

Worldwide Satellite Magazine – March 2016

SatMagazine



The North American Market... + More...

SatMagazine

March 2016

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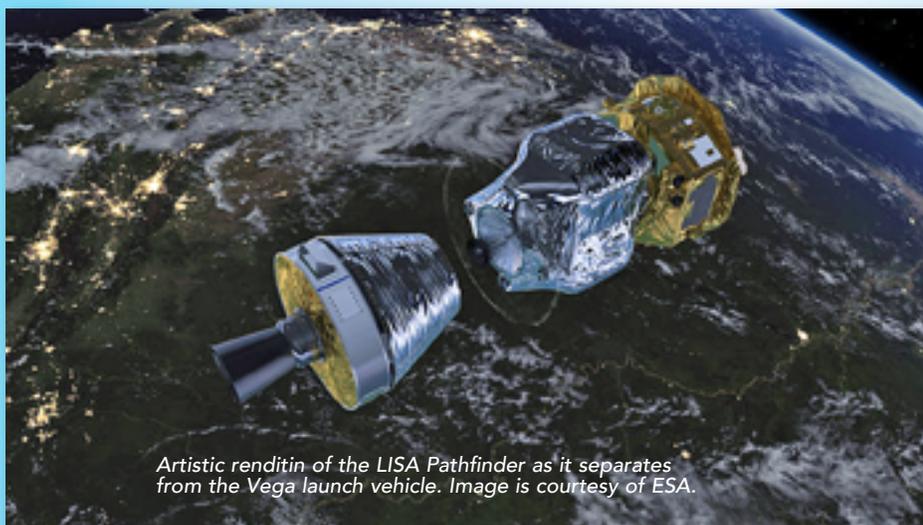
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ESA + Airbus Defence & Space Make Waves With Pathfinder Milestone



Artistic rendition of the LISA Pathfinder as it separates from the Vega launch vehicle. Image is courtesy of ESA.

LISA Pathfinder, the European Space Agency's (ESA) gravitational-wave detection technology demonstrator, built by Airbus Defence and Space, has achieved the next milestone to enable science operations.

Satellite operators from ESA, supported by engineers from Airbus Defence and Space, successfully released the test masses (nicknamed Jake and Elwood) inside the spacecraft's scientific instrument.

The LISA Technology Package (LTP), which weighs around 150 kilograms, includes laser

interferometers measuring changes in the distance between two precision-engineered gold/platinum test masses, each weighing 1.96 kilograms and changes in distance of these test masses to the spacecraft.

Now in orbit around Lagrange point L1, 1.5 million km away from Earth, the two test masses have been released from a grabbing, positioning and release mechanism and held in position with a weak electrostatic field that can be very precisely controlled.

Over the coming weeks, the spacecraft control system, also developed by Airbus Defence and Space, will reduce the electrostatic force on the test masses, culminating in the science mode of operation, when no force is applied to one test mass along the axis connecting the two masses. The spacecraft is then forced to follow this "drag-free" test mass.

The laser interferometers measure the relative position and orientation of the masses—which are 40 centimeters apart—to an accuracy of less than one millionth of the width of a human hair, or less than 0.01 nanometer.

Airbus Defence and Space in the UK was chosen by the European Space Agency (ESA) to build the spacecraft and propulsion module and is responsible for delivering the integrated satellite.

Airbus Defence and Space in Germany was selected by ESA and the German Aerospace Centre, DLR, to be the system's leader for the LTP, which was developed with contributions from European research institutes and companies.

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SmallSat Symposium Sells Out... Completely..

Silvano Payne, the Publisher of Satnews, reports that the SmallSat Symposium, scheduled to convene from February 23rd through 24th, 2016, at Hogan Lovells in Menlo Park, California, is completely sold out.

"This is fabulous," said Payne. "All of the available attendee seating has been booked.



Registrations are now closed. Those in attendance at this event will gather crucial information and resources from more than 70 smallsat subject matter experts. Certainly, the SmallSat Symposium is now an event not to be missed by industry

professionals... now, or in the future." With registration closed, those who are interested in attending or presenting at the 2017 SmallSat Symposium should contact Satnews Publishers for additional details, as they become available. To view the list of the symposium's dynamic speakers, please access smallsatshow.com/?page_id=140

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DEV's ARCHIMEDES Heading To Cyprus For Gulfsat Communications

GULFSAT Communications has deployed DEV Systemtechnik's next-generation L-band RF Matrix switching solution, ARCHIMEDES, in order to upgrade GULFSAT's Teleport in Cyprus.

The capabilities and flexibility of DEVs' ARCHIMEDES switching solution define the next generation of L-band Matrix Switching Systems enabling satellite, broadcast, CATV, and other communications facilities to expand their infrastructure capacity while reducing capital expenditures—"Expansion by Reduction."

After demonstrations and tests in Kuwait, GULFSAT decided to deploy the DEV ARCHIMEDES Matrix Switch because DEV's solution requires less rack space and has



significantly lower power consumption than predecessor products.

In addition, ARCHIMEDES' integrated functionalities such as LNB Powering, Redundant Controller and the easy-to-use Multi-Touch Display uniquely addressed GULFSAT's requirements.

The ARCHIMEDES Matrix can also be upgraded easily in order to meet GULFSAT's future needs for capacity growth due to its extremely flexible, modular design.

Nikesh Paul Mathew, Senior Satellite Engineer, said, "When DEV Sales Managers demonstrated their RF Matrix Switch ARCHIMEDES at our premises in Kuwait, we were impressed with its features.

"We decided to install the DEV ARCHIMEDES in our teleport in Cyprus as we can manage and control the services remotely."

dev-systemtechnik.com/

gulfsat.com/

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EUTELSAT 65 West A Arrives In French Guiana For Arianespace Flight

The telecommunications satellite for Arianespace's second Ariane 5 flight of 2016

has arrived in French Guiana with the delivery of EUTELSAT 65 West A to the Spaceport.

Transported aboard a chartered Antonov An-124 cargo airliner that touched down at Félix Eboué Airport near the capital city of Cayenne on Friday, the SSL-built (Space Systems Loral) satellite was then transferred via road to the Spaceport's payload preparation facilities.

EUTELSAT 65 West A began initial pre-launch processing during the weekend, including a fit-check with the adapter that will serve as its interface with Ariane 5.



Based on the SSL 1300 satellite design, EUTELSAT 65 West A will be orbited on an Ariane 5 mission in early March from the Spaceport— designated Flight VA229 in Arianespace's numbering system.

Scheduled to be this year's second Ariane 5 mission, the launch will keep Arianespace on track for as many as eight with the workhorse vehicle in 2016.

Once orbited by Arianespace, EUTELSAT 65 West A will be added to the in-orbit fleet of Paris, France-based Eutelsat, which supplies satellite capacity and services for video, data and broadband applications.

When operational at an orbital slot of 65 deg. West, the new relay platform will serve expanding markets in Brazil and across Latin America.

