarded to SSL this quarter," said John Celli, president, SSL. "Our companies have a long history of working together to help expand the world's communications infrastructure."

Equipped with C- and Ku-band transponders, Telstar 18 VANTAGE will offer superior performance for broadcasters, telecom service providers and enterprise networks on the ground, in the air and at sea.

The satellite's broad C-band coverage will extend across the Asia region to Hawaii enabling direct connectivity between any point in Asia and the Americas.

Telstar 18 VANTAGE Ku-band capacity will expand on Telesat's coverage of growing satellite service markets in China, Mongolia, Southeast Asia, and the Pacific Ocean.

"The strong relationship between Telesat and SSL has enabled our engineering teams to collaborate on a highly innovative design for Telstar 18 VANTAGE that will meet the growing needs of our Asia customers," said Dan Goldberg, Telesat's President and CEO.

"Telesat's contract award was the result of SSL's strong technical and commercial expertise, along with their ability to deliver on schedule."

Telstar 18 VANTAGE is based on the highly reliable SSL 1300 platform, which provides the flexibility for a broad range of applications and technology advances.

Scheduled for launch in 2018, Telesat's newest satellite is designed to deliver service for 15 years or more.

Telesat announced that the company has entered into an agreement with APT Satellite Company Limited (APSTAR), under which APSTAR will make use of capacity on Telstar 18 VANTAGE to serve its growing base of customers.

This agreement extends the long term relationship between APSTAR and Telesat that has existed for more than a decade.

Telstar 18 VANTAGE will be the third satellite with high throughput capabilities in Telesat's global fleet and, like the others, will use a combination of broad regional beams and high throughput spot beams in Ku-band to maximize throughput and spectral efficiency.

"Telstar 18 VANTAGE is a high throughput, highly flexible, state-of-the-art satellite that will provide a significant competitive advantage to customers serving the demanding requirements of broadcast, enterprise and government users throughout Asia," said Dan Goldberg, Telesat's President and CEO.

APT Satellite will hold the leasehold interests and exclusive right of the use of approximately 36.2 transponders for the entire lifetime of the APSTAR-5C Satellite.

ssllmda.com/

telesat.com/

apstar.com/

Aerojet-Rocketdyne's Thruster Maturation

Aerojet Rocketdyne, a subsidiary of Aerojet Rocketdyne Holdings, Inc. has been selected for a public-private partnership with NASA to mature the design of the 1-Newton GR-1 monopropellant thruster, which uses a green propellant known as AF-M315E.

Once matured, the improved GR-1 thruster will enable the technology to transition from development to production for commercial and government customers, using a green propellant that provides a safer, more efficient and higher-performance alternative than traditional hydrazine propellants.

The 1-Newton GR-1 is a small rocket engine used for attitude, trajectory and orbit control of small and medium-sized satellites and spacecraft. Under the partnership, Aerojet Rocketdyne will deliver for development and validation testing a fully-integrated 1-Newton GR-1 thruster that uses a Hydroxyl Ammonium Nitrate fuel/oxidizer blend (AF-M315E) propellant.

In return, NASA will test the thruster at NASA Glenn Research Center; NASA's Goddard Space Flight Center will oversee test planning and ensure infusion of the green technology on future NASA missions.

Aerojet Rocketdyne was selected for this project under NASA's "Utilizing Public-Private Partnerships to Advance Emerging Space Technology System Capabilities" solicitation, which seeks to develop space technologies that can enhance commercial space and benefit future NASA missions.

According to NASA, these partnerships can accelerate the availability and reduce costs for the development and infusion of emerging space system capabilities. NASA provides technical expertise, test facilities, hardware and software to help mature the capabilities.

"We're very excited about this partnership and working with NASA to advance our technology for a 1-Newton GR-1 thruster that uses green propellant," said Julie Van Kleeck, vice president of Advanced Space & Launch Programs at Aerojet Rocketdyne.

"Without question, the matured design will enable private and public companies to use the propulsion system in a more affordable and efficient manner, and with safer propellants."

rocket.com/propulsion-systems/monopropellant-rockets

JUICE For ESA To Be Delivered By Airbus Defence and Space

The European Space Agency (ESA) and Airbus Defence and Space have signed a 350 million euros contract to develop and build ESA's JUICE (JUPiter ICy moons Explorer) spacecraft.

The contract was signed in Toulouse in the presence of Alvaro Gimenez, Director of Science and Robotic Exploration at ESA, and Eric Béranger, Head of Space Systems Programs at Airbus Defence and Space. JUICE is the first large mission of the ESA Cosmic Vision program, with a launch date set for 2022.

JUICE is the first European mission to Jupiter; its overarching theme is the emergence of habitable worlds around gas giants. JUICE will investigate the Jovian system, with a focus on its icy moons and the possibly ocean-bearing worlds of Europa, Ganymede and Callisto.

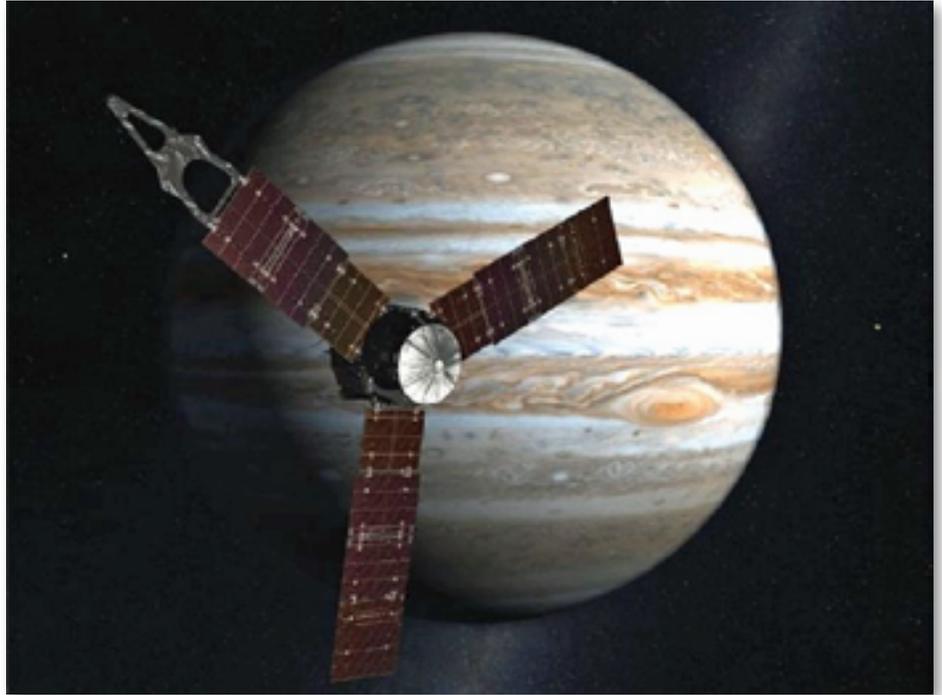
The mission will study the Jovian system addressing two key themes: exploration of the habitable zone within the Galilean satellites, and exploration of the Jupiter system as the archetype of gas giants.

Following a launch on Ariane 5, JUICE will cruise for 7.5 years making extensive use of gravity assist maneuvers (in order to save fuel and energy) around the Earth, Venus and Mars before reaching the Jovian system.

After insertion into Jupiter's orbit, JUICE will use multiple fly-bys to complete a comprehensive orbital tour over 3.5 years. At the end of the tour, JUICE will be set in orbit around Ganymede, becoming the first spacecraft ever to enter orbit around an icy moon in the outer Solar System.

The complex mission profile will be supported by dedicated navigation cameras on-board the spacecraft.

To fulfill its scientific mission, the spacecraft will carry 10 instruments covering a wide range of measurement techniques (optical, sub-millimeter, radar, laser altimeter, magnetic, electric, plasma and particle sensors, and radio-science).



Artistic rendition of the JUICE spacecraft is courtesy of NASA.

To avoid any perturbation of the scientific instruments, the spacecraft will have an unprecedented level of magnetic cleanliness. Weighing five and a half tonnes, JUICE will be powered by a large 97 m² solar generator, the largest ever built for an interplanetary mission. This will ensure the spacecraft produces enough energy even in the low solar environment at Jupiter.

Airbus Defence and Space heritage includes missions to Venus (Venus Express), Mars (Mars Express), Titan (Huygens), and comet 67P / Churyumov-Gerasimenko (Rosetta). The company is currently building missions to the Sun (Solar Orbiter), Mercury (BepiColombo) and Mars (ExoMars), as well as all the satellites built and under construction for Earth research (Swarm, Cryosat, the Sentinel satellites and many more...).

These previous missions have allowed Airbus Defence and Space to develop unique expertise in autonomy, allowing spacecraft to be self-sufficient during long-duration cruise phases as seen on Rosetta, as well as careful electromagnetic cleanliness plans, which are essential in missions like Swarm—the magnetic field measurement mission.

“Building on the expertise we developed on our sites in Toulouse (France), Friedrichshafen (Germany), Stevenage (UK) and Madrid (Spain), the Airbus Defence and Space project team is now running at full speed and the first equipment is expected for delivery in summer 2016,” said François Auque, Head of Space Systems.

“The selection of subcontractors has started and will be completed by 2017, and we will be prime contractor for an industrial consortium of more than 60 European companies. When the project reaches its peak activity around 2017-2018, as many as 150 people will be working in the prime project team.”

KVH Expands + Goes Big With mini-VSAT... Capacity Doubles

KVH Industries, Inc., expanded the capacity of its mini-VSAT Broadband network with two major upgrades recently, supporting growing customer demand for broadband at sea.

One expansion added a new satellite beam that doubled the mini-VSAT Broadband network capacity in the North Atlantic Ocean region, including Canada's Hudson Bay.

The second expansion added a new beam across Europe, the Middle East, and Africa to add 30 percent more capacity across areas such as the North Sea and the Mediterranean Sea.

With 25 transponders (22 Ku-band and 3 C-band) on 18 satellites, KVH's mini-VSAT Broadband network serves customers worldwide and is the leading maritime VSAT service by market share, according to an independent industry report*.

Commercial and recreational mariners use the mini-VSAT Broadband network for broadband services that include Voice over Internet Protocol (VoIP); VPN access; and a suite of news, television, movie, sports, and music



content that is multicast to vessels via KVH's IP-MobileCast service.

The network also supports the IP MobileCast delivery of onboard training, weather data, and chart update services that reduce operational expenses and improve safety and security.

The North Atlantic expansion is in response to customer demand from coastal recreational users and commercial vessels transiting between the United States, Canada, and Europe.

The expansion across Europe and the Middle East reflects the increased demand onboard a variety of commercial vessels for fast and reliable broadband services at sea in those areas.

"Our customers are in need of faster speeds, more content, and affordable service, and we continue to enhance what is already the world's leading maritime VSAT network," said Brent Bruun, KVH executive vice president for mobile broadband.

"Our network is stronger than ever before in these heavily traveled waterways. KVH's strategy of adding capacity when and where it's needed while leveraging cutting-edge satellites and technology continues to deliver the best user experience in the industry."

kvh.com/

** KVH is the world's No. 1 maritime VSAT supplier as measured by vessels equipped with mini VSAT Broadband service, according to the COMSYS Maritime VSAT Report, 4th Edition, March 2015.*

120th Year Anniversary For Harris Corporation

Harris Corporation marks its 120-year anniversary by recognizing its heritage of transformation and innovation.

Founded in the back room of an Ohio jewelry store in December 1895, Harris grew from a tiny printing press company into a top 10 defense contractor with \$8 billion in annualized sales, 22,000 employees, customers in 125 countries, and a diverse portfolio of technologies that connect, inform and protect the world.

Harris is the longest-thriving major defense contractor and one of 398 publicly held companies still in existence for 120 years or longer—including GE, CVS, Coca-Cola, Pfizer, P&G, and J.P. Morgan. (120+ Companies).

Harris has transformed itself numerous times through strategic mergers and acquisitions, including expanding its printing presence in 1926 by merging with the Seybold Machine and Premier-Potter companies, transitioning into electronic communications with the 1967 merger with Radiation Inc., and nearly doubling its defense industry presence through its largest-ever acquisition of Exelis in 2015. (120-microsite)

Harris has also introduced a long list of notable technology innovations, including the world's first automatic and four-color printing presses, the Washington-Moscow hotline, GPS navigation space antennas, multi-band military radios, and advanced air traffic management and weather forecasting solutions.

Harris today is an industry leader in technologies for defense, space, weather, air traffic management and electronic warfare. (Harris video)

"Embracing transformation and pushing technology boundaries are foundational to Harris' success over the past 120 years," said William M. Brown, chairman, president and CEO. "We continue that heritage today with our recent defense-market expansion and our industry-leading investment in advanced research and development. We are proud of Harris' legacy, and even more excited by the opportunities that lie ahead."

harris.com/

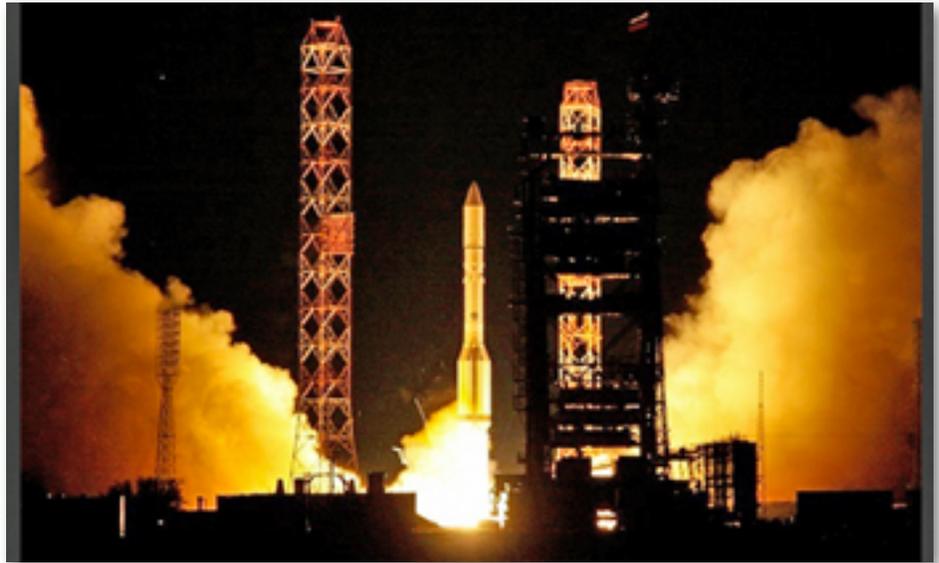
InfoBeam

Express-AMY1 Expressed To Orbit

Russia's TASS news agency reported that a Proton-M carrier rocket with the Express-AMY1 communications satellite onboard lifted off from Baikonur space launch facility in Kazakhstan, this according to the Russian Space Agency, Roskosmos.

"The Briz-M rocket booster separated in nine and a half minutes," the space agency's representative said. This was the last carrier rocket launched from Baikonur this year and 18th since the start of 2015.

The launch was initially scheduled for 00:30 Moscow time on December 24 but had to be postponed due to a strong wind at the launch site.



A Good Report Card... + A 10th Anniversary... For United Launch Alliance

After another year with 100 percent mission success, the United Launch Alliance (ULA) team capped off the year with the launch of the OA-4 mission to the International Space Station (ISS) on December 6 and prepares for its 10th anniversary.

"What an incredible year for ULA," said Tory Bruno, President and CEO of ULA. "I couldn't be prouder to be a part of the best launch team in the world. I am so thankful to all of our employees and industry partners for their commitment to get the job done. I am also grateful for the support from all our families as we continue to push boundaries and get ready for next year!"

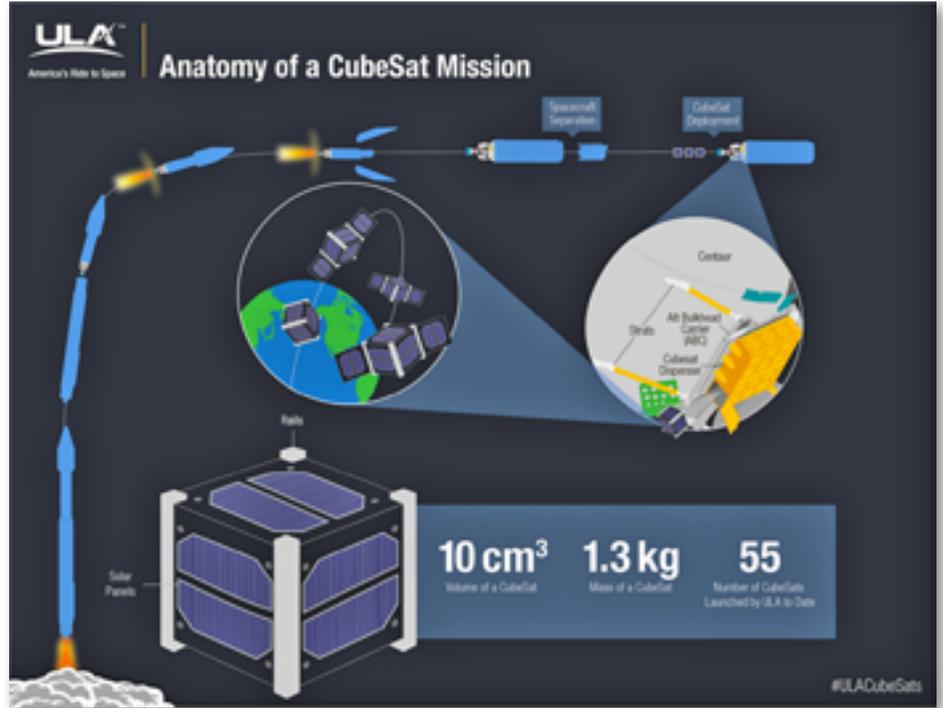
In 2015, ULA flawlessly launched 12 missions from two coasts using the Delta II, Delta IV and Atlas V rockets in support of the U.S. Air Force, U.S. Navy, National Reconnaissance Office, NASA and multiple commercial customers.