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Moving On Up... SSL Appoints A New CTO

Space Systems Loral (SSL) announces that Dr. Matteo Genna has assumed the role of Chief Technology Officer (CTO).

Dr. Genna joined SSL nearly 20 years ago as a Systems Engineer in the Research and Development group where he contributed to advancing the design of SSL's highly successful 1300 satellite platform, which celebrated its 100th launch last year.

In this role, he was accountable for the design, performance, reliability, and quality of every SSL-built satellite. In his new role, Dr. Genna is responsible for advances that are enabling SSL to collaborate with NASA and DARPA. This is reflected in programs such as Dragonfly, for robotic satellite assembly on orbit, and Psyche, for a spacecraft to explore an asteroid.

Dr. Genna has contributed to a broad range of innovations, ranging from avionics to electric orbit raising, keeping the 1300 at the forefront of today's technology. As a Manager in the Advanced Systems Group, Dr. Genna led teams responsible for designing SSL's satellites and developing novel solutions for integrating hosted payloads. In 2014, Dr. Genna was named Vice President of Mission Assurance and Chief Engineer.

Dr. Genna holds a Bachelor of Science degree in Physics from the University of California, San Diego, and a Ph.D. in Physics from the University of California, Berkeley.

www.sslmda.com

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Optus Satellite + Electrotech Deliver Connectivity To Spirit Of Tasmania

Passengers on the Spirit of Tasmania ferry service will be able to stay connected while on-the-move following the introduction of satellite data streaming services, through a wholesale partnership between Optus Satellite and Electrotech Australia.

The Spirit of Tasmania connects mainland Australia with Tasmania. Consumer data services will be delivered alongside telemetry services, that provide communications visibility between the ferry and staff. Optus Satellite Vice President Paul Sheridan said the introduction of consumer data services is great news for travellers on the Spirit of Tasmania, and vessel owner TT Line.



“The two pronged technology deal will see service delivery for enterprise use—in order to keep the ferry and staff in communication, as well as additional capacity provided to allow passengers to connect to the Internet.”

“The addition of wideband Internet via satellite to these newly refurbished vessels is an exciting

development and opens up a wide range of possible commercial services TT Line are now able to offer their customers,” Electrotech’s Managing Director Stephen Renkert said. The solution includes SeaTel 6012—33 systems supplied, installed and commissioned by Electrotech Australia to deliver the high bandwidth Internet.

Optus Satellite has the largest fleet of satellites servicing Australia and New Zealand, with 6 satellites currently in geostationary orbit. Optus is a key provider of choice for enterprise and government organizations, with satellites utilized to deliver TV, mobile telephony and broadband services across Australia and New Zealand.

Lockheed Martin Gets The Nod From SKYPerfect JSAT



Artistic rendition of an A2100 satellite. Image is courtesy of Lockheed Martin.

SKY Perfect JSAT Corporation has awarded Lockheed Martin a contract for JCSAT-17, a satellite based on the A2100 common design.

JCSAT-17 is an S-band satellite that will operate well in excess of 15 years.

The satellite will include a flexible processor that will allow SJC to redirect capacity to concentrate on disaster relief efforts or other high-volume events. JCSAT-17 is the eighth satellite SJC has awarded to Lockheed Martin, beginning with NSAT-110, JCSAT-9 through JCSAT-13 and most recently JCSAT-110R.

The satellite will be manufactured in Denver, Colorado and delivered in 2019.

The modernized A2100 is built on a flight-proven bus that is the foundation for more than 40 satellites in orbit today.

Through an internally funded, multiyear modernization effort, Lockheed Martin enhanced the spacecraft's power, propulsion and electronics, while also adopting the latest advanced manufacturing techniques to decrease production costs and timelines.

"We've built a number of satellites for SJC and we're honored that they have placed their trust in us again," said Carl Marchetto, vice president and general manager of Commercial Space at Lockheed Martin Space Systems. "And with the sale of an additional A2100, it adds yet another satellite to our healthy backlog."

lockheedmartin.com/

JAXA's X-Ray ASTRO-H Satellite Is Sunny Side Up...

The Japan Aerospace Exploration Agency (JAXA) confirmed that the X-ray Astronomy Satellite (ASTRO-H) has deployed its solar array paddles (SAPs) normally through data transmitted from the satellite and received at the Uchinoura Ground Station at 7:40 p.m. on February 17, 2016.

ASTRO-H was launched by the H-IIA Launch Vehicle No. 30 from the Tanegashima Space Center at 5:45 p.m. on the same day.

H-IIA F30 with the "ASTRO-H" onboard launched at 5:45 p.m. on February 17, 2016 (JST) from the Tanegashima Space Center. The rocket flew smoothly, and, at about 14 minutes after liftoff, "ASTRO-H" was separated from the H-IIA F30.

The Japan Aerospace Exploration Agency (JAXA) confirmed on February 18, that the X-ray Astronomy Satellite "Hitomi" (ASTRO-H) was injected into the planned

orbit as follows after its orbit calculation. The satellite is currently in good health.

The explanation of the name of the satellite is as follows:

- » *ASTRO-H is the eye to study the hot and energetic universe. Therefore we name ASTRO-H, "Hitomi". The word Hitomi generally means "eye", and specifically the pupil, or entrance window of the eye—the aperture!*

There is also an ancient legend that inspires the name Hitomi.

"One day, many years ago, a painter was drawing four white dragons on a street. He finished drawing the dragons, but without 'Hitomi.' People who looked at the painting said "why don't you paint Hitomi, it is not complete! The painter hesitated, but people pressured him. The painter then drew Hitomi on two of the four dragons. Immediately, these dragons came to life and flew up into

the sky. The two dragons without Hitomi remained still."

The inspiration of this story is that Hitomi is regarded as the "One last, but most important part," and so we wish ASTRO-H to be the essential mission to solve mysteries of the universe in X-rays. Hitomi refers to the aperture of the eye, the part where incoming light is absorbed. From this, Hitomi reminds us of a black hole. We will observe Hitomi in the Universe using the Hitomi satellite!

For your information, a nano-satellite "PRISM," which was developed by Professors Nakasuka and Funase laboratory, at the University of Tokyo, and is currently in operation, shares the same name of Hitomi as its nickname. The laboratory kindly accepted JAXA's request to use the same name for ASTRO-H, and the organization wishes to express their sincere appreciation for their cooperation.

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C-COM OK'd For Northern Canada Deployment



C-COM Satellite Systems Inc. has received approval to operate its Ka-band iNetVu® mobile antenna products on the Galaxy Broadband network.

Galaxy Broadband is a leader in enterprise grade VSAT services to remote areas across Canada and the United States.

The iNetVu® Ka-98H system was successfully deployed and tested on the Galaxy F2 Ka-band network in January, expanding C-COM's footprint for service in the most Northern parts of Canada.

This development will provide mobile customers in Canada's north the capability to deploy the C-COM manufactured iNetVu® Auto-Deployable VSAT solution over Galaxy's extensive Ka-band network that covers BC, Northern Alberta, Northern Saskatchewan, Northwest Territories, Nunavut and Eastern Alaska.