The company also celebrated exciting milestones—reaching 100 launches with the October 2 Morelos-3 mission and completing ULA's first mission to the ISS, both on Atlas V vehicles.

"These missions are so important for keeping our service members safe around the world, enhancing our GPS capabilities and enabling scientific research in space that will inspire the next generation of rocket scientists and astronauts," Bruno said.

ULA also announced two new initiatives in 2015 that will transform the future of space lift. At the 31st Space Symposium in April of 2015, Bruno unveiled the Vulcan rocket, ULA's next-generation launch system, which will be the highest-performing, most cost-efficient rocket on the market.

Additionally, Bruno announced ULA's Cubesat program in November of 2015, supporting science, technology, engineering and math (STEM) education and making space more accessible by offering universities the opportunity to compete for free rides to space on Atlas V rockets.



"This initiative will not only make STEM rides free, frequent and predictable, but will potentially double the world's lifts for CubeSat," said Bruno.

Over the course of the year, ULA was awarded three launch services contracts, besting all commercial competitors for NASA's Tracking and Data Relay Satellite (TDRS-M) and Solar Probe Plus missions as well as the EchoStar XIX commercial mission.

"Customers are selecting ULA's launch vehicles for competitively awarded missions due to our proven reliability and schedule certainty," said Bruno. "We launch when our customers are ready to launch."

ULA also implemented new cost-savings initiatives in 2015. In coordination with the U.S. Air Force, ULA began conducting Offsite Vertical Integration (OVI) of the Centaur upper stage for the Atlas V rocket reducing the time required between launches and mitigating the risk of weather-related processing delays.

In addition to OVI, ULA dramatically reduced costs of major supply chain items by 40-45 percent through strategic partnership initiatives with Orbital ATK,

Blue Origin and RUAG for solid rocket boosters, the BE-4 engine development and composites production capability which will bring jobs from overseas to the United States, respectively.

ULA will celebrate its 10th anniversary year with its highest operations EELV tempo to date, with 16 launches planned for 2016.

"Congratulations and thank you again to all of our employees and families. I am truly humbled to work alongside you as we provide our nation with assured access to space."

With more than a century of combined heritage, United Launch Alliance is the nation's most experienced and reliable launch service provider.

ULA has successfully delivered more than 100 satellites to orbit that provide critical capabilities for troops in the field, aid meteorologists in tracking severe weather, enable personal device-based GPS navigation and unlock the mysteries of our solar system.

ulalaunch.com/

AddValue's Data Relay Terminal Aboard The Velox-II Satellite



Addvalue Innovation Pte. Ltd., a wholly-owned subsidiary of Addvalue Technologies Ltd, announces the company's space qualified, satellite-based, data relay terminal that had been integrated into the VELOX-II satellite, was successfully launched into a Low Earth Orbit (LEO) on December 16, 2015, via an Indian rocket.

The VELOX-II satellite, which was built by Nanyang Technological University (NTU) under a contract by Addvalue, carries the Addvalue's proprietary data relay terminal as the primary payload.

Also aboard were other Singapore developed satellites. The Addvalue's data relay terminal is an essential component of its planned Inter-Satellite Data Relay System ("IDRS").

Addvalue first announced its joint collaboration with NTU to test its IDRS concept on the VELOX-II satellite in November of last year.

Addvalue's IDRS is an innovative new service that addresses a long standing constraint on the operation of LEO satellites. Currently, communication with LEO satellites is only available when the satellite is within sight of an Earth Station.

Further, this limited connectivity is available only on a rigid time schedule based on the particular LEO satellite orbit and the geographic placement of the

Earth Stations. Thus, LEO satellite operators must contend with communication links that are not available on a 24/7 basis. With the launch of the VELOX-II satellite, Addvalue will be able to demonstrate the technical feasibility of IDRS, its new LEO satellite link, to provide high capacity on-demand 24/7 two-

way IP-based data services for LEO satellite missions. Addvalue will begin evaluating the performance of its IDRS data relay terminal once the VELOX-II satellite platform is declared operational.

addvaluetech.com/

Reaping The Benefits + Avoiding The Pitfalls Of IoT

By FreeWave Technologies

The Internet of Things—or, IoT—is far more than simply the newest fitness monitor or cool device.

IoT is the process of transparently deploying countless sensors and devices which produce data that is then transformed into valued information.

This happens every time a consumer buys a smart device, such as a fitness monitor. The consumer knowingly enables the device to monitor an event, such as a run. In turn, the device creates data, e.g., step count, which is transported across the Internet to a cloud application.

Analytics are then performed on aggregated data, such as a friends' data, to create information, which could be "rankings," which is then consumed through human or machine action, for example, to improve one's performance to run father or faster.

This IoT process of creating, transporting, storing and acting on data for consumer applications is similar to the process needed for industrial applications. Industrial applications focus on measuring production and operational factors, distributing data to business systems and people within an organization, and directly improving business processes and profitability as a result. The Industrial Internet of Things (IIoT) is the latest catalyst to process automation. IIoT is summarized as:

- *The number of sensors to monitor processes is exploding*
- *Connected devices transport data at higher speeds*
- *Cloud networks make data storage and availability scalable*
- *Analytics extract information from a myriad of sources*



These four IIoT elements touch every aspect of an enterprise's production or manufacturing environment and require the two organizations, Information Technology (IT) and Operational Technology (OT) which are responsible for implementing and operating IIoT information and business systems, to adopt new strategies; one strategy is IT/OT convergence.

IT/OT convergence promotes a single view of an enterprise's information, and process management tools help ensure that every person, machine, sensor, switch, and device in an organization has accurate information in the best form and at the correct time.

As OT products such as Programmable Logic Controllers (PLCs) and Remote Terminal Units (RTUs) become more aligned with IT infrastructure and applications, ensuring OT information is integrated efficiently with IT systems at a process level is a difficult task for many companies.

Getting IT and OT systems to work together to maximize business efficiency—all the while avoiding negative consequences, risks and pitfalls in the process—makes this task even more challenging.

However, thanks to new technologies, this process is becoming more practical and is creating numerous opportunities that are resultant in huge economic benefits when these two disciplines are integrated successfully.

Technologies That Enable IT/OT Convergence

While the economic benefits are defined by each organization, the technologies that enable IT/OT convergence are currently available and are rapidly proliferating due to IoT, Big Data and the drive to more intelligent SCADA networks. The enabling technologies include:

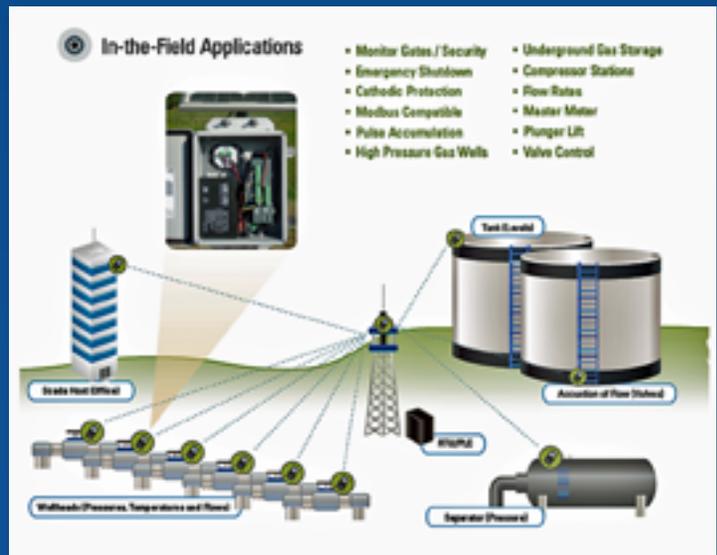
- *High power/performance sensors, controllers, RTUs and PLCs*
- *Operating systems that include standard communication stacks and security protocols*
- *Low power Ethernet, Wi-Fi and wireless communication to sensors and controllers*
- *Standard protocols such as MODBUS, DNP3, IEC 60950*

There are numerous companies that provide products in each of these areas. However, it is the high speed, high capacity communications that is the true enabler in IT/OT convergence.

With high data capacity, OT networks, the overhead associated with Internet and security protocols, is no longer critical to network latency or SCADA applications for wired or wireless communications. OT and IT networks are now using the same underlying network and transport layers, thereby clearing one of the fundamental barriers to convergence.

The careful selection of technology for IIoT or industrial applications helps drive the convergence of IT/OT systems. For example, in electric utilities, the rollout of Advanced Metering Infrastructure (AMI) and Distribution Automation (DA) networks is truly an OT application.

The source of the data will fuel IT/OT convergence because it is the data analytics applications—such as outage detection, fault management, prepay and others—that bring value to the Smart Grid.



Oil & Gas "In-The-Field" IIoT Applications

In the same vein, for oil and gas production, increasing the number and type of sensors at the wellhead to monitor tubing pressures, lift arrival, flare stack operation and other necessities, provide greater insight into production and, in turn, allow SCADA systems to improve operational efficiencies and lowering production costs.

Benefits Of IT/OT Convergence

In operational networks, there is a wealth of information available from systems that are already in place. Information systems collect supplementary information from the Internet.

When these information streams are combined and used in a business process through an effectively designed communication network with carefully selected technology, the benefits are considerable and ultimately make organizations more efficient. The key benefits include:

Optimization of business processes

Decisions will be made in real-time with higher levels of confidence because more information will be available regarding the event or condition. For example, load shed or curtailment events will be based on energy availability (IT sources) and demand throughout the distribution network (OT sources). Management of an event in an IT/OT converged network will execute as a closed loop process by targeting a feeder or substation, issuing curtailment signals to customers under that substation or feeder, gauging the real-time response and repeating as required to achieve the target reduction.

Reduced operating costs

Improving business process intelligence through smarter analytics to minimize spinning reserves to compensate for variable generation sources such as wind or solar. As an example, operators are able to intelligently manage variable generation assets, which requires integrating reliable weather information (IT sources) and grid power demands (OT sources) with business process or analytics to this converged information to optimize fixed and variable generation assets.

Shorter development time and common platforms

IT and OT groups traditionally developed in two separate domains where almost all of the communication, hardware and software were specific to that domain, which made integration of IT and OT systems complex. Now, with the proliferation of communication standards, powerful processors and operating systems provide a common environment for IT and OT groups. IT and OT groups now share fundamentals in communications and network architecture, which simplifies the transport of data across systems, thus the technology divide between IT and OT is closing and becoming common.

Extension policy and security across networks

In the past, many OT groups depended on standalone or siloed data networks and possibly obscurity for network security. With interconnected IT and OT networks, the entire network must be secure to minimize vulnerabilities at any single point in the combined network. Many OT products now support standard communication and security protocols. Therefore, organizations need to implement and manage policy and security measures against their entire IT and OT networks leading to standardized access and minimizing network vulnerability.



- *IT has been maintaining business systems and communication networks with five or more nines of reliability and employs computer and IT specialists. IT typically plans and manages rollouts and upgrades in a very methodical manner leading to longer rollouts. IT is solidly based on communication standards and centralized operations and it may be looked on as a "roadblock" to rolling out OT applications.*

In order for IT/OT convergence to be successful, communication is essential and in turn, there needs to be a clear understanding of each group's roles.

By converging IT and OT, organizations will realize these and numerous additional benefits and numerous that are specific to the organization's business processes and IIoT strategy.

Challenges + Issues Surrounding IT + OT Integration

With identifiable business benefits and rapidly developing technologies that are closing the IT/OT divide, there are functional and operational differences between IT and OT groups that exist and complicate integration or convergence.

IT and OT groups typically have fundamentally different charters, focus and personnel within their respective organizations. The challenges to IT/OT convergence are not the sensors, hardware, software or technology, but how each group perceives each project or opportunity and, in turn, the solutions, which are skewed by their respective domains. The challenges in IT/OT convergence and project execution are:

- *Project ownership*
- *Communication between groups and with stakeholders*
- *Adapting or harmonizing conflicting organization needs, process and policy into a single and common structure*

Project ownership and understanding will be called into question because of historical experiences between the groups. Some of the fundamental differences within an organization may be:

- *OT has largely been outside the highly pragmatic world of IT and employs process specialists such chemical or electrical engineers. OT likely manages projects, networks and solutions, with the focus of keeping production and real-time operations running. Additionally, OT employs vendor or proprietary hardware and software that is specific to a production process and may not meet the security standards of the IT organization.*

Considerations

As organizations work to benefit from the convergence of IT/OT functions, stakeholders, product owners and organizational managers must continue to understand differences between IT and OT while embracing the similarities.

Typically, IT owns the corporate strategic direction, policy, security and implementation of networked communications and business systems.

OT, on the other hand, owns process definition, device selection and information flow in order to optimize and manage production systems.

Product owners own the definition of the business process and the goals for the IT/OT project.

To move any project forward, project management is essential. The IT group is the likely choice for overall management of IT/OT convergence projects because of experience with centralized management, network security, information storage, and business systems. After all, the resulting product of an IT/OT project is improvements to business process resulting in cost reduction and harmonization of corporate policy and security.

As these two areas may be at occasionally at odds, organizations working on IT/OT convergence need to clearly define stakeholders, areas of ownership, and so on.

Managing The Interworking Between IT + OT

Now that the benefits and challenges of IT/OT convergence have been defined, an understanding of the basics on management of this convergence is critical.

Therefore, a general framework for IT/OT projects is needed to harmonize the roles and divide the joint project or application into manageable elements or layers, and align the elements with the business goals or drivers. The general IT/OT project approach is:

- Determine the business goals or drivers
- Develop the implementation roadmap since IT/OT projects are likely multi-phase implementations
- Develop the business and get stakeholder buy-in
- Develop the business process workflow and use cases

Once the business process flow and use cases are well known, the detail elements or tasks of the project are defined. These include the data and interfaces for the various actors to interact.

It is clear that OT owns the micro-vision and implementation of any solution and IT owns the macro-vision and implementation of the same solution. OT groups work from the sensor to data collection to process control to transfer of data to a database.

Conceptually, OT works from the bottom up, while IT groups work from the business process to data storage to data transport across dedicated networks or corporate networks. Conceptually, IT groups work from the top down. Having a framework to align project interface, roles and functions is vitally important.

ISA-95 is a multilayer standard or framework that defines IT/OT convergence as 5 layers with OT working layers 0 (sensing and manipulating process) to layer 3 (managing work flow) or upward, and IT working layer 4 (managing business activities such as ERP or MRP) to layer 3 (establishing basic schedules) or downward.

While the ISA 95 standards are not yet complete, the division and allocation of the overall IT/OT integration is a model and serves IT and OT groups as they define projects' scope, divide applications or tasks, and define interfaces and communications.

IT/OT Integration Dangers + Pitfalls

While OT systems are changing and are becoming more aligned with IT systems through the use of standard interfaces and security protocols, OT and IT domains are still worlds apart and require a keen understanding of their respective differences. For example, IT groups may deploy hundreds or thousands of network devices, such as computers, routers and switches,

to their enterprise networks each year. There is a market expectation that these vendors will release products that present standard interfaces and comply with security protocols, in addition to the expectation that these vendors will maintain their operating and security systems with regular patches and updates.

On the other hand, OT devices are typically specific to an application or task and likely lower in product volume. As a result, patches and upgrades may be slower in arriving. In addition, process programs may be developed on a PLC or RTU that may use features specific to a product release. As a result, maintaining and upgrading OT systems may present a level of fragility IT groups are not familiar with or may not comply with the necessary security safeguards.

Therefore, IT and OT must communicate and work closely to understand the nuances of application specific devices and hardware, how these devices may influence network operation and, in turn, policy. Pitfalls of IT/OT convergence are a challenge that many organizations will face, but with the best-fit technology and good relationships between the OT and IT groups, consistent communication with business owners and stakeholders, they can be avoided.

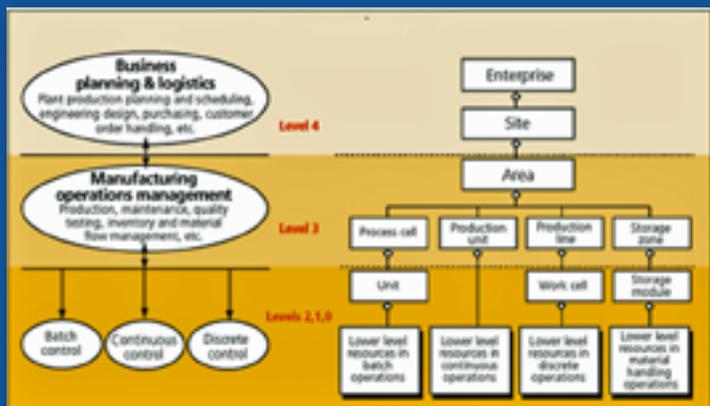
The Benefit Of Convergence

Worldwide IIoT markets are exploding. In order to benefit from the proliferation of data and its transformation into information, companies need an IoT strategy that includes IT/OT convergence in addition to Big Data.

As technology changes continue to close the divide between IT and OT systems, IT/OT convergence will see shorter development cycles, higher levels of policy and security administration and smarter business analytics. These are inherent gains of IoT and Big Data markets. In short, technology, hardware, software and communications are not likely the key challenges to IT/OT convergence.

The key challenge for many organizations will be management of IT/OT convergence projects due to the inherent differences in their IT and OT groups because of how each sees the problem and solution. With planning, ownership and clear communication among all of the groups and stakeholders, IT/OT convergence can certainly be realized, along with the potentially huge gains for any firm's bottom line.

freewave.com/



Hierarchies per ISA-95.



A framing construction project in Alberta, Canada, using IIoT technologies.

SatHealth™: MSS Disaster Relief Operations Are A Specialty & An Obligation For Telemedicine Success

By Amal Ezzeddine, Senior Director, Government Services, Thuraya Telecommunications Company



In times of natural disaster, conflict and disease, the need for vital information is essential and saves lives.

Look at the natural disasters that have occurred over the years: typhoon Haiyan in the Philippines; the Tsunami in Japan; earthquakes in Haiti, Pakistan and China. With each of these disasters, access to telecommunication services has played a most critical role in ensuring a community receives the support needed to recover from nature's or man's violence.