With Galaxy's service offering, mobile clients in the Canadian Arctic can now have access to a network that can deliver 5 Mbps down and 2 Mbps up, rivaling speeds available in more southern locations of the country.

"We feel this is a very good opportunity for delivering mobile solutions throughout our Ka-band beam coverage, including the Canadian Arctic," said Rick Hodgkinson, President and CEO of Galaxy Broadband.

"We see many opportunities for remote exploration, temporary sites and Government solutions using mobile antennas in combination with Galaxy's high power Ka spot beams that deliver an Enterprise high QoS network."

c-comsat.com/

galaxybroadband.ca/

Instruments Have Now Been Integrated Into NOAA's JPSS-1

Building a weather satellite is no easy task—several years of design and engineering work are required to piece all of the instruments together and prepare a satellite for launch.

As NOAA's Joint Polar Satellite System-1 (JPSS-1) satellite moves towards its early 2017 launch date, the fifth and final instrument, the ATMS (Advanced Technology Microwave Sounder), an instrument critical to forecasting weather three to seven days in advance, has been integrated with the satellite.

"This marks a very significant milestone for the JPSS program," said Harry Cikanek, JPSS Director. *"Soon, the spacecraft will be prepared for the environmental testing phase which is the next step toward launch."*

Historically, microwave sounders, such as ATMS, have had the greatest impact on forecast accuracy. The instrument works by collecting microwave radiation from the Earth's atmosphere and surface day and night, even through thick clouds.

This is particularly valuable for forecasters because it will allow them to "see" inside and below clouds, and it can be used to produce images inside hurricanes and other storms. ATMS measurements also provide rainfall rates and snow and ice information.

The image shows the ATMS channel 18 data, which measures water vapor in the lower atmosphere. Tropical Storm Sean is visible in the data, as the patch of blue, in the Atlantic off the coast of the Southeastern United States.

Compared with NOAA's legacy microwave sounders, ATMS offers more channels and better resolution and collects a wider swath of



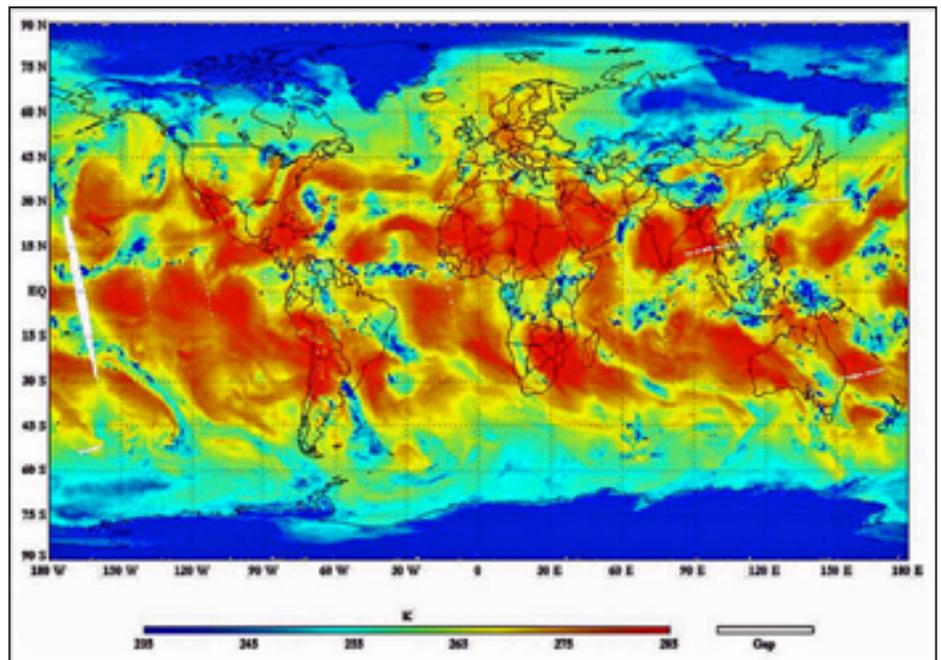
Ball Aerospace technicians lower the ATMS instrument onto the JPSS-1 spacecraft. Photo is courtesy of Ball Aerospace & Technologies Corp.

data. ATMS will be operating in tandem with CrIS (Cross-track Infrared Sounder) aboard the JPSS-1 satellite.

By working together to cover more of the electromagnetic spectrum (microwave and infrared), ATMS and CrIS will provide coverage of a broad range of weather conditions.

"The JPSS-1 ATMS sensor will guarantee that this critical data stream remains seamlessly in place to support global forecasting in the future," said James Yoe, Ph.D., NOAA's National Weather Service.

ATMS is built by Northrop Grumman in Azusa, California, and was delivered to Ball Aerospace & Technologies Corp. in Boulder, Colorado, where it was integrated with the spacecraft. ATMS currently flies on the NOAA/NASA Suomi NPP satellite mission and will fly on the JPSS-1, JPSS-2, JPSS-3, and JPSS-4 satellite missions.



The image shows the ATMS channel 18 data, which measures water vapor in the lower atmosphere. Tropical Storm Sean is visible in the data, as the patch of blue, in the Atlantic off the coast of the Southeastern United States.

Image courtesy of NOAA.

SpeedCast's Beylier Named As 2016 Teleport Exec. Of The Year By The WTA

The World Teleport Association (WTA) has announced that Pierre-Jean Beylier, the CEO of SpeedCast, has been named as its 2016 Teleport Executive of the Year.

Mr. Beylier will be honored during WTA's Teleport Awards for Excellence luncheon on March 8 during SATELLITE 2016, hosted by Crystal.



The Teleport Executive of the Year award is presented to an individual for demonstrated entrepreneurship, leadership and innovation in the development or operation of a teleport-based business. Under the leadership of Pierre-Jean Beylier, known as PJ, SpeedCast executed five acquisitions in 2015, which doubled the company's revenue, while

achieving 99 percent retention of the staff in the acquired companies.

This remarkable performance stems from corporate values summed up in the acronym "CAST"—Customer-focused, Agile and responsive, Success through people and Team spirit. The work of integration these acquisitions is called Project Bordeaux, whose goal is to turn six companies into one streamlined and efficient organization. Project Bordeaux stresses communication: giving all team members visibility into what the organization is doing, what it has achieved and what is coming next. The result has been increasing cross-team collaboration leading to a higher "win" ratio and faster project delivery.

PJ also leads the company's engagement with humanitarian and charitable organizations. The company has contributed equipment and technical support under the NetHope initiative for recovery from Hurricane Haiyan.

SpeedCast is a corporate supporter of charitable events including Australia's Big Red Ride, which raises money for muscular dystrophy research, World Championship Sailing in Japan, and other events. With its focus on nonprofit organizations, SpeedCast is also a major supplier to such NGOs as UNHCR, UHHDOC and Save the Children International. From his base in Hong Kong, PJ has built a company with global reach across the mobile, maritime, energy, government, mining and NGO markets.

"A healthy technology sector offers opportunities to small, entrepreneurial companies as well as to mid-size and large firms with the potential to acquire them," said executive director Robert Bell. "The teleport industry is just such a sector and executives like PJ Beylier not only build on the success of the companies they acquire but increase the potential of the industry for growth."

worldteleport.org/

And The Beat Goes On... The Intelsat 29e Push



Flight VA228 was the 84th launch for Arianespace's Ariane 5, which operates from French Guiana. Photo courtesy of Arianespace.

Launched from the Arianespace's European spaceport in Kourou, French Guiana, flight number 228 successfully placed the Intelsat 29e telecommunications satellite in geostationary transfer orbit.

This was the seventh launch of an Ariane 5 with Airbus Safran Launchers as lead contractor, in coordination with the teams

from the respective parent companies, Airbus Defence and Space, and Safran.

Airbus Safran Launchers demonstrated, with Arianespace, the ability to respond to the specific needs of one of its clients in record time, as the launcher was adapted to accommodate a single satellite rather than the customary two satellites for which

Ariane 5 ECA has been optimized. Launch performance was 6700 kg (of which 6552 kg was the actual satellite) to geostationary transfer orbit with an inclination of 0.5 degrees, thereby optimizing the lifetime of the satellite.

"Following the year 2015 with 6 successful launches in 7 months, 2016 starts with a demonstration of our ability to adapt, thanks to the engagement of the teams and the operational flexibility of the industrial organization," Alain Charmeau, CEO of Airbus Safran Launchers pointed out. "This level of flexibility is made possible by the expertise and know-how of the teams at Airbus Safran Launchers and its parent companies. This first success of 2016 marks the beginning of a series of operational challenges for Ariane 5 over the coming year. I would like to thank the European Space Agency, CNES and Arianespace for their confidence."

Airbus Safran Launchers has been the prime contractor for the Ariane 5 European launcher, one of the largest and most ambitious space programs in the world, since January 2015.

Building on the expertise of the Airbus and Safran groups, the company oversees an industrial network that brings together more than 550 companies (more than 20 percent of which are SMEs) in 12 European countries.

Airbus Safran Launchers manages the entire industrial supply chain, from the manufacture of equipment and stages to the complete integration of the launcher in French Guiana, in line with the customer's specifications.

Representing cutting-edge European expertise, the Ariane 5 launcher has been specially designed to inject heavy payloads into low Earth orbit or 2 satellites into geostationary transfer orbit.

Airbus Safran Launchers is also the prime contractor for the future European launcher Ariane 6, whose maiden flight is scheduled for 2020.

Aerojet Rocketdyne Support For The Intelsat 29e Launch

Rocket engines made by Aerojet Rocketdyne, a subsidiary of Aerojet Rocketdyne Holdings, Inc., are now providing in-flight maneuvers for the Intelsat 29e communications satellite, which launched aboard an Ariane 5 rocket from Guiana Space Centre in French Guiana on January 27.

Boeing Satellite Systems International, which built the Intelsat 29e satellite, has also announced that the spacecraft is now fully operational.

"Aerojet Rocketdyne is thrilled to be a part of another successful satellite program for Boeing, as well as part of another successful Intelsat mission," said Ron Felix, vice president of the Space Systems Business Unit at Aerojet Rocketdyne. *"Aerojet Rocketdyne has rocket propulsion products on every one of the 50+ operational Intelsat satellites located around the globe, and we look forward to continuing that tradition."*

Aerojet Rocketdyne propulsion included 16 rocket engines on the satellite: 12 four-Newton MR-111C hydrazine and four 22-Newton MR-106L hydrazine engines, all of which provide attitude control and adjustment, east-west station-keeping, spin control, decommissioning and settling burns.

The MR-111 and MR-106 engines have extensive flight history, each having flown on more than 2,000 missions with 100 percent mission success.

Intelsat 29e is the first of six Intelsat EpicNG satellites being built by Boeing. Intelsat EpicNG is a high performance, next generation satellite platform that delivers global high-throughput capability.

The next four Intelsat EpicNG satellites, also being built by Boeing, will include six Aerojet Rocketdyne electric propulsion thrusters for north-south station-keeping, in addition to the 16 hydrazine rocket engines.

The electric propulsion system provided by Aerojet Rocketdyne for each of the four remaining Intelsat EpicNG satellites includes a 4.4kW power processing unit, electrical harnessing and four 2.2kW MR-510 electric arcjet thrusters.



Aerojet Rocketdyne has flown more than 170 MR-510 arcjet thrusters with 100 percent mission success. The MR-510 arcjet provides fuel-efficiency performance that is three times better than the MR-111 and MR-106 hydrazine rocket engines.

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boeing.com/**

Off + Away With Sentinel-3A

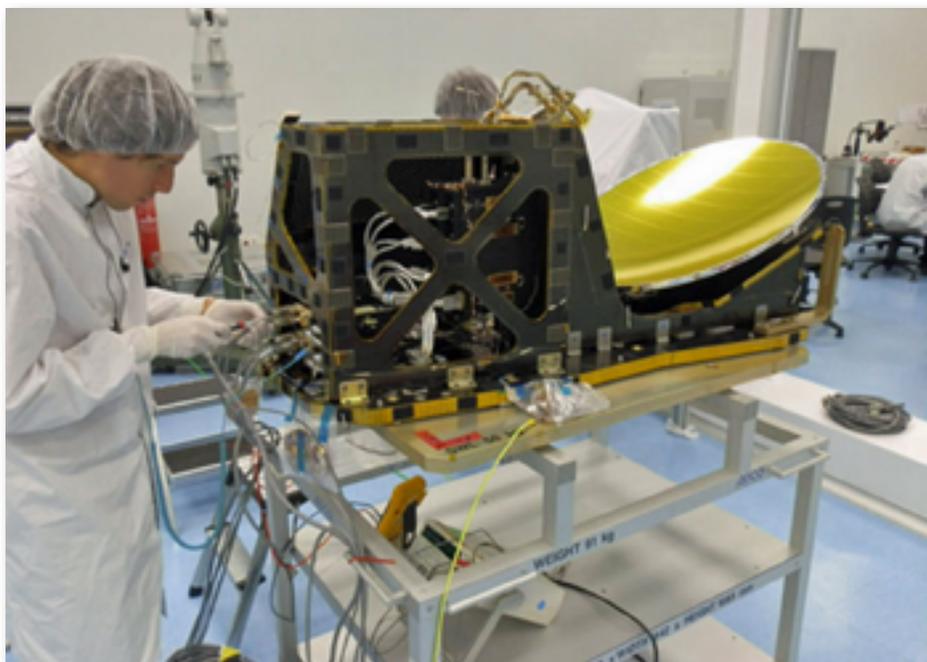


A Rockot launcher drives Sentinel-3A to orbit.

The first of the two flight models of the Sentinel-3 satellites—Sentinel-3A, primed by Thales Alenia Space—was launched on February 16 via a Rockot launcher, from the Plesetsk cosmodrome in Russia.