In the aftermath of the 2010 earthquake in Haiti, Valerie Amos, UN Under-Secretary-General for Humanitarian Affairs and Emergency Relief Coordinator, said, "...Without direct collaboration with humanitarian organizations, volunteer and technical communities run the risk of mapping needs without being able to make sure that these needs can be met."

What steps does the satellite community need to take to prepare to assist with the next natural disaster?

Mobile Satellite Services (MSS) operators must not wait for disaster to strike before taking steps to collaboratively help on relief efforts. To prepare appropriately, a number of steps must be taken that will ensure the ability of quick deployment and the effective use of available resources.

These steps include equipment fully ready and packaged for deployment to working teams on short notice. Rescue teams should be appropriately trained on the use of communication equipment.

A crucial requirement is that satellite communications (SATCOM) equipment be an integral part of the drills, exercises and training programs that rescuers undertake. Communication equipment should be tested continuously and packaged with all of the necessary accessories, such as cables, antennas and solar panels. Humanitarian teams need technical support and know-how on the ground, where such matters most. After



all, time costs lives. There must be full, continuous collaboration and co-operation between all involved parties.

As technology is able to assist people at a time of their greatest needs, maintaining a reliable, mission-critical network operational is a huge responsibility while ensuring high-quality communications services are readily available where and when they are needed. For the satellite community to transform the humanitarian response further into an even more effective force, operational readiness, immediate transportation and deployment are of key importance.

The Benefits Of The SATCOM Infrastructure

A well-known fact is that, during an environmental or man-made crisis, terrestrial networks become unreliable for a number of reasons, such as congestion or infrastructure destruction. In these situations, NGOs frequently turn to MSS operators for the provision of what could be the only means of communicating with the outside world and for coordinating relief and appropriate responses. SATCOM in these situations is simply more reliable than terrestrial networks.

SATCOM is also the easiest to deploy in rural and remote areas. The satellite provides blanket coverage in any country around the world, whether an urban or rural area. End-user equipment and services include satellite handheld terminals for voice connectivity, data terminals (such

as the Thuraya IP+ for broadband connectivity) and even a Public Calling Office (PCO) using prepaid or postpaid credit such as is typically used as a village phone.

These products and services help establish effective communications to rural areas which, in turn, provides people with medical help, medicine, food, and emergency communications.

SATCOM becomes their main connection to the world. Also well-known, and proven fact, is that the availability of Information Communication Technology (ICT) infrastructure in any area acts as a catalyst towards economic stability.

As technology and communication solution providers, support for the surge in the use of telemedicine in remote areas is on the rise. Terminals (such as Thuraya IP+) are used to connect telemedicine units, which enable relief workers to send information about patients, such as vital signs and images of injuries or trauma and receive instructions and information, to emergency doctors and health providers in trauma centers or hospitals.

Additional roles played by SATCOM enable connectivity to many different applications, such as food distribution and census bureaus, for example. During the Ebola outbreak in Africa, Thuraya IP+ terminals were established in hundreds of treatment centers across the countries that were hit by the

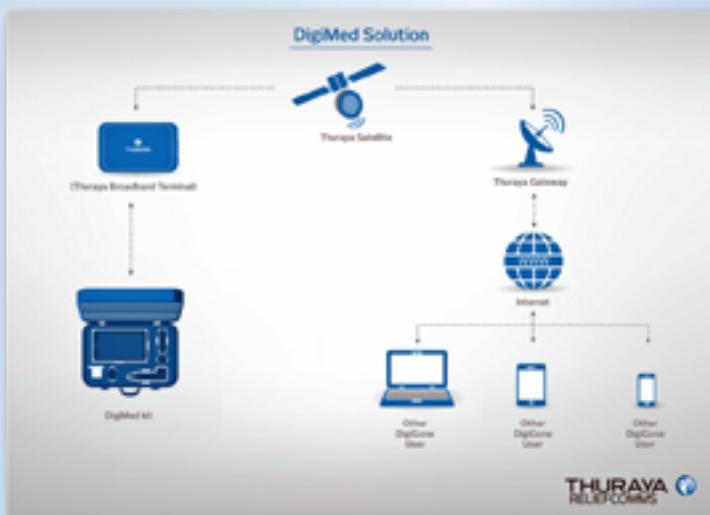


disease to provide reports about new cases as well as citizen's deaths and survival numbers.

When more than a quarter of a million people were displaced by the deadly floods that ripped through Malawi in January of last year, the International Telecommunication Union (ITU) deployed satellite phones for relief and recovery efforts in districts that were affected by severe flooding.

Most recently, the ITU dispatched satellite handsets to Micronesia when the island was hit by Typhoon Maysak. These phones were used by Search and Rescue (SAR) teams to deliver rapid disaster relief. Such devices can make a huge difference in the speed at which NGOs and emergency response teams can assess and react to a situation.

The recent launch of the cost-effective DigiMed Solution by DigiGone is a huge advancement in telemedicine and SatHealth™. DigiMed bridges an information gap during crises by allowing real-time teleconferencing to occur between doctors and patients at the scene of an emergency.



Such solutions continue to revolutionize the field of telemedicine and serve as a vital lifeline for organizations working in the field or at sea. DigiMed provides critical voice communications for relief teams, weather, and mapping services—all crucial activities for those working in disaster areas.

Michael Dunleavy, President, DigiGone, said, "DigiMed meets the demands of our end-users and is a favored companion of NGOs, global media organizations, government entities, as well as energy and maritime companies requiring a reliable, portable, secure and easy-to-use satellite broadband terminal. A combination of extraordinary value and efficiency, DigiMed delivers enhanced medical care to the remotest of locations at a truly affordable price."

Capable of streaming patient data in real-time and allowing medical professionals to make on-the-spot decisions in emergency situations, DigiMed portable kits are designed and built for easy transport and storage. The DigiMed solution, when used with Thuraya (IP+, IP Voyager and Orion IP) terminals, establishes a secure, flexible platform that can be customized to a specific user.

New Developments + Challenges

New and lightweight flying drones, otherwise known as Unmanned Aerial Vehicles (UAVs), are also starting to play a more important role in disaster relief. UAVs can run reconnaissance missions in disaster zones, spot stranded victims, map changed ground, and document areas that need attention.

Drones help deliver communications quickly and efficiently, reaching disaster areas that are not accessible by road. With the correct terminal, drones can take and send images and they can also check the quality of a network, or give the network a boost. Drones have already been used to deliver polio virus vaccinations in Nigeria, Afghanistan and Pakistan as they are capable of carrying up to 10 kg in weight.

Clearly, satellite connectivity can make the use of telemedicine in remote areas possible. The Emergency Telecommunications Cluster (ETC) deployed Thuraya XT terminals in Sierra Leone to meet critical communication requirements.

The challenges were considerable. On top of the major health concerns themselves, the institutional infrastructure was poor and government resources were inadequate. To make matters even worse, cellular networks were deteriorating due to the influx of health workers and the lack of



technical staff available to manage the cellular networks. Networks were breaking down as traffic increased.

This left infected people in isolated areas with no coverage—just when they needed the assistance the most. People needed to collect data, conduct community surveillance and maintain contact with Ebola treatment centers.

While technology comes at a price, affordability is important. The satellite industry should offer developing nations flexible pricing plans, where charges are only applied when in use and services are provided at the appropriate cost. Preferential airtime rates, additional capacity readily available and technical training support all need to be supplied.

Facilitating the movement of communication equipment across borders also comes with a variety of hurdles. The Tampere Convention needs to be endorsed and ratified by governments all over the world to allow the satellite community to fully assist humanitarian teams.

To date, around 50 countries have ratified the Convention. This vital piece of international legislation could allow for communications equipment to be made available at regional offices of the United Nations and at International Aid agency offices and NGO headquarters ahead of disasters, saving critical time and ensuring the availability of vital equipment.

In October, a Crisis Connectivity Charter was signed in Geneva, under the umbrella of the EMEA Satellite Operators Association (ESOA) and the Global VSAT Forum (GVF). This Charter was signed with the global humanitarian community represented by the UN Office for Coordination of Humanitarian Affairs (OCHA) and the Emergency Telecommunications Cluster (ETC).

The agreement embodies a commitment from some major players in the satellite community to provide connectivity during the response to humanitarian crisis... and beyond. The Charter formalizes terms and protocols that are designed to accelerate the ability of emergency response teams to access satellite-based communications at times of disaster in 20 high-risk countries that have been identified by the ETC.

This Charter moves the satellite community one step further toward educating and working with NGOs and governments to deliver secure, reliable, portable, easily deployable and user friendly solutions in the event of any disaster. As an end-to-end satellite-based response, the agreement opens the door for more coordination among satellite operators, humanitarian agencies and governments. This will allow the humanitarian community to plan far more effectively, refining and improving its response to disasters.

The intent is to create dependable solutions based on a deep understanding of SAR requirements and the environments that will be confronted in the field. Timely and informed decisions regarding SAR activities, emergency management and situational awareness in remote and often dangerous locations are crucial determinations.

Relief users require technology that is simple and seamless and which can function in the dusty terrains of North Africa or in the rainy tropics of the Philippines. They rely on the commercial satellite industry to provide the best service at the best price.

MSS operators are duty-bound to deliver on these needs. While the satellite technology community has made huge strides in delivering life-saving services and products to relief organizations and those affected by man-made and natural disasters, there is a great deal more to be done and the community must continue to build on what has already been learned and experienced. True transformation goes beyond technology and governments, NGOs—private-sector stakeholders must come together to develop a viable long-term logistics solution, and deliver real change.

Case Study

Connecting First Responders during Typhoon Haiyan

When Typhoon Haiyan hit the Philippines on November 8, 2013, the Visayas region bore the brunt of one of the most powerful tropical cyclones ever recorded. Satellite technology served as the key enabler for first responders to communicate and deliver relief support to the survivors.

In addition to causing extensive infrastructure damage, Typhoon Haiyan resulted in severe disruption to communication networks in the worst-hit areas such as the city of Tacloban.

Global aid organizations and non-governmental organizations (NGOs) such as the International Telecommunication Union (ITU) and NetHope sprang into action. However, the lack of a reliable means of communications meant officials were unable to provide them with critical information such as road status and accessibility to the affected communities.

Gisli Olafsson, Emergency Response Director at NetHope, said, “When disasters strike, the damage to critical infrastructure could prevent relief workers from having reliable access to situation updates. That’s when satellite communications capabilities become very important, in helping key decision makers make quick field assessments and deliver aid to those who are most in need.”

In the thick of the emergency disaster response, Olafsson, who led the NetHope team deployed in the Philippines, explained that his organization’s immediate objective was to help restore communications infrastructure. NetHope



issued an appeal to collect the technologies needed to bring connectivity to the millions of people affected by the disaster. Working on the ground, the NetHope team also supported its 22 member organizations and other responding NGOs by ensuring that they are able to utilize the available technology capabilities to better coordinate relief efforts.

“We have member organizations operating in many different locations and a lot of coordination is required to cover all the affected areas, which cannot be accomplished without the proper communication platforms,” Olafsson added. “Our main role was to serve as a facilitator between our corporate partners who are donating the communications equipment, and the NGOs involved in delivering aid to the affected communities.”

As part of a longstanding emergency telecommunications agreement between Thuraya and the ITU, 50 Thuraya satellite phones, equipped with GPS to facilitate SAR, were also dispatched to support the Philippine government in the disaster response. In addition to the deployment of emergency communications equipment, ITU experts also worked with the local authorities to train first responders in the use of the satellite equipment during their operations and for logistical support. Thuraya donated 65 SIM cards, each preloaded with US\$300 worth of credit, within 20 hours of NetHope’s request.



Dr. Rodrigo H. Hao, the Chief of Medical Professional Services involved in providing medical relief during Typhoon Haiyan, highlighted the importance of communications in disaster preparedness. “The biggest challenge our team faced was the lack of communications during the relief efforts. If we had prior access to the equipment ITU delivered, it would have made a huge difference in enhancing the delivery of health services and disease surveillance,” he explained.

Dr. Zavazava added, “With the rapid deployment of satellite equipment, first responders gained access to timely information on the ground to help them collect data to support their emergency response activities. This enabled effective search and rescue operations and the evacuation of victims, as well as the coordination of humanitarian work such as the distribution of medicine, food, and water.”

Collaborating With Local Partners

Najwa Natalie Ayoub, Thuraya Market Development Manager for NGOs and Relief, concurred that the speed of satellite deployment is key to executing a successful disaster response.

“Delivering an immediate response is of critical importance, and Thuraya is committed to providing highly portable, reliable and easily deployable satellite equipment to support NGOs,” she said. “Thuraya is also able to allocate additional network resources to specific disaster areas, enabling expanded support through a congestion-free network to provide the communication platform needed for coordinating relief efforts.”

To facilitate the relief efforts, Thuraya reached out to its Philippine service partner Smart Communications (Smart) and initiated the provision of more than 100 Thuraya SF2500 units, Thuraya SatSleeve and Thuraya XT handsets to the Philippine government agencies and relief organizations.

Typhoon Haiyan At A Glance

- *Maximum category 5 Typhoon Haiyan (known locally as ‘Yolanda’) hit the Philippines on November 8. The most powerful storm ever recorded, wind speeds reached 270 km/h when the typhoon made landfall.*
- *Worst-hit area: Visayas Islands (Eastern Visayas, Central Visayas and Western Visayas)*
- *Affected people: 14.1 million (4.8 million under the poverty threshold)*
- *Displaced: 4.1 million people*
- *Missing: 1,785 people*
- *Fatalities: 6,190 and the number of confirmed casualties are rising as more areas become accessible.*
- *Damaged houses: 1.1 million (548,793 destroyed)*

Source: United Nations Office for the Coordination of Humanitarian Affairs

Dr. Cosmas Zavazava, the ITU’s Chief of Department, Project Support and Knowledge Management, said, “The ITU took immediate action by arranging and paying for the transportation of the equipment to the Philippines. They also made an initial airtime allocation of US\$60,000 for the Thuraya handsets, which was later increased based on demand.”

ITU supplied 50 Thuraya handsets to address the pressing need for satellite-enabled communications to coordinate health relief efforts. Speaking to ITU during the operations,



Tina Mariano, Head of Smart's Global Access Group who was involved in coordinating the effort on the ground in Tacloban, described how satellite handsets were delivered to support air control operations, after the Philippine authorities requested for assistance. She explained: "After the air traffic control towers at Tacloban's domestic airport were destroyed during the storms, the use of satellite phones enabled the local authorities to coordinate and give priority to military evacuation flights."

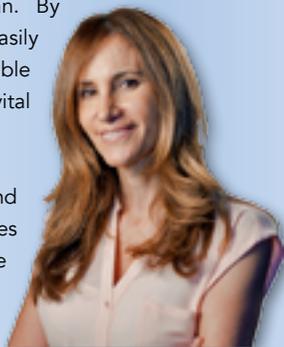
Thuraya and Smart also converted more than 70 Marino Phonepal (SF2500) units into mobile call centers, which were set up in more than 27 municipalities to enable survivors to contact their family members. The lack of power supply proved to be no obstacle, as the SF2500 units could be easily charged using 12-volt car batteries.

For many of the survivors in Tacloban, the public calling offices were their first opportunity to get in touch with their family and friends. Mariano recalled, "It was a highly emotional scene at the public calling offices, full of people crying and trying desperately to get in touch with their loved ones. Moments like these make you realize the true value of satellite communications."

Enhancing Disaster Preparedness Using Satellite

As can be determined via the above case study, Thuraya's robust satellite network performed a key role in providing relief workers with a reliable communication channel that kept them connected at all times during the relief operations for Typhoon Haiyan. By providing satellite equipment that can be easily deployed, Thuraya and its partners were able to help the Philippine authorities restore vital communication links in the affected areas.

"First responders require highly compact and portable equipment to address emergencies under demanding conditions," Najwa Natalie Ayoub, Thuraya Market Development Manager for NGOs and Relief, said.



Thuraya IP Voyager.

"Thuraya's broadband terminals are designed for mobility, and can be easily deployed for a range of video conferencing, email and other applications. Equally important, our handheld solution gave the relief workers high voice quality and hands-free calling capabilities. Thuraya handsets helped facilitate timely coordination and deployment of relief efforts during Typhoon Haiyan."

The versatility of satellite handsets and broadband terminals in a disaster zone is another important factor for rapid and effective deployment of emergency communications equipment. For instance, the Thuraya SatSleeve enabled NGO workers to make the most of the satellite network coverage using the familiar interface of their own smartphones.

Ayoub said, "We recognize that 'bring your own device' (BYOD) is becoming the norm today, and demonstrated our versatility by developing equipment that is highly portable, secure and streamlined. With the Thuraya SatSleeve, relief workers were using their iPhone or Android phones to respond even more quickly and efficiently in highly pressurized environments."

Thuraya aims to further raise the awareness of satellite as the critical infrastructure for relief operations and help government authorities around the world explore how satellite communications equipment can be integrated into disaster management plans.

"Satellite services should be included in the early planning for any disaster preparedness policy in order to facilitate rapid damage assessment and coordination between key emergency personnel. We aim to continue working with local municipalities and police departments to streamline first-responder protocol in times of a disaster, to enable government and aid agencies to communicate their needs more quickly," Ayoub concluded.

thuraya.com/



The Role Of Satellites In The Internet Of Things (IoT)

By David Logsdon, Senior Director of Public Advocacy, CompTIA, + David R. Beering, Principal/Owner, Intelligent Designs LLC

The ancient Egyptians could be considered the forebears of a trend that is now emerging on the technology horizon.

Tracking the movements of the sun, the Egyptians used sundials to measure the length of the sun's shadow to help to calculate the time of the day. This sensor communicated to Egyptian builders, farmers and tradesmen the length of each day, helping each one to then plan accordingly. These first world sensors helped to transform Egyptian civilization.

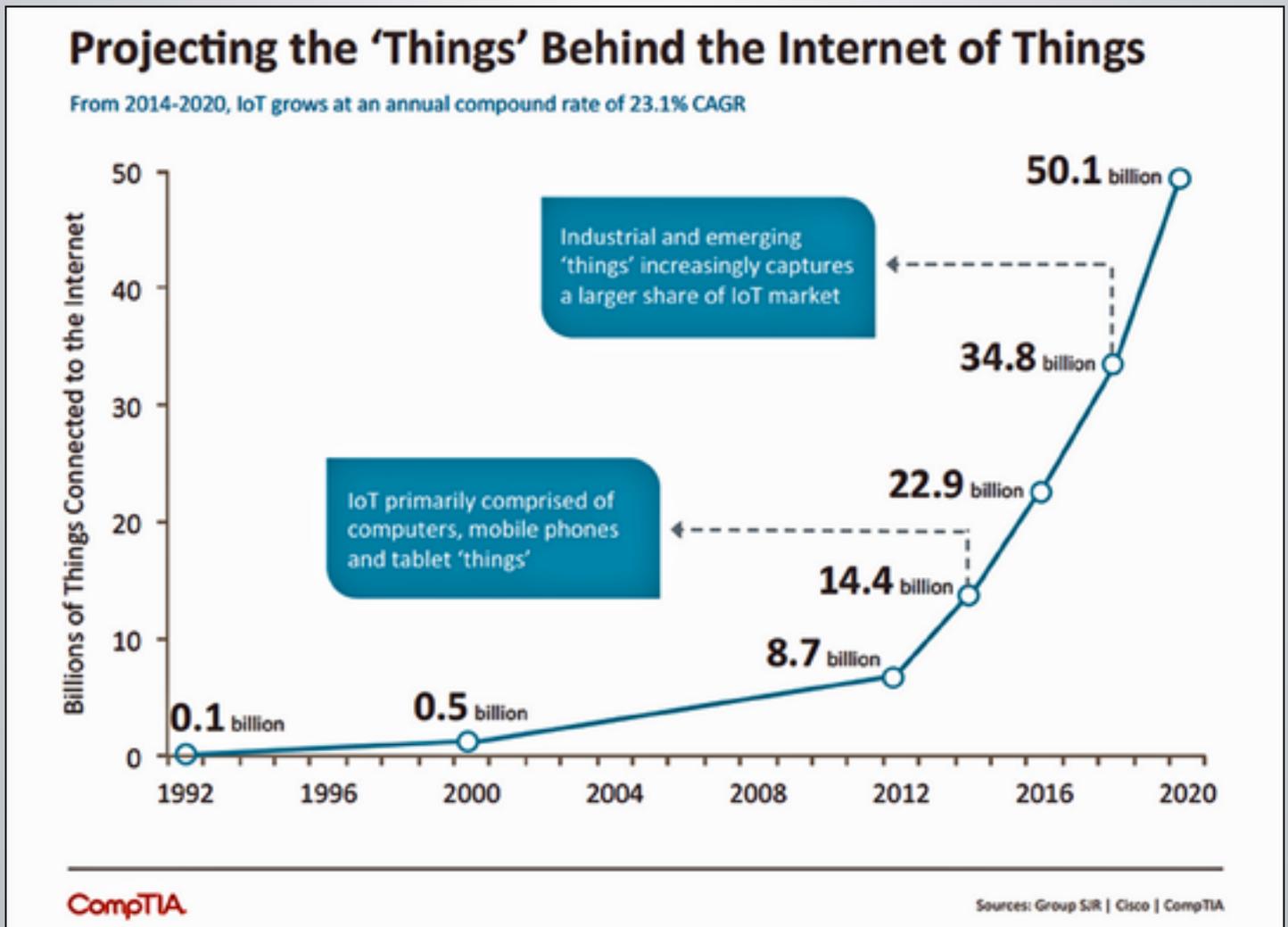
Once again, civilization looks to the skies for technological innovation. The Internet of Things (IoT) has become part of the nation's vernacular. According to CompTIA's *Sizing Up the Internet of Things* (IoT) report, the highly touted IoT (objects that are embedded with sensors which have the ability to communicate) will be composed of 50.1 billion connected devices by the year 2020 and \$1.9 trillion in global economic value-add.

The information being generated by IoT devices has the ability to connect everything to everything else. Not just communication between the different devices, but across industries. The future has arrived—but only with the help of satellites.

At the center of the IoT satellite universe is the Global Positioning System (GPS). GPS is the underlining satellite backbone to the IoT ecosystem. Offering Positioning, Navigation, and Timing services to industries, such as banking, transportation, agriculture, public safety and disaster relief as well as health inspired wearables, GPS is the conduit between different sensors. GPS enables these sensors to be more precise, allowing for real time feedback. GPS makes these sensors "smart."

In the not-so-distant past, satellite communications (SATCOM) systems were large, complex and costly. These systems were used primarily by government agencies and large corporations that had operations in remote places.

Satellites simply made it possible for these organizations to extend their reach. With the advent of direct-to-home (DTH) satellite television services, the model started to shift from being mainly enterprise-based to a technology that consumers could actually access at a reasonable price.



The huge uptake in DTH satellite services effectively commoditized Ku-band components (antennas, feeds, frequency converters, receivers), which opened an opportunity for the satellite services market to shift from broadcast television to IP data—just in time for IoT to explode onto the scene.

The role of satellites in IoT is expanding just as fast as the IoT phenomenon itself. More recently, this trend has been fueled by three primary developments:

- *The emergence of bandwidth efficient, affordable Time Division Multiple Access (TDMA) services over Fixed Satellite Systems (FSS), making it possible to buy FSS capacity by the megabyte, as opposed to full-time*
- *The evolution of satellite systems originally designed to carry primarily voice services to carry IP data using small, low power user terminals*
- *The availability of higher powered satellites with large antenna arrays and spot beams, making it possible to reduce the power and aperture required on the ground to achieve acceptable IP data rates across the satellite*

Each of these developments has enabled IoT in slightly different ways.

The first development area—the emergence of bandwidth-efficient TDMA services over FSS (Fixed Satellite Services)—is not necessarily new, as TDMA satellite services have been around for decades. However, the rapid adoption of new TDMA services based on advanced technologies that have been developed by iDirect, Hughes, Newtec, and others, has allowed FSS providers to offer IP-based satellite data services that allow customers to purchase capacity using various usage-based models, as opposed to purchasing spectrum on a full-time basis.

These systems typically operate at higher frequencies (i.e. C-, Ku-, Ka-band) and require antennas with larger apertures. These services operate primarily on geostationary satellites, due to the delicate nature of the timing required to keep all of the network elements synchronized.

With recent advances in efficient modulation and coding technologies (i.e., DVB-S2X), these TDMA networks are able to squeeze more usable bandwidth out of every megahertz of spectrum with every new release. These advances drive down the cost of the services to the consumers, and more importantly, increase profitability for the satellite operators.

The second development area is rapidly engaging customers with narrowband IP data requirements on a global basis. This area generally involves the repurposing of Mobile Satellite Systems (MSS) previously designed to carry voice traffic. These systems include INMARSAT, Iridium, Thuraya, and recent start-up Omnispace, which is developing assets originally fielded by ICO Global. All of these satellite systems are repurposing channelized satellite payloads that were originally designed to carry voice traffic, and have been re-engineered to carry IP data.

Another attractive characteristic of these MSS platforms is that they all operate in the L- or S-band. Most of the MSS platforms also use spot beams, which further enhance their ability to deliver high data rates using very small user terminals, many of which can be held in one's hand.

These platforms operate in three different orbits. INMARSAT and Thuraya operate in geostationary orbit, Omnispace operates in Medium Earth Orbit (MEO), and Iridium operates in Low Earth Orbit (LEO). Of these systems, only Iridium and Omnispace offer true global coverage, with Iridium offering modest data rates of up to about 20 Kbps, and Omnispace offering data rates up to 600 Kbps today. The emergence of low / medium speed IP data services over MSS platforms has made it possible to support telemetry and remote access to devices and locations that were previously unreachable by any means.

The final area of development that will fuel the explosion of IoT over satellite is the emergence of High Throughput Satellites (HTS). Nearly every major satellite operator has announced HTS systems.

These satellites will be primarily geostationary constellations that will use large, high powered spacecraft which will allocate power and spectrum in narrow footprints (spot beams). High frequency (mainly Ku- and Ka-band) geostationary satellite systems will be able to operate at an efficiency similar to their L-band counterparts in terms of the delivery of higher data rates for a given aperture size and power requirement.

As these systems will spread their allocation across multiple spot beams, frequency re-use will be relatively straightforward, effectively multiplying the capacity of these satellites. The result will be satellites that can support aggregate IP data throughputs measured in multiple gigabits per second, able to support tens of thousands of simultaneous users. Examples of these next generation HTS systems include Intelsat's EPIC™ and Telesat's Vantage™.

As federal and state governments move forward with IoT policies and regulations, decision makers must keep the satellite industry in mind. Congress has called for a national IoT strategy. State governments are certain to follow suit. Let us all make certain that the satellite industry has a well-deserved seat at this table.

Intelligent Designs LLC is a small business based in the Chicago, Illinois area. The firm specializes in design, systems integration, and implementation of high-performance communications systems that utilize satellites and line-of-sight communications components. Much of the firm's work involves IOT, with recent projects focusing on delivering IP data connectivity to airborne, shipboard, and land mobile users via satellite.

*Intelligent Designs is led by David R. Beering, a satellite professional who has held key roles in the development and implementation of more than 80 satellite communications projects. Follow him on **Twitter @drbeering**.*

David Logsdon is the senior director of public advocacy for CompTIA as well as the Executive Director of CompTIA's Space Enterprise Council. In this role, he runs the association's New and Emerging Technologies Committee (focused on the policy surrounding social, mobile, big data/data analytics, cloud, Internet of Things and smart cities).

*He was also the staff lead for CompTIA's federally focused technology convergence commission, which examined the impact on the public sector when social, mobile, analytics and cloud converge. Follow him on **Twitter @DJLSmartData**.*

SatBroadcasting™: Signals Solutions Supplied



By Rainer Lorger, Sales Director, DEV Systemtechnik

Ericsson Television Limited's main R&D facility is located in Southampton in the United Kingdom (UK).

There are various Ericsson R&D and engineering teams that require high quality L-band and DTTV signals for the test and development of Ericsson compression, reception and transmission products.

The Challenge

At the Southampton facility, an outside antenna farm provides live signals for testing. In house, those same signals will also be used for demonstration and testing purposes. This means that a very high signal quality in the lab environment is critical to the testing process.

The distance between the antenna farm and the R&D labs is more than 400 meters. Over a distance greater than 100 meters, coaxial cable is not recommended for use, due to high signal loss. RF over Fiber is a low loss, elegant and efficient alternative for signal delivery. The application also requires remote management for all of the equipment, including RF levels and LNB power.

Ericsson was seeking a modular concept to satisfy their needs, a fix that would offer excellent and reliable RF performance.

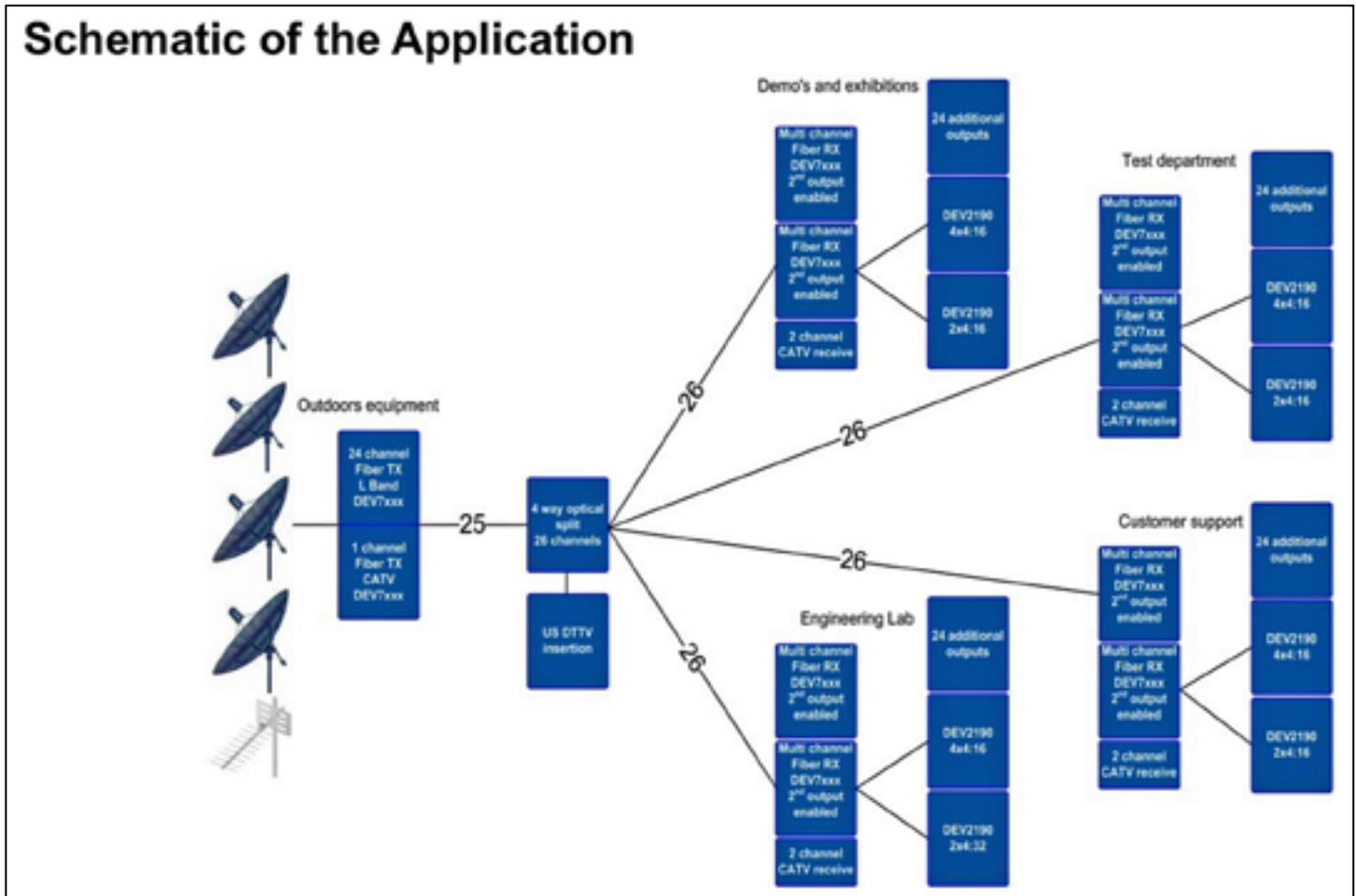
The DEV sales and project management team worked to design the best technical and commercial solution for Ericsson with that company's project manager. The solution was RF over Fiber technology that was based on DEV's OPTRIBUTION® product line.

DEV 7xxx range of equipment with TX and Rx cards for L-band and CATV-band signals was used for the RF over Fiber transport. DEV optical splitters were used to split the signals at the optical level to four different locations within the building. The DEV 2190 product range was used to amplify, split and manage the RF signals for the various departments.

Customer Benefits

Using a consulting approach, DEV's answer fully supported the customers' requirements, based on standard DEV equipment.

Using this equipment assured a uniform, easy-to manage solution, using proven RF over Fiber equipment for the highest signal quality and reliability. Ericsson benefited from:





DEV's Optribution Outdoor Chassis for RF over Fiber Transmission.

- One partner for project management of the entire RF signal handling chain
- Single competent partner in RF over Fiber and coax transmission
- Best RF performance
- Space and cost saving solution with the highest density on the market.
- Enhanced system reliability via 1+1 Redundancy or N+1 Redundancy
- Permanent signal monitoring and recording
- Intuitive and complete operation with DEV Web Interface
- Complete SNMP-MIB for seamless integration into all common M&C Systems
- Modules are hot-swappable and can be integrated in all OPTRIBUTION® Chassis for maximum reliability and availability
- Broad choice of optical connectors (SC/APC, FC/APC or E2000 HRL)
- LNB bias powering with all TX modules
- Flexible configurations within one chassis
- Single reliable source for post-sales support.
- Reliable long term partnership



DEV's 7113 Intelligent Optribution Chassis for RF over Fiber Transmission

The Testimonials

John Fowler, the Engineering Infrastructure Manager at Ericsson Television Limited in the Solution Area—Media said, "Upgrading Ericsson Television Ltd satellite and terrestrial signal distribution network from copper to fiber using DEV Optribution equipment has seen considerable improvements, both in reliability and signal quality.

"The fiber infrastructure is unaffected by electromagnetic interference or cable length. As a result the fiber was routed in the most convenient way around the building, rather than previously worrying about cable lengths and avoiding sources of interference.

"The resulting improvement from the fiber distribution as measured in our laboratories shows an improvement of carrier to noise margin by 8-10dB. To date the system has been 100 percent reliable. The ability to remotely monitor and log signal levels from our dishes is an enormous benefit.

"As a result of the fiber distribution, weak signals from satellites where we are on the footprint fringes can now be received confidently and reliably. This is important for our core business in our development labs, and especially for our customer support team who need to monitor and analyze errors from customer transmissions in many European countries."

The customer now benefits from a solid and highly reliable system for the distribution of L-band and DTTV signals throughout all of the facility's departments.

dev-systemtechnik.com/

Rainer Lorger is the Sales Director at DEV Systemtechnik and he has more than 30 years of expert knowledge and experience in sales management. Together with his team, Lorger has worked to establish DEV as a leading, global supplier of RF solutions, from transmission to antenna to receiver product

A New View Of Wildlife

By Matt Boker, Freelance Author, courtesy of Cisco's "The Network"

Millie, a sea turtle paddling around the Caribbean Sea, sports one atop her shell. Several newly freed scarlet macaws wear similar devices as they flutter through a Guatemalan rainforest. A fledgling program in South Africa is taking satellite tracking of rhinos a step further by adding a horn-mounted camera to reduce poaching.