Sentinel-3A is the size of a small car with a mass of 1150 kg and is designed for an operating life of seven years.

On board Sentinel-3A is an Airbus Defence and Space-built microwave radiometer (MWR)



MWR photo is courtesy of Airbus Defence & Space.

used to remove signal errors caused by water vapor in the atmosphere.

This allows accurate tracking over a variety of watery surfaces: open ocean, coastal sea zones, sea ice and inland waters.

The 26 kg radiometer measures the thermal radiation emitted by Earth, enabling signal delays caused by moisture in the troposphere to be added to the altimeter pulses, to deliver more accurate data.

Airbus Defence and Space was also responsible for the thermal architecture of the service and payload interface module, which will ensure the correct performance under the extreme temperature variations to which the satellite will be subjected once in orbit, and acryo-cooler system for the Sea and Land Surface Temperature Radiometer (SLSTR) instrument.

The Sentinel-3 mission is specifically designed to ensure long-term collection and operational delivery of high-quality measurements for ocean, land and atmospheric services.

The satellites build upon the heritage and data from the Airbus-built missions of ERS, Envisat and SPOT, and include enhancements to meet the operational revisit requirements and to facilitate new products and an evolution of services.

The satellite will extend observations to inland waters and coastal zones.

The primary application of the Sentinel-3 mission is to monitor the world's oceans, measuring the temperature, color and height of the sea surface and the thickness of sea ice.

The data produced will allow scientists to monitor sea-level change and sea-surface temperature, manage water quality, track marine pollution and biological productivity.



Artistic rendition of the Sentinel-3A satellite on orbit. Image is courtesy of ESA, Pierre Carril.

Sentinel-3 will also provide a land-monitoring service with wildfire detection, land-cover mapping and vegetation health monitoring, providing complementary data to the multispectral optical mission of Sentinel-2. Eurokot Launch Services GmbH is the Bremen,

Germany, based joint venture of Airbus Safran Launchers and Space Center Khruichev.

In addition to the Sentinel-3A launch Eurokot will orbit two more satellites for Europe's Copernicus program.

After this successful launch of Sentinel-3A, EUMETSAT is now preparing to exploit the Copernicus satellite on behalf of the European Union, in cooperation with ESA.

Under the Copernicus agreement it signed with the European Commission on November 7, 2014, EUMETSAT will be the operator of the Sentinel-3A satellite and will deliver its marine mission on behalf of the European Union, in cooperation with ESA.

EUMETSAT will take over operations of the Sentinel-3A spacecraft in five months from now, upon completion of the ESA-led, in-orbit commission phase, and will process Sentinel-3 marine data and products at its Sentinel-3 Marine Centre for real time delivery to the Copernicus Marine Environment Monitoring Service and end-users.

Sentinel-3 is the second of five Copernicus missions to be operated by EUMETSAT, the first being the cooperative Jason-3 marine and climate mission launched on January 17 of this year.

Arianespace Signs On To Launch New ViaSat Satellites



Artistic rendition of the ViaSat-2 satellite. Image is courtesy of ViaSat and Boeing.

Arianespace and ViaSat Inc. (NASDAQ: VSAT) have contracted for the launches of ViaSat-2 and a ViaSat-3 class satellite.

Both ViaSat-2 and ViaSat-3 class satellites are geostationary satellites and operate in the high capacity Ka-band frequencies.

ViaSat-2 and ViaSat-3 will each weigh approximately 6,400 kg at launch and will be injected into geostationary transfer orbit by the Ariane 5 ECA, respectively, during the first quarter of 2017 and by late 2019/early 2020.

Boeing Satellite Systems in El Segundo, California, is the build partner on both satellites.

These launches will take place at the Guiana Space Center, Europe's Spaceport in Kourou, French Guiana.

ViaSat is focused on providing affordable, global, high-speed broadband Internet with competitive advantages on the ground, in the air, and at sea—as compared to other satellite and terrestrial alternatives.

The ViaSat-2 satellite system is expected to improve speeds significantly, reduce costs and expand the footprint of broadband services across North America, Central America, the Caribbean, a portion of northern South America as well as the primary aeronautical and maritime routes across the Atlantic Ocean between North America and Europe.

The satellite will offer approximately double the bandwidth of ViaSat's previous generation satellite, and seven times the coverage.

An ultra-high capacity satellite platform, ViaSat-3 comprises three ViaSat-3 class satellites plus advanced state-of-the-art ground network infrastructure, enabling the first truly global high-speed broadband service.

Each ViaSat-3 class satellite will offer more than 1,000 Gigabits per second (Gbps) or 1-Terabit per second (Tbps) - of bandwidth to enable high-speed Internet, including video streaming, at scale across multiple applications simultaneously.

The first ViaSat-3 satellite system will address the Americas, followed by a second satellite system serving Europe, Middle East and

Africa (EMEA) and a third system planned for the Asia Pacific region.

The ViaSat-3 satellite platform is expected to deliver unprecedented coverage, capacity, cost, service and flexibility.

Mark Dankberg, ViaSat's Chairman and Chief Executive Officer, said, "We have a long-standing relationship with Arianespace, and have committed to launch two ViaSat satellites in the next four years with them. By partnering with Arianespace on ViaSat-2, we build confidence in our plan to bring new

high-speed service plans across the U.S. and the region by the middle of 2017.

"These service plans are made possible with the innovative technologies underlying the ViaSat-2 network. Beyond ViaSat-2, we plan to launch a ViaSat-3 class satellite with Arianespace, where we will offer our customers even higher speeds and higher quality broadband services—ranging from faster home Internet services and in-flight video streaming to high-speed, high-value connectivity for government aircraft missions.

"These two satellite launches are key in the evolution to bring a global broadband communications network to market that delivers affordable, high-speed Internet access to all."

Arianespace Chairman and Chief Executive Officer, Stéphane Israël, said, "Arianespace is proud to be entrusted with the launches of ViaSat-2 and one ViaSat-3 class satellite, and thus be given the opportunity to contribute to the implementation of space-based solutions for global connectivity. I thus want to express my gratitude to ViaSat for its confidence and for involving Arianespace in the development of its broadband communications network. With this contract, Ariane 5, which completed last month its 70th successful mission in a row, is confirmed as the reference launch vehicle selected by most private satellite operators worldwide."

viasat.com

arianespace.com

www.boeing.com

Coming In March... NSR's 10th Wireless Backhaul Via Satellite Analysis

NSR's Wireless Backhaul via Satellite, 10th Edition is the longest-standing industry analysis and forecast of the satellite Internet and telephony backbone— the study includes 3 key segments:

- » *Mobile Backhaul*
- » *Internet & Telephony Trunking*
- » *IP Content Distribution (NEW FOR 10th Edition)*

The assessment covers the installed base of sites in seven regional markets, investigates trends impacting market growth and business models, forecasts capacity requirements and equipment shipments, and calculates satellite capacity and CPE revenues. The main issues and questions addressed in the study include:

- » *What are the trends driving or restraining growth in the installed base for each market vertical and region?*
- » *How is HTS expanding the addressable market in all verticals, and how are Business Models*

evolving for Service Providers, Equipment Vendors and Satellite Operators?