Originally developed for the military and released for public use in the 1980s, global positioning technology has moved far beyond automotive consoles, where it's become standard equipment to help drivers find their way.

"Satellite tracking allows us access to an avalanche of novel data for some of the most interesting species on the planet," said Robin Naidoo, Ph.D., lead wildlife scientist at the World Wildlife Fund (U.S.— worldwildlife.org/). "With this technology we can uncover new and exciting animal movement patterns, and sharpen our understanding of wildlife habitat needs.

"For example, via satellite collars we now know zebras in Namibia and Botswana have the longest terrestrial mammal migration in all of Africa (over 300 miles round trip). Information like this provides critical justification for large-scale, cross-boundary conservation areas that allow wildlife to roam freely."

Founded in 1959 to protect endangered sea turtles, the Sea Turtle Conservancy (conserveturtles.org/stctmp.php) has attached transmitters to 130 turtles throughout the Caribbean and Central America since 2000.

Among the latest is an adult hawksbill named Millie, who received a platform terminal transmitter in July after nesting on a beach in Nevis, a 36-square-mile island paradise.



When Millie surfaces to breathe, the transmitter signals her data to a NOAA satellite, which sends the information to an Argos receiving station on Earth for access by conservancy staff in their Gainesville, Florida, headquarters. The data includes the turtle's location, number of dives during the last day and length of the most recent dive.

"Through satellite tracking we hope to learn about sea turtle migratory behavior, and identify migration corridors and foraging areas," said Dan Evans, the conservancy's technology and research specialist.



"Satellite tracking information can also be invaluable from a conservation perspective, as it allows researchers to assess threats to sea turtles that they would face while migrating or at their foraging sites," Evans said.

The duration of tracking depends on battery life and how long the devices remain on the turtle, though it usually continues for about a year. After about two years, the transmitters fall off the turtles.

The conservancy's long-distance champ was a leatherback who traveled 10,293 miles in 603 days of tracking. As for Millie, she logged nearly 800 miles in her first four months of monitoring. The conservancy posts Millie's coordinates and those of 20 other turtles on its website as part of its education-oriented Turtle Tracker program.

Following Endangered Macaws In Guatemala

Raised in captivity as the offspring of rescued parrots, nine scarlet macaws soared out of their cages and into the Maya Biosphere Reserve of northern Guatemala on October 1, 2015. To monitor their movements, five of the birds had been outfitted with GPS transmitters, which were attached with collars designed to rust off within five years.



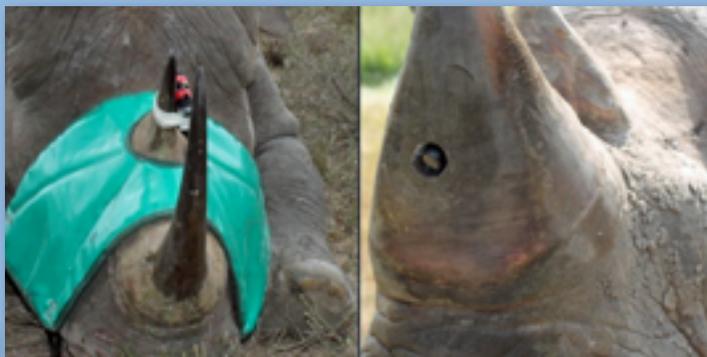
"For the time being, the aim of satellite tracking is to determine the success rate of the released birds," said Colum Muccio, administrative director of the Wildlife Rescue and Conservation Association in Guatemala. "In most releases—in Costa Rica, Peru—a pretty high percentage of the released birds don't make it. They either fly back to the nearest house and ask for food and are recaptured, or they don't know how to avoid predators.

"We want to know how many of the birds survive so we can adjust our release strategy. In the future, this information will also give us information about migration patterns, nesting sites and foraging sites," Muccio said.

Early tracking results showed the macaws were generally hanging around their release site, although one ventured 2.25 miles across the nearby Mexican border and back.

Rhino Horn-Cams In South Africa

In Africa, poachers kill a rhinoceros every six hours, according to Humane Society International, which hopes to reduce the slaughter through a new combination of GPS tracking, a heart-rate monitor and a tiny camera imbedded in a rhino's horn.



A British team developed the system, called Protect RAPID (real-time anti-poaching intelligence device); field trials expected to start in 2016 in South Africa.

"The RAPID technology provides anti-poaching forces with the ability to identify precisely where poaching activity might be about to take place, and therefore gives them a vital window of opportunity to save rhinos," said Claire Bass, executive director for Humane Society International (U.K.), one of the project's funders.

The rhino wears the transmitter in a collar; the heart-rate monitor is subcutaneous. An abnormal heart rate triggers an alarm at the control center, where staffers would switch on the camera embedded in the animal's horn to see if it's harmless activity or poaching.

"If it's poaching, the GPS allows them to pinpoint the rhino's exact location instead of wasting hours searching, and rangers can be deployed via helicopter or truck within minutes," Bass explained.

"Right now, rangers often find dead rhinos days after they've been killed and the poachers are long gone," she added. "This device sends a clear message to poachers that we have the technology to catch them 'red handed' like never before, and that in itself can act as a significant deterrent to poaching in the first place."

Editor's note

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Satellite Thermal Vacuum Testing: A Qualified Sensor

By Sook-Hua Wong, Product Planner Keysight Technologies, Inc.

Equipment used in space applications needs to go through stringent environmental tests in order to prove that survivability within the extreme conditions experienced during launch or while in space. Some of the key environmental tests include vibration, thermal vacuum and electromagnetic compatibility.

- Vibration test is important to ensure that the equipment is able to sustain high impact during the rocket launch and planetary landing
- Thermal vacuum test is crucial to confirm the equipment is able to operate under space vacuum condition
- Electromagnetic compatibility test is required due to densely packed electronic systems operating in various frequencies. RF signals radiated from high power equipment (transmitters) can affect the performance of low power equipment (receivers)

This article focuses on the thermal vacuum (TVAC) test, which is typically the final as well as the most complex and expensive test to be conducted. Detailed planning is typically required six to 18 months in advance in order to ensure the success of the test.

TVAC testing helps to uncover possible problems, such as outgassing of equipment that could contaminate the environment, design flaws due to short circuits or overheating of materials, and corona (metal vapor arcing) effect. In this article, the existing power measurement test setup for TVAC test and a new method with a TVAC qualified LAN power sensor will be compared. The new proposed method provides a simplified test setup and more accurate, reliable power measurements for TVAC testing of satellite equipment.

Typical TVAC Test Setup

Figure 1 below shows the typical test setup for a TVAC test. The whole satellite or satellite components/modules are placed inside a TVAC

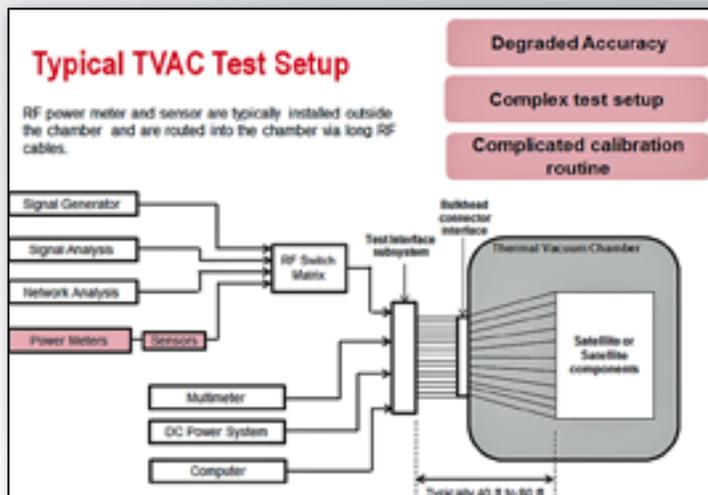


Figure 1. Typical TVAC test setup with all the measurement equipment located outside of the chamber and connected to the satellite or components via switch matrices or test interface subsystem.



chamber. All electrical connections to the system under test must include hermetically-sealed connector feedthroughs in order to maintain the vacuum. In general, all the measurement equipment, including power meter and sensors, are located outside of the chamber and are connected to the satellite or components using the sealed feedthroughs via switch matrices or a test interface subsystem.

Long RF cable runs are often needed to connect the power sensor to the satellite inside the chamber. This results in degradation in accuracy due to poor SWR and insertion loss from the long RF cable. Complex calibrations are required to calibrate the path loss as the RF cable performance changes with temperature.

New TVAC Test Setup

With a TVAC qualified power sensor, the sensor can now be connected directly to the satellite inside the TVAC chamber (see Figure 2 below). The benefits include:

- Simplifying the test setup and complex calibration routine. You can now connect the sensor directly to the output of the device-under-test, removing the need to go through a long RF cable that requires complex calibrations in order to calibrate out the performance changes of the RF cable due to temperature effects. The power sensor will provide accurate output power measurements immediately without path loss calibration
- More reliable and accurate power measurements. Eliminating the long RF cable removes power measurement uncertainties due to insertion loss, poor SWR performance and temperature effects of the cable. The power sensor is fully calibrated and offers warranted accuracy specifications over a wide temperature range of 0 to +55°C. The sensor's internal zero and calibration function

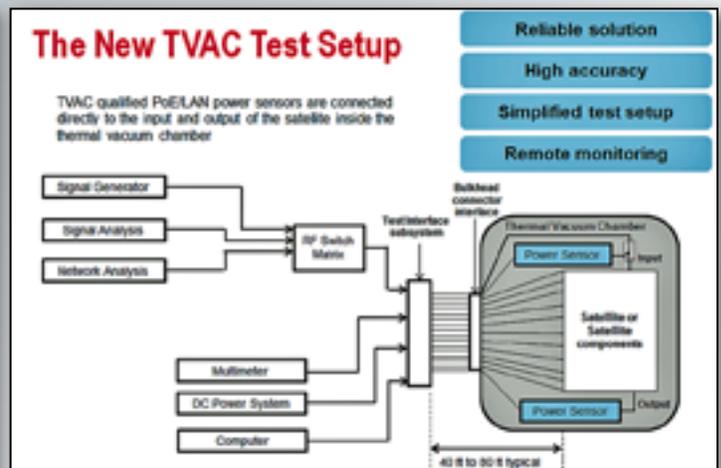


Figure 2: New TVAC test setup with sensors connected directly to the input or output of the satellite for improved accuracy and a simplified test setup.

also allows users to perform zeroing and calibration on-the-fly to improve overall measurement accuracy

- Remote monitoring. By connecting the LAN power sensor to a shared network via network switch or Power-over-Ethernet (PoE) hub, the power sensor can be controlled remotely from any part of the world.

The benefits of using the TVAC power sensor compared to a traditional bench power meter and sensor solution are shown at the top of the next column..

Design + Qualification Process Of TVAC Power Sensor

Several steps are required to develop a TVAC power sensor.

1. Selection of low level materials

TVAC power sensors are built with low level materials with minimum outgassing properties. All the materials used should be matched against the NASA/ESA outgassing database and items not listed in the database should be subjected to a screening test in accordance with ECSS-Q-ST-70 02C (Thermal vacuum outgassing test for the screening of space materials by European Cooperation For Space Standardization) to ensure any outgassing is within prescribed limits.

2. TVAC qualification test

After the entire sensor has been developed with materials that meet the low outgassing criteria, the full sensor assembly needs to go through a TVAC qualification test whereby the sensor is subjected to operation tests ranging from -10 to +60 °C and non-operating storage tests from -40 to +100 °C inside a thermal vacuum chamber. Power measurement readings in a low pressure environment inside the TVAC chamber will be compared to measurement readings at atmospheric conditions to ensure that there are minimum variations in accuracy between these different environments.

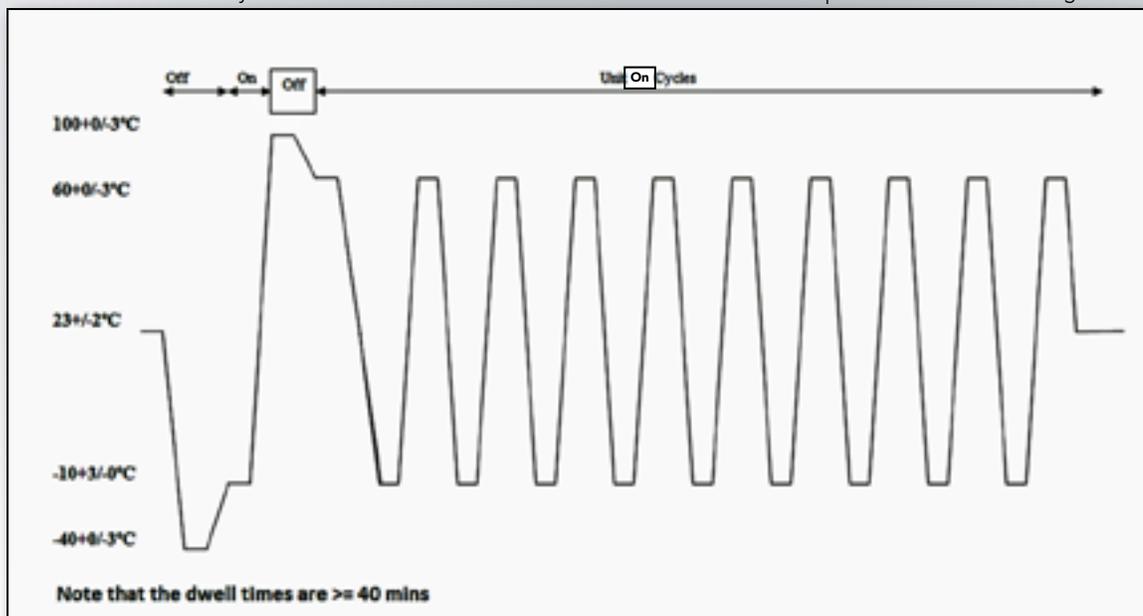


Figure 3. Keysight TVAC qualification test profile for U2049XA, Option TVA. The test was carried out over duration of 10 days with eight hours per temperature cycle. Performance tests were carried out throughout the different hot and cold temperatures to ensure that the sensor is able to measure accurately over a wide range of temperatures under vacuum environment, and that repeated temperature cycling does not degrade performance.

Item	Power Meter + Power Sensor	TVAC Power Sensor
Sensor's location	Outside chamber, 60 feet away from payload	Inside chamber, directly connected to payload input / output or through some adapters ✓
Losses due to cable (base on a typical TVAC cable)	34 dB at 18 GHz	Minimal losses ✓
Input power to sensor	-10 to -40 dBm	+24 to -6 dBm ✓
Mismatch uncertainty	2.56 percent (between sensor and long cable, cable SWR 1.25)	1.30 percent (between sensor and source, source SWR 1.12) ✓
Measurement uncertainty at 18 GHz	4.59 percent (E4413A-H33 at -26 dBm) 3.72 percent (8485D-033 at -25 dBm)	4.59 percent (U2049XA at +9 dBm) ✓
Measurement speed	400 readings per second (E4413A-H33) 20 readings per second (8485D-033)	50,000 readings per second ✓
Total dynamic range and supported signal types	90 dB - CW only signal (E4413A-H33) 50 db - CW / modulated signal (8485D-033)	90 db - CW / modulated signal ✓

3. TVAC bake out

Finally, as part of standard production test processes, every TVAC power sensor will be subjected to thermal vacuum bake out in a TVAC chamber at high temperatures for several hours. The purpose is to remove all possible outgassing particles. At the end of the bake out process, the sensor will be immediately packed into a vacuum sealed bag to minimize reabsorption of moisture. With this process, users can be assured that the sensors they receive are contaminants-free and will not contaminate the TVAC chamber during TVAC tests.

A LAN power sensor with a TVAC option is ideal for long distance remote monitoring of satellite or components inside a TVAC chamber. The sensor helps to improve power measurement accuracy and simplify the test setup and calibration process. The new proposed method is able to provide a simplified test setup and more accurate, reliable power measurements for TVAC testing of satellite equipment.

With its patented internal zeroing and calibration capability, wide 90

dB dynamic range and frequency range of 10 MHz to 33 GHz, the Keysight U2049XA wide dynamic range LAN power sensor is ideal for satellite applications. The thermal vacuum option (U2049XA-TVA) is ideal for usage inside a thermal vacuum chamber.

For more information, please refer to the application note at [keysight.com/find/rfpowertips](https://www.keysight.com/find/rfpowertips)

We Don't Talk Hot Air

Surface Heating Systems Ltd (SHS) manufactures a range of antenna heating products to prevent the build-up of snow and ice on antennas ranging from 0.3 meter microwave antennas to (at present) 18 meter Earth Station antennas in C-, Ku- and Ka-band frequencies.

The company has successfully supplied and installed systems across the globe, enabling operators to function in the most arduous of weather conditions in countries such as...

- *United States*
- *Canada*
- *Argentina*
- *Antarctica*
- *Europe*
- *Scandinavia*
- *Russia*
- *Turkey*
- *Afghanistan*
- *Japan*
- *China*

- *Korea*
- *Australia*
- *New Zealand*
- *Plus more...*

The company was founded in 1997 by Mick Cummings, who, having served 14 years in the Royal Navy Submarine Service as an electro-mechanical engineer, adapted the skills he attained to develop a range of electric heating products for industrial and domestic applications. From beginnings in a single room office, the company has steadily grown over the years and now operates out of a 10,000 square foot manufacturing facility and employs a number of skilled and semi-skilled personnel.

Antenna Heating—Some Basic Terminology

De-Ice is the application of energy to remove existing/accumulated snow and ice that exists on an antenna. The energy required, in most instances, can be up to and more than 800w/m².

Anti-Ice is the application of energy to prevent the build-up/accumulation of snow and ice on an antenna. The energy required can range from 250 to 400w/m².



Earth station antennas – Replacement of costly Hot Air systems.



18m & 16m & Hot Air De-ice System Replacement – Norway.



3.3m RSI Anti-Ice System – Control Panel.

With the use of modern heating elements, insulation and controls, SHS prefers to manufacture Anti-Ice systems as the energy savings, when compared with a standard hot air De-Ice system, could be as much as 50 percent.

Systems

Hot air De-ice systems are by their nature quite powerful. The energy required to heat the enclosed plenum can be phenomenal. When this is coupled with the additional weight on bearings/jacks and maintenance of all of the moving parts, such makes hot air systems rather expensive to operate and maintain.

SHS has replaced a number of hot air systems, thereby reducing the customer's overall operating costs and releasing generator capacity. This enabled customer to install additional new antennas complete with company standard anti-ice systems, as well. The payback, depending on the size of the antenna, for such systems can be as little as three years.

Antenna Distortion

Contrary to statements issued by others, the heating of the antenna surface does not distort or de-focus the antenna. SHS Anti-Ice systems have been thoroughly tested on Ka-band antennas by an independent test authority at Munich University. Test results and findings are available on request.

Control

Proper control of the system is vital. SHS uses the most modern control systems, with minimal moving parts, to ensure systems operate only when they are required to. This produces considerable savings for the end customer in running the unit as well as with maintenance costs.

The system can be operated to enable various combinations of heating, such as 1/2 or 1/3, 2/3 and full heating, and that includes the firm's web based I/O unit which can allow control and monitoring via a device such as a smart phone, tablet or laptop.



3.7m Anti-Ice Systems – Long Island, USA.

3.7m Anti-Ice System – Madley, UK.



1.8m Vertex KA Band Anti-Ice System – Munich. 3.7m ASC Anti-Ice systems – UK.

Resin + Composite Antenna Anti-Ice Systems

SHS also manufactures a range of self-adhesive heater systems for antennas. These are manufactured from injected resin and composite materials and are built in various shapes to suit the space between the rear of the strengthening ribs at the rear of the antenna and range in power loading from 250 – 400w/m², depending on the make of antenna. These can be made in full or 1/2 heating and, again, SHS uses the latest self-adhesive technology, making on-site installation fast and economical.

GRP Heater Systems

For smaller antennas, from 0.3 meter Microwave antennas to 2.4 meter resin antennas, SHS manufacture a range of heated GRP shells which simply attach to the rear of the reflector. These are suitable for most frequencies, including Ka-band. The units are comprised of a molded GRP shell with

Anti-Ice, Insulated Electric Panels

At SHS, with nearly 20 years of experience, the manufacture of Anti-Ice, self-adhesive, heater panels has been perfected. This is a lightweight, flexible, foil based insulated sheet with the heating elements applied in the workshop at precise spacing to ensure the correct w/m² output. These can be manufactured to suit most antennas in a range of different voltages, such as 440v, 230v, 110v and 48v.

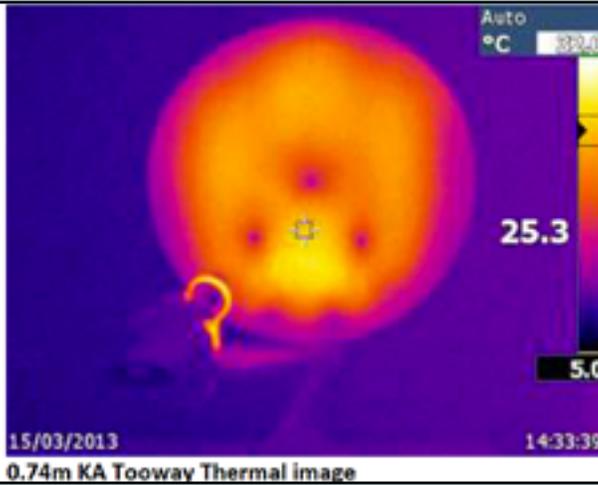
Installation is simple and quick. Simply clean and dry the antenna, peel off the self-adhesive liner and apply to the antenna, then connect the tails to the controller and sensor.



Microwave Antenna Anti-Ice Systems.



0.74m KA Tooway Anti-Ice System



0.74m KA Tooway Thermal image

The SHS system is a patented design and is comprised of a semi-rigid, molded, plastic front cover with integral heating elements and temperature control. Installation is quick by simply locating the cover over the front of the antenna and securing the cover in place with the provided screws or clips and then plugging the unit into the power supply. There is no need to remove the antenna from the mount or re-align.

As the temperature falls, the heating activates and cycles between 5 to 7 degrees C, ensuring the front of the antenna remains ice and snow free without excessive running costs. Above that

integral heating elements, insulation and controls. Installation is quick and simple via self-adhesive or self-drilling screws and sealant.

temperature, the system will turn off.

The company is continually up-dating and designing new systems for antennas which arrive in the market.

No matter the size of the antenna, a look at SHS for an honest opinion on how your snow/ice problems can be economically rectified is certainly worth your time.

For example, Global Antenna Services recently had the opportunity to work with Surface Heating systems personal on a 9 meter project in Vernon, New Jersey.

“Having had the opportunity to work on several other types of Anti-Icing and De-icing systems over the years, we found the SHS system to be easy to install, the workmanship was impeccable and testing was easy and fool proof,” said Bob Cato, the company’s owner. “If you are looking for an Anti-Icing system, I would suggest you look at the entire project, the cost of the system, the cost of labor for the installation, the amount of energy needed to keep the system running and finally how well the SHS will keep your antennas clear of ice and snow build-up.”

shs-ltd.com/



2.4m Skyware Global Anti-Ice System-Norway



1.8m Skyware Global Anti-Ice System-Germany

Microwave Antenna Anti-Ice Systems

At SHS, our feeling is that everyone should be able to enjoy trouble free communication & TV viewing, even when snowing. Instead of putting up with snow on an antenna or sweeping the white stuff away with a long broom, an economic solution has been developed by SHS for small business and domestic antennas.



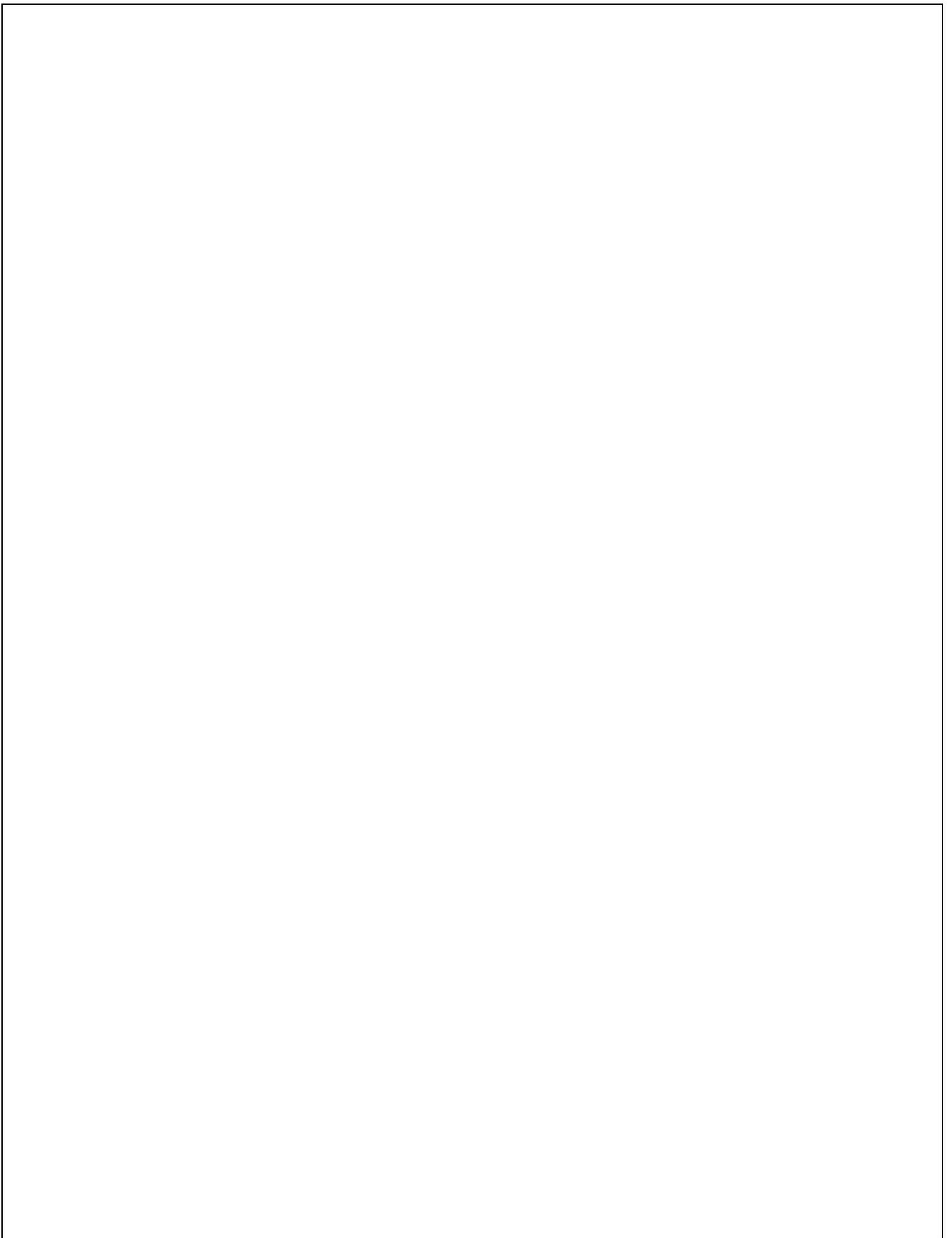
Snow on un-covered antenna



Heated cover



Heated cover



SatBroadcasting™: How Satellite Operators Can Become Significant Players In OTT, IPTV + Streaming

Richard Frankland, Regional Vice President of Sales, Americas, Irdeto



Consumer habits continue to change as the explosion of more available screens and devices continue to pour onto the market, all available for viewing content.

Understanding who is using what device, how they are consuming content, and what their top concerns are is key to providing customers with a satisfying experience. According to a recent, global study commissioned by Irdeto of more than 5,000 adults, smartphones and laptops were the most commonly used devices used for viewing on demand content at home.

In the US, PCs or laptops are the devices people are most likely to purchase over the next five years (35 percent), followed by smartphones (33 percent), tablets (24 percent), smart TVs (19 percent) and gaming consoles (16 percent).

How can satellite operators take advantage of the changing habits of consumers? Consumers are increasingly eager for that multi-screen experience, and this means that satellite operators must consider how they will anticipate the technology upgrades that are required to support multi-screen viewing as well as how to implement customer retention strategies to offer compelling content to their customers.

There is much to be learned from OTT providers, such as Netflix and Amazon, who know how to satisfy a demanding consumer base and successfully align their strategy with the numerous devices on the market. However, payTV operators are in a unique position to take advantage of the existing infrastructure, content agreements and knowledge of their subscriber base, to develop new technologies and personalized viewing experiences on multiple devices, solidifying their relationships with their consumer-base.

Leveraging Existing Infrastructure

By taking advantage of existing infrastructure, satellite providers are able to leverage their Push-Video on Demand (VoD) capacity to subscriber personal video recorders (PVR) to deploy a Home Networking solution, such as in-home streaming of content on multiple devices and

download-and-go offers. This allows satellite providers to use their existing bandwidth to deliver high-resolution, premium content (HD, 4K and UHD) without requiring expensive investment in OTT distribution and support for mobile broadband connectivity—this is a great differentiator versus other OTT service providers.

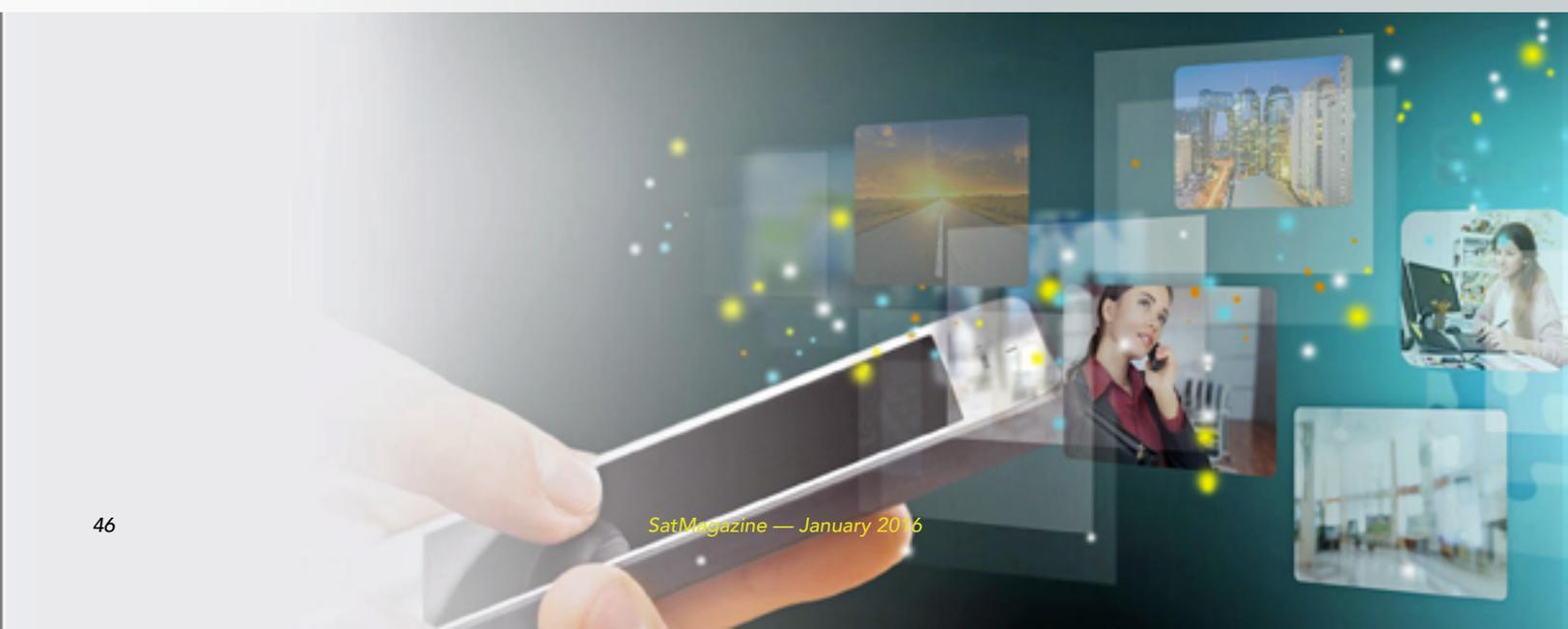
Operators can also take advantage of existing content distribution rights for viewing content within the home, although download-and-go options may require additional permissions with content rights holders. With the investment in content rights and PVR storage typically already available with satellite gateways, this type of content sharing to personal devices is a highly cost-effective solution for satellite operators who seek to offer new services to their subscribers.

Additionally, the new 4K codec allows satellite operators to immediately benefit from bandwidth savings. New compression technologies driven by 4K adoption will allow operators to deliver 4K content more efficiently as well as also achieve significant bandwidth savings for HD and SD content, which continues to comprise the majority of the operators' service offering today.

While rolling out 4K/UHD capabilities, operators will also need to keep in mind that their security will require updates to meet the conditions imposed by MovieLabs for early release 4K/UHD content. The flexibility of their security infrastructure is crucial to support both legacy and 4k/UHD devices. While many consumers have broadband-ready devices, the issues they may face will most certainly relate to insufficient bandwidth on mobile devices to consistently view high quality videos, especially 4K UHD content.

Growing Their OTT Footprint

Satellite operators are able to implement a number of activities to grow their OTT footprint. Beyond the relatively simple Home Networking extension, operators can also leverage the IP connection from the home gateway to offer additional on-demand options that are not possible through push-VOD, such as search functionality on full library and pay-per-view as well as "classic" triple play bundles that include telephony and broadband.



A great example of this capability is the AT&T—DirecTV bundled packages. When combined with a mobile broadband connection, these offer a vastly expanded range of options for streaming content within and beyond the home.

In many markets, there are several advantages to bundling an OTT service with the “main” satellite subscription, such as:

- *High-value OTT “add-ons” generates significant subscriber satisfaction and lowers churn*
- *Fends off competition from OTT players such as Netflix*
- *Allows the tailoring of OTT services in line with different satellite subscription offers and maintain a branded “look and feel” across both main TV and consumer devices*

Keep in mind that customer preference for different types of content, such as live content, and the device on which they view this content, may call for an offering that diverges from a primary offering. An example is Dish, which offers both a subscription satellite service and an OTT platform for pre-paid content through SlingTV. Dish understands that customers value the ability to view live news and sports programming and want to watch TV on smartphones, tablets, computers and game consoles in addition to TV sets.

In the case of DirecTV’s Yaveo, an OTT offering for the Hispanic community, the broadband offering of on-demand and live-streaming Spanish language programming was targeted at potential consumers who do not have a satellite connection.

Join In Developing Premium + Personalized Content

A variety of “theme-packaged” content offers, with flexibility to meet different consumer demands, is key as consumers move away from monolithic “one package fits all” services to more tailored offerings that suite their specific tastes.

In the field of sports particularly, “companion apps” that provide additional OTT content for fans who watch sports on their main screen are hugely popular for instant replay or background information about players or leagues. Certain satellite players are even leveraging the content rights they have already negotiated to offer on-demand services through dedicated OTT boxes, targeting households that do not subscribe to their main satellite service with sport, movie or premium content packages.

Both major satellite operators in the US have done the same, with DirecTV launching a similar OTT offer (without the STB), called Yaveo last December, with a content line-up tailored to the Hispanic community in the US, and Dish following suite in January with their Sling TV package at \$20.

Learning from OTT providers when combined with leveraging existing infrastructure will enable satellite providers to solidify their relationships with their customers and to reach out to new viewer populations. Consumers viewing habits are constantly evolving with access to a wide variety of platforms—satellite providers have a unique ability to provide a number of different solutions leveraging the content and infrastructure investments they’ve already made.

irdeto.com/

Editor’s note:

There is an informative eBook available from Irdeto entitled “From Broadcast To OTT — How To Deal With The Most Common Pitfalls” available at this direct URL — forms.irdeto.com/ebook-top-3-potential-pitfalls-from-broadcast-to-OTT?src=irdetowebiste



With nearly 20 years of experience in the payTV space, Richard specializes in strategies and technology that shape the evolution of broadband and broadcast entertainment models. Richard started his payTV career at BSkyB in the mid 1990’s, working at the UK’s first interactive television venture, Open Interactive.