- » *How are market elasticity and the downward trend in pricing creating new demand and opening new markets?*
- » *What is the addressable market, and what are the opportunities in each region?*
- » *What are the technology trends shaping the industry, and how is demand for 2G/3G/4G services evolving in each region?*
- » *What are the implications of bandwidth-hungry sites in the battle of frequencies and architectures? What is the satellite capacity demand for each service in each region, and how is this being provisioned?*
- » *With Video and Media consuming most of the IP Traffic, can satellites enter the IP Content Distribution market serving CDNs, Video Offload and other opportunities?*
- » *What are the revenues to be generated from capacity provisioning and customer premises equipment (CPE) sales in each region and market vertical?*

Widebeam C-, Ku- and Ka-band coverage together with an HTS breakout into C-band, Ku-band, Ka-band and non-GEO HTS is now a standard part of this report. In addition, for the Mobile Backhaul section, this study includes a comparison of backhaul technologies (terrestrial and satellite), a series of financial models comparing different satellite architectures and base station technologies, and a section assessing the addressable market both in terms of total mobile base stations and the opportunities to extend network coverage.

nsr.com/research-reports/satellite-communications/wireless-backhaul-via-satellite-10th-edition/?utm_source=CC+Import&utm_campaign=95148c99ff-WBS10_CS.2_16_2016&utm_medium=email&utm_term=0_ff2c5c9f7f-95148c99ff-186137873

InfoBeam

Gilat's Satellite Backhaul Brings High-Speed LTE Services To SoftBank

SoftBank Corp. ("SoftBank"), a subsidiary of SoftBank Group Corp. providing mobile communication, fixed-line communication and Internet connection services to customers in Japan, and Gilat Satellite Networks Ltd., a provider in satellite networking technology, satellite mobility solutions and services, have announced that SoftBank intends to provide high-speed LTE services using Gilat's satellite-based cellular backhaul technology following a successful field trial.

This technology makes it possible for SoftBank to cost-effectively offer high-speed mobile communication services in remote areas where it is difficult to install fixed-line facilities and base stations. SoftBank expects to offer commercial services in Japan, based on this technology, within 2016.



SoftBank has already succeeded in providing cost-efficient 3G mobile communications in Japan, where it is difficult to build facilities for fixed-line and mobile communications, by using satellite communications as backhaul. SoftBank contributed to the development of Gilat's SkyEdge II-c high-speed satellite communications platform early on, and conducted verification work along the way. The latest trials demonstrated FTP downlink rates of up to 100Mbps using actual mobile handsets, which until now have been very difficult to achieve.

Yasuyuki Imai, SoftBank's Executive Vice President and Head of the Technology Unit, said, "With this technology, we will be able to also offer high-speed LTE services in mountainous regions, remote islands and other areas in Japan where it is difficult to install fixed-line backhaul cost-effectively and quickly. We already have satellite-based backhaul in those regions, but now we will be able to offer our customers LTE speeds. We also expect to see the application of this technology to the mobile network of our group company Sprint in the US."

Dov Baharav, Gilat's Chairman of the Board and Interim CEO, said, "Gilat is a pioneer in delivering 4G satellite-based cellular backhaul for mobile network operators—our new technology allows for quick time to market and complete 4G service."

gilat.com

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Hughes Mines Point-To-Point Satellite Links For MSHA Mine Emergency Operations

Hughes Network Systems, LLC has completed implementation of a managed enterprise network for the US Department of Labor's Mine Safety and Health Administration (MSHA).

The program is delivering remote connectivity to MSHA Mine Emergency Operation's (MEO's) vehicles and facilities across the country, further enhancing the agency's broadband capacity and communications infrastructure.

The contract has a ceiling value of approximately \$1.36 million over the course of one year plus four option years.

Under the program, Hughes is providing point-to-point satellite links for mobile site-to-site communications that satisfies low latency requirements for MSHA's high-priority network traffic/applications.

In addition, Hughes is providing access through an enterprise network comprised of point-to-point connections between the IP Gateway at the Hughes Network Operations Center and MSHA's data center. This solution delivers MSHA its requisite Internet connection speeds (3,072Kbps down/1,024 Kbps up), allowing it to deploy small private networks more economically and eliminating the need for a backhaul.

Other contracted deliverables provided by Hughes include:

- » Project planning and implementation scheduling
- » Coordination of overall site installation process
- » Implementation of site maintenance plan
- » Reporting and project status reviews
- » Ongoing operations and support management

"As the world's leading satellite broadband provider, Hughes is in a unique position to satisfy MSHA's enterprise network requirements, especially as it relates to mobile and remote connectivity solutions," said Tony Bardo, assistant vice president of Government Solutions at Hughes. *"The equipment and services under our HughesON™ suite of managed services will greatly increase the mobility of MSHA's personnel and help facilitate their mission to improve the safety of our nation's mines."*

hughes.com/

SpeedCast + Gazprom Partner To Address Africa's Energy Sector Comms

SpeedCast International Limited ("SpeedCast") has announced a new agreement with Gazprom Space Systems ("GSS"), a Russian-based satellite operator, to expand satellite communications services in Africa.

This partnership allows SpeedCast to access capacity on GSS's Yamal-402 Ku-band satellite to provide high-performance services to global oil and gas companies across Africa.

With the uplink based in Germany, customers will be able to land their traffic directly into Europe, taking advantage of high-speed interconnection throughout Europe.

Further, Germany's excellent standards of infrastructure and advanced data security laws will ensure the highest levels of security for customers' sensitive data.



"We are always searching for the best solutions for our customers in the key countries in which they operate," said Moti Shulman, Vice President, Technologies & Network Planning, SpeedCast International Limited.

"The expansion of our services for the African resource market augment SpeedCast's current service capacity in Africa. We are thrilled to partner with Gazprom Space Systems to deliver communication services into the African region. Delivering innovative

solutions to meet the needs of our customers is at the heart of our success."

Dmiry Sevastyanov, Director General, Gazprom Space Systems, said, *"Our partnership with SpeedCast will further strengthen our common ability to deliver the reliable and efficient broadband and mobile connectivity that energy companies demand today."*

**speedcast.com/
gazprom.com/**

GVF To Spotlight SATCOM Mobility

In response to escalating demand for satellite-based solutions—as well as challenges posed by new user requirements—the Global VSAT Forum (GVF) will launch the Applied Innovation Conference.

The industry event, which will be hosted by Intelsat at their Washington, D.C. offices, will examine new technology solutions applied through space segment, Earth station equipment, networking, and delivery of satellite communications and broadcasting.

“The conference will present a unique opportunity for the technical community, at all levels of the supply chain, to achieve peer-reviewed recognition for innovation, to network with colleagues, and to better understand the real-world needs of the market,” said David Hartshorn, Secretary General, GVF.