In 2001, he relocated to Sydney, Australia, to work for OpenTV in expanding its Asia Pacific customer base as Senior Director of Business Development. Following five successful years during which the Asia Pacific business increased significantly, Richard relocated to Denver, Colorado, in 2006 to take up the role of VP of Americas Sales.

In 2009, he joined Irdeto as VP of North American Sales for Conditional Access and, in 2012, his role was expanded to regional VP, which incorporates all solutions sales for the entire Americas region. Richard is originally from New Zealand and has a finance and management degree from Auckland’s University of Technology.

To The Benefit Of Belarus – BELINTERSAT-1

The Belintersat project is being carefully planned—this mission will enrich the history of Belarus through the launch of the first telecommunication satellite for the country—BELINTERSAT-1.

This event is planned for launch on January 16, 2016, at the Sichan spaceport, in the People's Republic of China. The project's technical specialists are working diligently to ensure the satellite will be launched on the appointed date. To that end, the Ground Control Station (CGS) team participated in eight months of training in China to learn from colleagues the various technical underpinnings required for launch and satellite control operations.

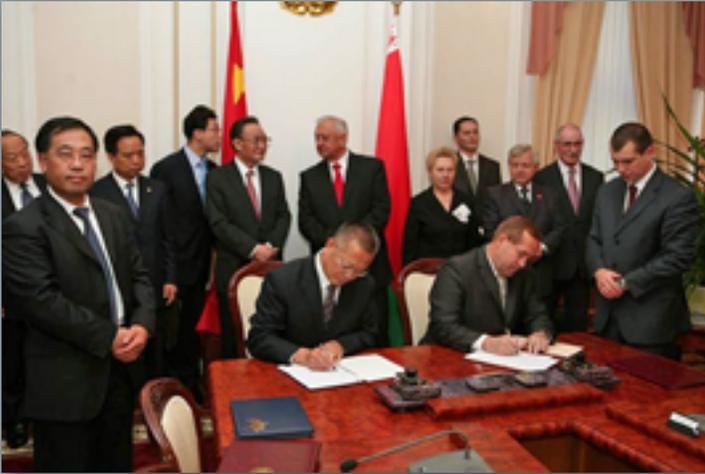
The project was initiated in 2012 when the national satellite communication system for the Republic of Belarus was activated. A closed competition for the manufacture of the satellite followed, with the winner being the Chinese industrial corporation, Great Wall.

This is the largest investment project ever undertaken within the field of telecommunications for the Republic of Belarus. Other previous projects in the country have not been of such innovative, economic or social importance. The project's goals include collaboration with commercial and state customers from the Republic of Belarus, as well as with overseas countries.

The ground infrastructure has passed all crucial control tests and now includes the GCS itself and a teleport. In turn, the team for this project is now fully trained and prepared to carry out the planned orbital tests, all of which will lead to the satellite entering commercial operation.

The ground infrastructure serves to control the satellite from Earth. GCS was successfully placed into operation in November, 2015, and the plan is to establish a teleport by March of 2016.

*The BELINTERSAT-1
Ground Control Segment Antenna.*



The signing of the contract for the creation of the national satellite communication system of the Republic of Belarus.

With the satellite being launched, the Republic of Belarus is making the nation's first, serious, breakthrough into space. However, plans for further satellite development are even more ambitious. An orbital position for the next communication satellite is currently being studied and the next satellite is planned for construction using the technologies that are leading the design work within the world satellite services market.

BELINTERSAT-1 will be launched into the 51.5 degrees East orbital slot and will provide a full range of modern satellite services across Europe, Africa and Asia, and will also provide global coverage in Eastern hemisphere. The satellite will pack 38 transponders, 34 at 36 MHz, and 4 at 54 MHz bandwidths.

A wide range of telecommunication services will be offered that will include television content delivery, a broad range of broadcasting services as well as broadband Internet access. The satellite will operate in the Ku- and C-bands, with full commercial exploitation of BELINTERSAT-1 to be conducted over the spacecraft's 15 year lifetime expectancy.

The satellite is based on the proven DFH-4 platform, with 100 percent of the components having passed all necessary qualifications, especially in regard to flight dynamics. The supplier of the payload (transponders) is the French-Italian company "Thales Alenia Space," recognized throughout the industry as a global leader in the field of development and construction of spacecraft.

For the commercial and government institutions in the territory of the Republic of Belarus, the Belintersat project will be providing a number of widely demanded services that will include...

- *Satellite Internet*
- *Mobile satellite communication*
- *Solutions for mobile operators*
- *Corporate networks provisioning*
- *Live TV broadcasting*

Payload data for BELINTERSAT-1.

	Beams	Typ quantity	Typ bandwidth, MHz	Polarization
C	African	up to 16	36	circular
	Global	up to 6		
	Eastern	up to 12		
Ku	African	12*	36	linear
	European	2		
		4		

* "Cross-strapped" option (uplink in Europe—downlink in Africa only)—4 transponders.

The most significant offering of these services for the market is the total coverage of the nation, which creates an ideal service for the citizens of the republic, the state government's institutions as well as a broad range of commercial organizations.

The BELINTERSAT-1's project teams cooperatively carry out active coordination with potential consumers whose focus is on satellite capacity. Special attention is being paid directly to foreign partners and customers, as the scope of the project is also focused on the export of communications services.

Specialists regularly attend exhibitions and forums in Belarus and abroad to expand business relationships and to increase their professional experience.

As the Republic of Belarus takes its first steps in mastering the commercial benefits of space, we can learn from the long-term experiences of our foreign partners on how to maintain the focus of the project's purposes and tasks.

Entering the world satellite market, the Belintersat project enlists many of the nation's best attributes to become a recognized SATCOM player within the international community, as well as to improve prospective partnerships with leading players in the various communications market segments.

Belintersat wishes to express sincere thanks to the project's closest partners from the People's Republic of China, Russia, Kazakhstan, Azerbaijan and Israel. The successful start of this project is, in many respects, a result of our colleagues crucial participation—their expertise and support have expanded Belintersat opportunities for a number of future developments, as well.

belintersat.com/

Herd Instinct: How Satellite M2M Will Boost Beef Yields

By Corry Brennan, Simplex Regional Sales Manager, EMEA, Globalstar

While becoming commonplace these days to track and manage assets, such as vehicles and equipment using satellite-based M2M solutions, tracking animals creates many additional challenges.

However, as we look to technology to help us increase yields from the Earth's limited agricultural resources, coupled with a growing demand for meat, MOOnitor Cows presents the potential to better understand cattle activity and to maximize the amount of beef produced.

To date, studies regarding cattle activities have involved students sitting in fields with clipboards for hours on end, or using wild animal tracking devices that are then combined with elaborate, offline data analysis.

A new Israeli company has developed a satellite-based solution that takes animal monitoring to a new level. By integrating the latest accelerometer technology, GPS, solar panel and satellite communications (SATCOM) technologies on a neck-mounted cattle collar, MOOnitor is able to help commercial ranchers understand how best to manage their herds to

maximize beef yields, evaluated by the number of weaned calves.

Through the measurement of cattle activity, such as how much time a cow spends resting, grazing and walking, ranchers can quickly react to developing situations and events. This information helps ranchers understand the key parameters that are related to animal behavior—quality of food and weight gain patterns, estrus events, pregnancies and other medical conditions. Ranchers can also use the information to increase production and optimize the number of weaned calves among the livestock population.

The MOOnitor collar includes an accelerometer, a GPS tracker, RF communications for on-site maintenance, two solar panels measuring just 85 by 65 mm, and a Globalstar STX3 satellite chip for communications. The system gathers approximately 50MB of data every day. The MOOnitor designed compression algorithm reduces that data down to only 36 bytes within a single transmission each day. The data is then analyzed in the back





office system to calculate the herd's daily energy balance and trending body conditions.

Given the often remote location and roaming tendencies of the cattle, satellite is sometimes the only reliable communications option available to ranchers.

"Cattle in countries such as the US, Australia and South America graze in remote locations that are not used for any other agriculture," said Dr. Sinay Goldberg, founder and CEO at MOOnitor. "Because cows are such independent beasts, ranchers tend to have little information about how their animals are faring, especially in large herds. By taking advantage of Globalstar's extensive and highly advanced second generation satellite network, we deliver the information needed to effectively manage the herd and improve production right to the ranchers' fingertips."

For MOOnitor, one of the most important features was to be able to deploy in locations that possessed no communications infrastructure. Using Globalstar's STX3 simplex satellite transmitter with the lowest power-consuming technology on the market enabled MOOnitor to pack data communication link into the collar, making the collars as independent as the cows carrying them. As STX3 uses little power, the collar can fully function for seven days on the unit's internal battery, even without sunshine, and only requires two hours of sun to be fully recharged. The STX3 module is also quite small—the size of a coin—which makes the fit of the unit into the collar design quite easy.

"Although MOOnitor technology would never replace a rancher, it enables vital monitoring capabilities and information such as earlier detection of sick cows. When they are sick, cows tend to hide in a herd so they are not vulnerable to predators. This behavior makes it even more difficult for ranchers to detect if a cow is unwell. The system detects whether a cow is sick, in estrus, pregnant or lactating," said Goldberg.

A key contributor to the project is Ran Malamud. One of the foremost experts in cattle technology, he brings 30 years of experience in nutrition and animal husbandry to MOOnitor and his expertise from the last two decades specializing in livestock management technology. "When designing MOOnitor, we combined our own in-house knowledge with data about cattle activity available from the many published research reports in the public domain."

MOOnitor recommends that ranchers deploy the collars across 10 to 20 percent of the herd—this enables them to extrapolate the results to very effectively manage the whole herd with a high level of statistical reliability.

"Although the dairy business works on a per-cow basis, any results about grazing, calves and introducing bulls, are always gathered and reported at a herd level," Malamud explained. "Just like humans, irrespective of their breed and location, some individual cows can eat a lot and stay slim. So we could get very inaccurate information if we only looked at a single animal; but with an entire herd, we get a truly accurate and reliable picture."

At a site in the north of Israel, 30 cows out of a herd of approximately 100 in number have been wearing the MOOnitor collar since June of 2015. Through this trial, MOOnitor has been extrapolating the data across the

entire herd to learn about their behavior and its impact on weaning calves and beef yields.

The information gathered and what can be inferred from that data are highly interesting and incredibly useful. For example, the data revealed the full impact of heat stress and how that can cause cattle to stop eating. There was also an instance where the collar data acted as an early warning system and indicated early on that a cow was sick.

"Throughout the trial, the hardware and communications have worked very well. The Globalstar satellite communications have achieved 97 percent success rate in message transfer, exceeding our SLAs. This figure is remarkable when one's considers that cows do not cooperate with antenna orientation directions. We have also learned the best way to attach the collars to ensure they don't get damaged and to ensure we receive data even when the collar location on the cow is not optimal," said Goldberg.

"One new learning from the pilot is that we can measure the amount of mastication or chewing during rumination. This parameter can be related to the amount of biomass being consumed or efficiency of converting this into beef. This is a major leap forward when you consider that previously a person would have to spend the hours manually recording such data. We believe that analyzing these metrics could provide further valuable data in the future," he added.

Before going into production later in 2016, MOOnitor is producing 100 collars to be deployed in beta testing in target markets that include Australia, the US, South America and South Africa. By gathering information from different environments and breeds, MOOnitor will be able to correlate the data from the Israeli pilot with the newly added pilots to further enhance data understandings.

The worlds of Precision Agriculture, M2M, IoT and satellite communications are resulting in exciting new developments for agriculture and farming. Human health monitoring has quickly taken off, and now cattle and ranchers can benefit from identical technologies. As ranchers understand their animals' wellbeing, they can maximize beef production to help their bottom line.

globalstar.com/

Corry joined Globalstar in February of 2013 as Regional Sales Manager for EMEA. In this role, he has responsibility for Sales and Business Development of Globalstar's suite of Simplex Devices and Chipsets, providing satellite-based asset tracking and management solutions across the transport, marine and remote asset management sectors.

Earlier in his career, he held senior sales roles at major enterprises, including Eircom, where from 2000 to 2010, he successfully held several key operational and managerial roles, including Head of Order and Fault Management. He then moved on to become Head of Key Account Management and, later, Head of Marketing.

Corry holds a BA from Trinity College Dublin as well as an MBA from Trinity College, where he was a Brendan McDonald Scholar.



The State Of Satellite M2M / IoT

By Alan Crisp, NSR Analyst, Hong Kong



Machine to machine (M2M) communications and the Internet of Things (IoT), are more than just the latest technological buzzwords.

With companies, customers, end-users and governments all expecting the technology to significantly change the way we live our lives, we can expect the world to become much more quantified—supply chains, logistics, cities and even health.

Cisco expects more than 50 billion connected devices by 2020, but others feel this number is too conservative, with some expecting in excess of 75 billion connections. While the majority of these devices will be connected over cellular, or in some cases wired connections, a comparatively small percentage of these connections do occur over satellite. These satellite based connections will generate a disproportionately large amount of revenues from mostly high value connections, where high SLAs are critical.

According to data from NSR's recently released report *M2M and IoT via Satellite, 6th Edition*, annual revenues from satellite based M2M/IoT are expected to increase from \$1.2 billion in 2014 to more than \$2.3 billion by 2024, corresponding to an annual growth rate of 6.5 percent. This represents a 6.9 percent annual growth rate for in-service M2M/IoT units, increasing from 2.7 million to over 5.3 million over the same 10-year period.

For the first time, now included in the *6th Edition of M2M and IoT via Satellite*, the much requested data breakout of Land Transport, Maritime and Aeronautical units and revenues are now included. Here we will discuss these three key markets, and the growth opportunities which present themselves worldwide.

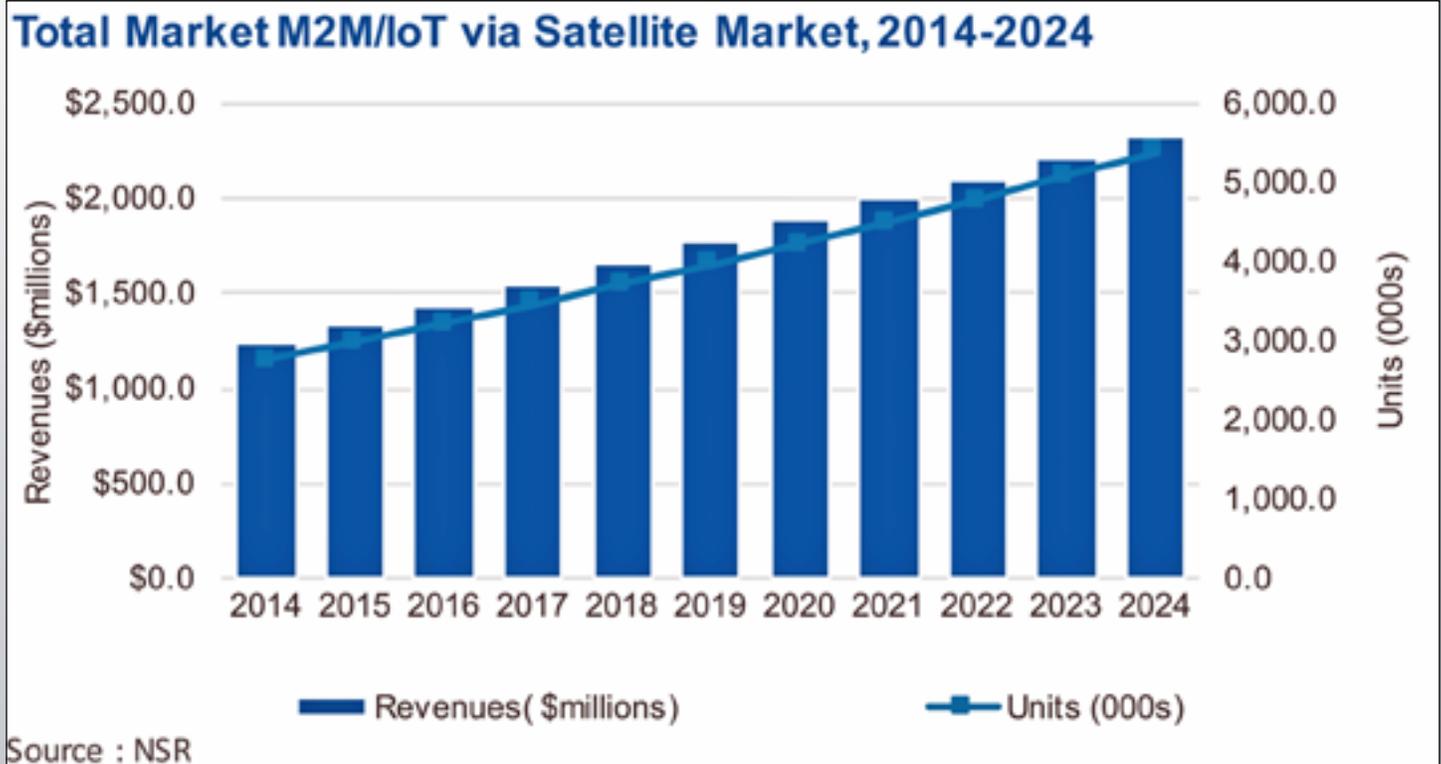
Land Transport: Driving The Future

The Land Transport market is by far the largest segment, raking in more than 32 percent of global revenues at end of year 2014, between rail, cargo, trucking and other vehicular transport. This is, in part, due to the high value of cargo that is now shipped around the world, a figure which is increasing every year as populations, the economy, and Internet shopping continue to grow rapidly.

However the Land Transport market does have its challenges. Out of all applications which NSR tracks for M2M/IoT, Land Transport suffers the most when examining terrestrial competition. This is by its very nature as vehicles and trains spend the majority of their time within a terrestrial footprint, and often times within urban areas, especially in the USA and European markets.

While in the short-term, ARPU is increasing as the kinds of data transferred continues to expand, this is expected to peak in 2021 at \$288 per unit, as price competition from cellular providers becomes increasingly significant. This is especially the case as cellular pricing moves from value-based pricing toward cost-based pricing, that is, moving in the direction of consumer cellular data per bit pricing.

Nevertheless, Land Transport is one of the ripest markets for the utilization of dual-band technologies, in which a single terminal can connect to both terrestrial and satellite connections. While the upfront cost can be greater, running costs can be significantly lower running this kind of system, with trucks for example only needed to transmit data over the more expensive satellite connections in rural areas with no coverage.



However, in less developed regions, most notably in Latin America and Southeast Asia, this is less common. Cellular networks cannot necessarily be relied upon and often cannot meet the strict SLAs that logistics and other companies require for the transportation of their high value goods.

Aeronautical: A Market Taking Off

The Aeronautical sector, likewise, has very high SLA requirements, but clearly cellular options are out of the question. Consequently, aeronautical ARPUs are significantly higher, ranging between \$680 and \$720 over the next decade—the highest of all transportation related applications.

However, in-service units are comparatively few, with 28,000 units in 2014 increasing to 48,000 by 2024. This is driven by safety requirements, aircraft to aircraft messaging, and meter usage, among others.

Due to legacy installations, L-band has the highest share of in-service units in terms of frequency, and this is not something that is expected to change any time soon. While MSS services generally dominate the entirety of the satellite M2M/IoT market, generally there's a minority for Ku-band VSATs for backhaul type networks and high bandwidth usage customers.

However for the Aeronautical application, L-band's proven track record will mean that, at least for safety and other M2M type applications on-board aircraft, terminals will remain L-band.

Following a number of high profile aircraft incidents, a trend has accelerated to equip flights, most notably major long-haul commercial flights, with

some form of voice and data communications outside of HF and VHF coverage. It is also looking increasingly likely that increased regulations will be implemented to track aircraft when outside of typical radar coverage.

For example, in December 2015, the European Union enacted regulations to do just that. Although intervals to send location data were not included in the regulations, more frequent updates will be required in the event of an emergency. Expect other jurisdictions to follow suit and adopt these more stringent regulations to help prevent future serious aviation incidents.

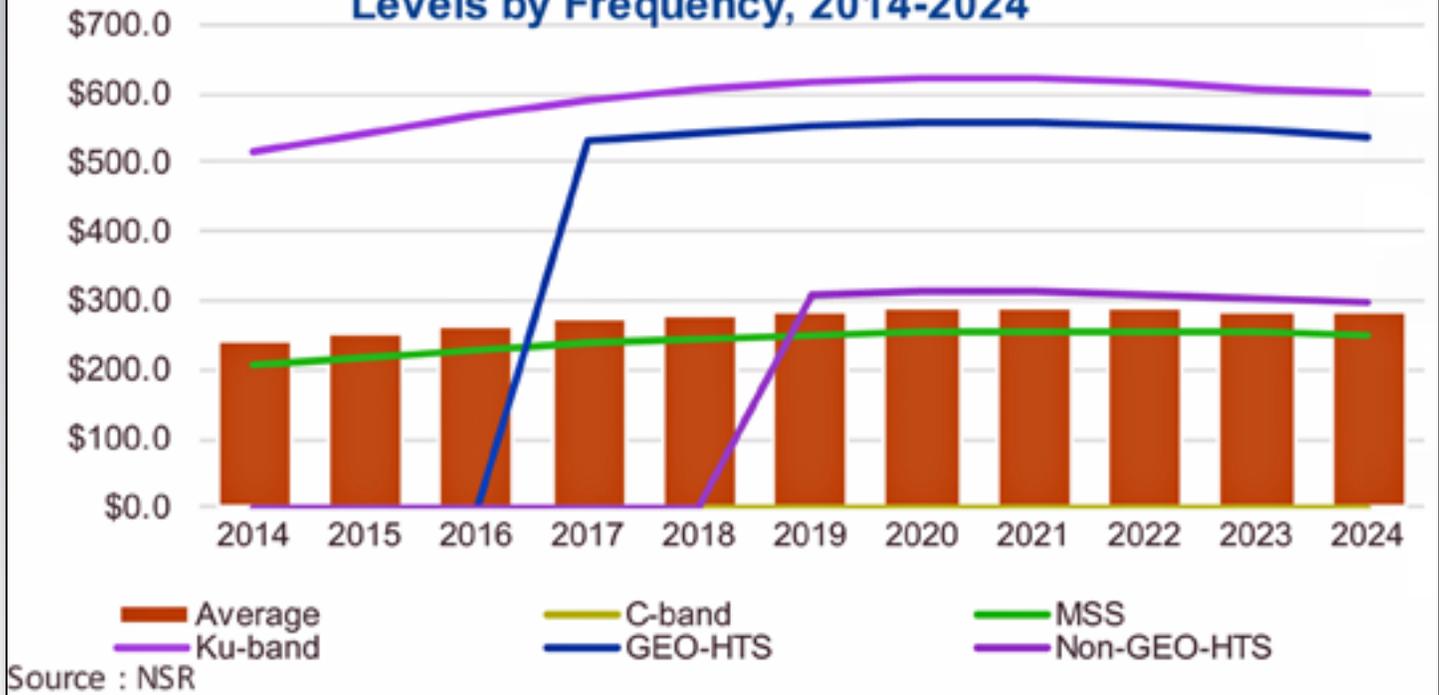
While this will bolster demand for the aero M2M market, it is expected to remain predominantly a wide-body and narrow-body dominated market, with business jets and other smaller aircraft unlikely to install M2M/IoT terminals in large numbers, especially as these systems are not yet considered a 'must have' in many parts of the world, with a negative cost perception relative to the perceived safety benefits.

Maritime: High Growth On The High Seas

Maritime applications have the strongest growth opportunities of all the transportation based applications, albeit coming off a lower base, with revenues increasing from \$85 million at end of year 2014 to more than \$200 million in 2024, representing an annual growth rate of 9.2 percent.

Bulk cargo ships, tankers, and private yachts and other recreational vessels are all represented here, but it is the bulk cargo which has more than 55 percent of the market over the next decade, due to high value of contents which M2M is helping to track.

Land Transport M2M/IoT via Satellite Annual ARPU Levels by Frequency, 2014-2024



Europe remains the largest market for cargo merchant shipping, with the ease of trade between European Union states bolstering demand for shipping products. In other regions such as Asia, growth will be driven by population increases, as well as strong economic growth and purchasing power, driven by China.

Trade blocks such as ASEAN are at a much earlier stage of development compared to the EU, and as such higher growth is expected, and likewise from other global trade pacts such as the Trans Pacific Partnership (TPP) increasing trade between Japan and Southeast Asia, for example.

A number of maritime tracking programs are in place, such as Long Range Identification and Tracking (LRIT) to track movements of all passenger ships, cargo ships, and mobile offshore drilling vessels. Satellite Automatic Identification System (S-AIS), and the Ship Security Alert System (SSAS) to alert law enforcement in the event of terrorism or piracy on a vessel.

However there are limited opportunities here for non-MSS terminals, with only ~12 percent using Ku-band, and just under 1 percent of HTS (both GEO and non-GEO) terminals by 2024.

While the polar market has remained a tiny fraction of the overall maritime M2M market, this is a market worthy of consideration. Longer-term this has the potential to grow with the eventual opening up of the northwest passage, however satellite operators will need to invest in capacity over this region in order to see real sustained take up of M2M and other types of demand from new shipping capabilities.

Expectations

There are expected to be over 50 billion Internet connected devices expected by 2020, and unquestionably huge opportunities worldwide for M2M and IoT. While the majority of connections will be on cellular connections, or even

lower bandwidth networks such as SigFox or LoRa, satellite will always play a key role to play for Land, Maritime and Aeronautical transport applications, especially those where high SLAs are demanded.

Especially in developed regions, but soon globally, the expectation and competitive pressure to be able track all goods at all times through the logistics and supply chain process will intensify, driving significant numbers of new transportation based customers to satellite based M2M/IoT.

With data polling increasing in both packet size and frequency, combined with the fact that more types of data are being collected than ever before for analytics and big data purposes, revenues and investment opportunities are set to expand.

New entrants, new customers and opportunities, and new revenue streams will be available to satellite operators, service providers, systems integrators and retailers alike.

[nsr.com/research-reports/satellite-communications/m2m-and-iot-via-satellite-6th-edition/](https://www.nsr.com/research-reports/satellite-communications/m2m-and-iot-via-satellite-6th-edition/)

Mr. Crisp joined NSR in 2014, following a Hong Kong based engineering role at Aurecon. Mr. Crisp is the co-author of NSR's annual M2M and IoT via Satellite report and also Linear TV and other video broadcasting reports

As a member of NSR's Fixed Satellite Services (FSS) group, Mr Crisp's areas are comprised of M2M and IoT communications, including the satellite and terrestrial M2M landscape. Previous consulting experience includes forecast analysis and risk management of natural disasters in Manila, where he made recommendations to policymakers about backup and emergency telecommunication links for use in city and nationwide emergencies.

Alan obtained a Bachelor's Degree with First Class Honours in Engineering (Civil & Structural) from the University of Adelaide, Australia.

Finding The Correct SATCOM Solution: A SpeedCast Perspective

By Cedric Mancini, Director of Engineering and Operations, SpeedCast

There is no doubt that to grow and thrive in today's global economy, a business must be connected 24/7—and that means in any location, no matter how remote, whether on land, at sea or in the air.

Satellite networks can provide the means to link multiple distributed sites across the globe. Historically, however, limited and expensive bandwidth, latency and intermittent availability have made satellite a highly restrictive and costly choice. The good news is that such is no longer the case.

With advanced satellite technology now able to deliver fast, efficient communications between companies, customers, partners and field employees, opportunities for business growth can be created through the ability to extend that connectivity into previously unreachable areas. The task then becomes in locating the correct satellite solution to fulfill the many requirements of complex organizations, across multiple locations, all within a landscape of tightening IT budgets. This certainly does present quite a challenge to those responsible for ensuring viable SATCOM connectivity.

There are three primary areas associated with delivering efficient satellite communication services to remote locations—high bandwidth costs, supporting employee welfare applications and devices and maintaining industry specific application performance. New satellite network advances and bandwidth management tools address these challenges by allowing companies to select specific network design components to fulfill their business objectives and management tools that effectively control the delivery of their traffic.

Enhancing Industry-Specific Application Performance

Essential for businesses operating in remote locations is to have uninterrupted real-time access to operational and management data. Limited connectivity can have a seriously negative impact if access to industry-critical information is reduced. Therefore, industries which rely heavily on remote operations to be supported by tightly integrated information systems that ensure uninterrupted access demand viable communications.

In any business environment, downtime means loss of revenue. For businesses with particularly high operating costs, such as the resources and energy industries where daily costs can be in excess of \$250,000, every hour of downtime is extremely costly. In these circumstances, IT must avoid network induced latency which, when added to the inherent nature of geostationary satellite latency, impacts on the ability to deliver mission critical traffic.

Managing Employee Welfare Applications

In a society where most of the world's population now has access to a mobile device, businesses operating in remote locations to provide their workforces with capacity for basic voice calls and limited email access is a "must."

Gartner data predicts the usage of user owned mobile devices will reach 46 percent by 2016 and 63 percent by 2020 and in remote industries, where workers rely solely on ICT to remain connected with their loved ones, these numbers could be significantly higher. The dawning of the Bring Your Own Device (BYOD) era has brought benefits for both businesses and the remote

workforce by allowing the removal of non-essential strategic applications from the corporate IT structure.

However, this also has serious implications on bandwidth availability and operational costs, with the potential for many individuals to be operating two or more wireless devices simultaneously. Recreational applications such as Skype, file sharing, social channels and messenger services are now a basic need, rather than a luxury at remote sites. Therefore, the challenge is to support these essential applications while simultaneously maintaining efficient, corporate communications. This can be achieved by using the correct network design and Quality of Service (QoS) tools—in example, application and time-based application filtering.

To address these issues correctly IT must have clear policies coupled with software and infrastructure controls which specify:

- Which platforms and devices are supported
- How many devices may be used simultaneously
- What service level a user should expect
- What the users' own responsibilities and risks are
- Who qualifies
- How the allocated bandwidth is distributed e.g. authorized log-ins versus prepaid options

QoS will classify and prioritize network applications based on business objectives to guarantee capacity for high-priority requirements. In some instances, such as in a shift work environment, time-based application management is applied so that the bulk of available bandwidth is assigned to corporate traffic during the day and shifted to recreational traffic overnight.

High Bandwidth Costs

Bandwidth-intensive applications, cloud storage and smart devices all place increased strain on satellite bandwidth availability in industries with remote operating locations. At the same time, IT managers are under ever increasing pressure to reduce operational expenditure and improve profitability. Consequently, the search is on to find new technologies that allow them to meet the requirements of both the business and its workforce without investing in more bandwidth.

Fortunately, the satellite industry is responding to this challenge and new tools and innovations are emerging to allow users to obtain the most from available bandwidth all the while supporting the increased traffic that is passing through today's corporate WANs.

To be successful, IT managers must examine their network design goals and employ bandwidth management tools that make more efficient use of existing capacity. Rather than focus solely on capital expenditure, when starting a remote communications project, consideration should be given on actual return on investment (ROI), which comes from using efficient bandwidth allocation to reduce the operating costs of leased capacity. With this in mind, a number of key factors should be taken into consideration when designing a network, such as the length of the project, satellite link size, logistics, location and the availability of resources. There are a number of management tools and techniques that can be used to help meet these needs:

WAN Acceleration: Applications overcome the limitations of satellite links via compression and data deduplication techniques, as well as minimizing latency effects by speeding up transport and application protocols. In order for this to be successful, the categories of traffic that transit the WAN must be identified as well as how the various acceleration techniques can be implemented to improve the performance of different types of application.

- **Application Filtering:** *Manages the utilization of bandwidth so that capacity requirements for application delivery are always met. QoS rules can be applied to prioritize critical traffic such as industry specific software over recreational traffic*
- **Caching Tools:** *Store video and software downloads and other Internet content on the network edge, eliminating repeated downloads across the satellite link. This data can then be subsequently delivered to the relevant end users over the local network.*

The most practical approach is to adopt a hybrid of all these solutions where content can be reduced by removing non-essential data and other inefficiencies caused by the web. For example, applications such as YouTube and web browsing can be cached to eliminate the requirement for the same piece of data to be downloaded more than once, application filtering can be applied to give higher priority to industry-specific traffic and accelerating the whole network will allow higher throughput for bandwidth intensive applications. In conclusion, there are a number of things to look out for when searching for the right satellite communications solution to overcome all issues associated with remote locations.

- **Service customization and flexibility:** *Avoid commercial 'all in one box packages'. These may be attractively priced and a good choice for small or home offices but not for complex multi-site operations. Instead choose a multi-vendor, integrated solution which can be tailored, both technically and contractually, to fit specific requirements taking into account all aspects of design, implementation and control of remote communications.*
- **A service provider's assets and experience:** *A service provider should have a proven track record of successfully providing network services to industries operating in remote locations. They should have redundant infrastructure which supports multiple platforms and network architectures and enables high throughput applications. It is also essential for them to have bandwidth reserved across multiple satellites to optimize availability and provide cost effectiveness through their purchasing power.*
- **Integrated bandwidth management solutions:** *Avoid the impracticality of deploying multiple devices by seeking a solution that can integrate all bandwidth management capabilities into one network. The ideal solution should allow for the application of hierarchical bandwidth control and both application and end user level to provide better overall functionality and consequently efficiency of bandwidth management tools. In addition, look for a service provider who offers a single platform for all bandwidth management with a single license.*
- **Robust network and monitoring control tools:** *It is essential to have access to bandwidth monitoring and control tools which provide real time visibility and analysis of usage, equipment monitoring and fault reporting across any link or service.*

To assist IT professionals with their multifaceted network challenges, SpeedCast developed SpeedStar™, an integrated bandwidth management solution, which optimizes both upload and download traffic through a combination of IP traffic specific compression, acceleration and caching technologies.

To increase the overall effectiveness, SpeedStar layer 7 application visibility ensures bandwidth is resource-managed for key applications. In addition, SpeedStar real time monitoring and analytics platform enables the technical support team to root cause congestion problems quickly and initiate corrective action efficiently. The end result is a greatly improved user experience, based on a 25 percent average reduction in customer bandwidth, which SpeedCast has observed as the average bandwidth saved across all SpeedCast networks currently deploying the SpeedStar™ technology.

Looking to the future, most of the enhancements that SpeedCast will offer will come from value added service evolution, optimal utilization of existing and new spectrum frequencies and the ability to take a customer and assist them on their communications journey no matter what level of sophistication they require.



SpeedCast is unique in the market place in that the company offers two technology platforms to meet the specific requirements of customers, traditional TDMA—a shared technology—or on dynamic SCPC, a dedicated technology. Within the Maritime customer space, the two leading services that SpeedCast sells are its VOIP telephony service and its Remote Access and Management (RAM) service. SpeedCast has also been a pioneer in the use of compression technologies to deliver a superior user experience while maintaining the same amount of bandwidth, thereby delivering a better ROI for its customers.

speedcast.com

SpeedCast is a leading global network and satellite communications service provider offering high-quality managed networks services in more than 90 countries; and a global maritime network serving customers worldwide. Headquartered in Hong Kong, with 27 international sales and support offices and 30 teleport operations, SpeedCast has a unique infrastructure to serve the requirements of customers globally.

With more than 5,000 links on land and at sea supporting mission critical applications, SpeedCast has distinguished itself with a strong operational expertise and a highly efficient support organization, which are the foundation of SpeedCast's success. SpeedCast is publicly listed on the Australian Stock Exchange under the ticker SDA (ASX:SDA).