The theme for the first Applied Innovation Conference will be “Satcom Mobility: Challenges and Solutions”. In preparation for the event, GVF has established a peer-review Technical Committee and is inviting submissions related to antennas; amplifiers; modulation and coding; acceleration; bandwidth management; constellations; interference management; payloads; propagation effect mitigation; fixed, COTP, and COTM terminals; user interfaces; human factors; and cost reduction. Developments that support interference prevention will be given a high priority in the Technical Committee’s selection process.

Authors of selected papers will be invited to present their work in a session or in poster format in the Conference exhibition area. Sessions will include panels of end

users, operators, and service providers with presentations of accepted technical papers. The panel, authors, and audience will have a unique opportunity to interact and develop new understandings of technological solutions to real-world industry needs. Accepted papers will be published in open-access, online

proceedings. For further details, including submission deadlines and other instructions for authors, contact the Technical Chair.

To register and reserve your seat, and to inquire regarding sponsorship opportunities and exhibit space, contact **Angie.Mar@gvf**.

A New Generation Debuts From NovelSat

NovelSat, a provider in satellite transmission technology, has released NovelSat NS4, the company's 4th generation satellite transmission waveform, for general availability.

In head-to-head demonstrations, NovelSat has shown that NovelSat NS4 delivers up to 22 percent higher spectral efficiency compared with DVB-S2X, the industry's current satellite transmission standard.

NovelSat NS4 is now available as an optional software package in all NovelSat satellite modems, modulators and demodulators, which also support and are backward compatible with all industry specifications.

For the satellite communications industry, that extra boost of spectral efficiency with NovelSat NS4 means more HD and 4K UHDTV channels and more data without increasing their costly satellite bandwidth budgets.

For those with steady satellite bandwidth needs, as much as 22 percent better



efficiency means they can transmit the same content using far less bandwidth.

In networks using the DVB-S2 standard, switching to NovelSat NS4 can boost capacity by up to 45 percent without increasing bandwidth.

The new NovelSat NS4 waveform, like all NovelSat features, is a software upgradable option that can be installed over the air (OTA) on all NovelSat satellite devices.

This software-only model has proven very popular with NovelSat customers who want to optimize bandwidth utilization without the hassle or cost of replacing equipment.

"Since we released NovelSat NS3 in 2011, NovelSat has consistently offered our

customers the most bandwidth efficient satellite technologies available," said Itzik Wulkan, NovelSat CEO.

"NovelSat NS4 is a technological breakthrough which is the culmination of years of experience and hard work that started the day after NovelSat NS3 was released."

Along with NovelSat NS4, NovelSat released the NovelSat NS4 Calculator. This is a tool that can be used, upon request, to show details about how NovelSat NS4 optimizes bandwidth usage with varying operating parameters.

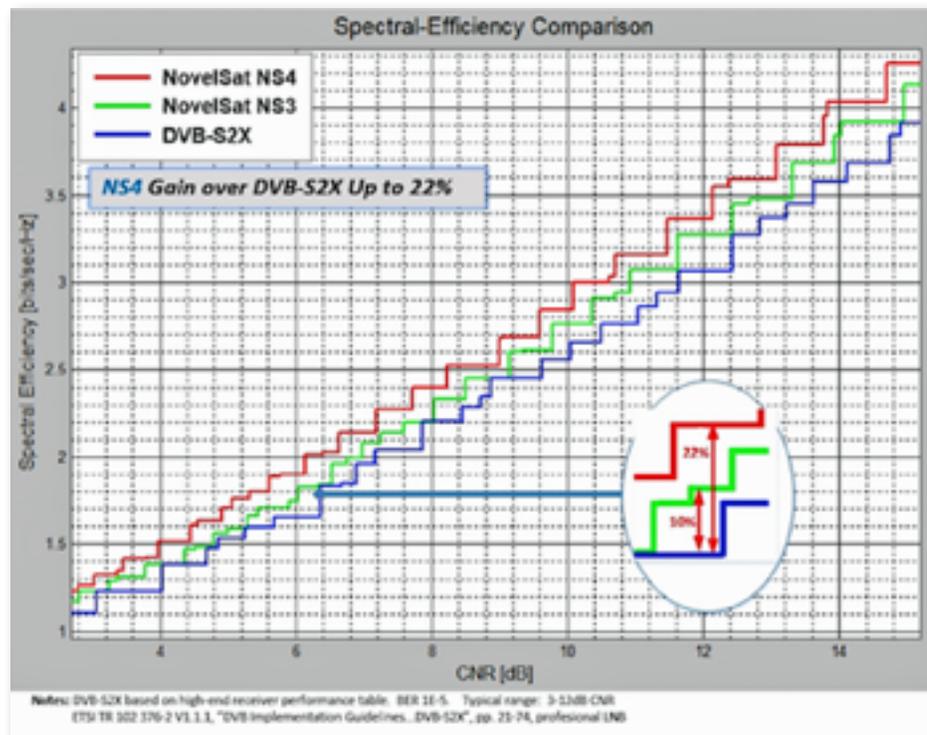
NovelSat also recently announced a new streamlined customer support program which, among its other advantages, offers Gold-level customers eligibility for free upgrade paths to NovelSat NS4.

NovelSat first demonstrated the competitive advantages of NovelSat NS4 at the Satellite 2015 Exhibition.

Next week, NovelSat is inviting broadcasters, satellite communications providers, users and integrators to see NovelSat NS4 demos at the Satellite 2016 show, March 8-10 at National Harbor, Maryland.

* DVB-S2X support available Q2-2016.

novelsat.com/



SapphireBlu™ SSPA/SSPB Enters Market From Advantech Wireless

Advantech Wireless has debuted a new, significant advance in solid state power amplifier (SSPA) technology with the release of its SapphireBlu™ Solid State Power Amplifier/Power Block (SSPA/SSPB), based on second generation Gallium Nitride (GaN) technology.

The new system is designed to service new satellites operating in the 12.75 to 13.25 GHz band.

This small form factor SSPA is designed to be hub mounted very close to the antenna's flange input, eliminating losses through a waveguide, which will now make it possible for a relatively small SSPA—alone—to transmit the signal.

Because of this efficiency, air conditioned shelters for a Klystron or indoor mounted HPA can be eliminated. Instead of needing multiple antennas at a teleport, operators can reduce their number, simplifying operations at each teleport.

Further, the unit operates as 1:1 redundant or 1+1 phase combined, to provide additional power when traffic demands, and the unit has a built-in L-band interface Back-Up Converter without separate up converters.

The SSPA units are very power efficient, reducing operational expenses for power consumption, and capital expenses from reducing the need for uninterruptible power sizing. This enables a more resilient system for operators at no additional cost.

Cristi Damian, VP Business Development at Advantech Wireless, said, *"This new technology is designed to replace multiple older technology klystrons or Traveling Wave Tubes (TWTs), with more resilient technology, much simpler hardware configuration on site, and a considerable reduction in operating expenses."*

Visit the Advantech Wireless Booth 717 during the Satellite 2016 Conference and Exhibition, occurring from March 7th through March 10th at the Gaylord National Convention Center, National Harbor, Maryland.

advantechwireless.com/

Hiltron Just In Time... Summer Games Delivery Via DBS Satellite Link



Hiltron announces a satellite link will be used to carry broadcast television

content from South America to viewers in Europe.

The new system will be located in one of the Baltic states and will be live by the end of June in time for the 2016 Summer Games in Rio de Janeiro.

"The new link will be a complete turnkey solution with five active channels and is designed to operate as a complete backup system which can be switched into action if the primary feed fails," said Hiltron Managing Director Jan Molter.

Core elements of the new system include a 3.6 meter diameter satellite dish on a Hiltron HMAM motorized antenna mount. HMAM is a high-precision motorized satellite antenna mount designed for two-way VSAT communication or receive-only downlink applications. The combined head and drives form a three-axis motorized mount with 180 degrees of azimuth adjustment, 90 degrees of elevation adjustment range and fully adjustable polarization.

Client-supplied solid state power amplifiers and upconverters will be integrated with a Hiltron HACU antenna control unit. This and its associated motor-control electronics are contained in a weatherproof outdoor housing.

The HACU can be operated from a PC running a graphic user interface compatible with standard web browsers.

The control GUI displays all the information required to set and maintain azimuth, elevation and polarization, including current and target positions plus a database of potential accessible satellites.

Also integral to the system will be a Hiltron HDCU-E combined ice-sensing and dish heating controller.

hiltron.de/

An Expansion Is In The Works For North Telecom



North Telecom is going to be expanding their facilities.

"This brings the North Telecom facility and extends the firm's reach to APAC. The company will now be able to bridge east to west and will be able to offer more cutting

edge service and solution to global market," said Mahdi Nazari Mehrabi, Managing Director Asia and CTO North Telecom.

"We are investing in this new facility and additional capacity in Singapore to serve the APAC region, these investment will allow NorthTelecom to extend its leading edge and forefront solution and services into Asia and Pacific market in the coming month," Mehrabi added.

The new facility will be equipped with state of the art ground equipment as well as a highly qualified and competence team on the ground.

North Telecom is a global satellite service provider that provisions satellite communications and ICT services on land and at sea.

Having high-quality managed network services from east to west, North Telecom is delivering leading edge satellite communication services and solution to meet our customer demand all across the spectrum.

Present in 12 international points of presence and 7 teleport operations, as well as serving to more than 100 partners across the globe, North Telecom is enabling business to reach their customers worldwide.

Information regarding North Telecom's fleet access is available at:

northtelecom.com/fleet

Berliner Glas Group Has Optical Systems In Space

The EDRS-A satellite was successfully launched into orbit and the “first section” of the SpaceDataHighway has now been built.

On January 29, 2016, at 23:20 CET, the payload EDRS-A on board the communications satellite Eutelsat 9B was launched into space by a Proton rocket from the Baikonur Cosmodrome. The satellite has already reached its position in geostationary Earth Orbit, that location being 9 degrees East.

EDRS-A is the first element of the European Data Relay System (EDRS). This system will ensure that low-orbiting satellites will be able to send their information to Earth in near-real time. EDRS-A is equipped with a laser communication terminal (LCT) that was developed and manufactured by Tesat-Spacecom GmbH & Co. KG based in Backnang, near Stuttgart, in Germany.

This laser communication terminal contains several optical components and systems manufactured by the Berliner Glas Group. Optical communication allows enormously increasing amounts of data to be made available in a faster, more reliable way to customers.

In order to exploit the advantages of data transmission with laser light, very sophisticated technologies have been developed and qualified for use in space. Copernicus, the European Program for monitoring the Earth, will be the first user of the SpaceDataHighway. Copernicus' satellites Sentinel-1A and Sentinel-2A that already are located in low Earth Orbit are also equipped with laser communication terminals. Sentinel-1A and Sentinel-2A will soon transmit their data to EDRS-A via laser. EDRS-A then will send the information directly to Earth.

The optical components and systems manufactured by the Berliner Glas Group are important elements of the laser communication terminals. The European Data Relay System will enable round-the-clock exchange of large volumes of data between satellites. This will significantly improve Earth observation performance as well as reduce emergency response times.

EDRS-C, the second geostationary satellite of the European Data Relay System, will be launched into orbit on board an Ariane 5 rocket. With EDRS-C, the second section of the SpaceDataHighway will be built. Its orbital position will be 31 degrees East.

edrsspacedatahighway.com

berlinerglas.com/home

NOAA's Jason-3 Reaches Final Orbit



Following a series of nine orbital maneuvers, executed over several days by the CNES team in Toulouse, France, Jason-3 has reached its final orbit—traveling 348 miles and only one minute and 20 seconds behind Jason-2.

Now that the satellites are flying in tandem formation, the calibration and validation of Jason-3's data can begin.

Jason-3, a U.S.-European satellite mission, lifted off from Vandenberg Air Force Base in California on January 17, 2016, at 10:42 a.m. PST aboard a SpaceX Falcon 9 rocket to become the latest spacecraft to track the rate of global sea-level rise.

Jason-3 will also help NOAA's National Weather Service more accurately forecast the strength of tropical cyclones that threaten America's coasts.

While flying in a low orbit 830 miles above the Earth, Jason-3 will use a radar altimeter instrument to monitor 95 percent of the world's ice-free oceans every 10 days.

Since the Topex/Poseidon, and Jason satellite missions started in 1992, researchers have observed global sea-level rise occurring at a rate of 3 mm a year, resulting in a total change of 70 mm—or 2.8 inches—in 23 years.

This successful launch was a major accomplishment for the Jason mission, but it is by no means the end of the road. On the contrary, much of the hard work has just started.

Satellite instruments and the data they provide are incredibly precise. Once operational, the Jason-3 satellite will be able to detect changes in sea level height down to the millimeter. This requires a careful fine-tuning of the instruments from here on Earth.

Once they reach space, satellites are put through a "commissioning phase" that usually lasts a few months.

During this phase, the teams check each of the satellite's systems to make sure they are working properly.

They will also evaluate the accuracy of the data coming from the satellite and make sure that the instruments it carries are properly calibrated.

Once all systems are checked out and deemed operational, the satellite will be moved into its final destination orbit.

Three days after Jason-3 launched, NOAA's partners at CNES began to acquire and process real-time data from the satellite.

NOAA and CNES will continue to calibrate and validate the instruments and data while EUMETSAT conducts processing trials of the data received at the Usingen ground station

Once this six month phase is complete, Jason-3 will officially begin operations in its planned orbit.

These highly detailed measurements of sea surface height, a measurement used to study sea level rise, are a critical factor in understanding Earth's dynamic climate.

Sea surface height data are also used to study hurricane intensity, tsunami dynamics, El Niño Southern Oscillation, eddy dynamics, ocean boundary currents, coastal and shallow water tides, as well as weather and climate forecasting.

nesdis.noaa.gov/jason-3/mission.html



The launch of Jason-3 aboard a SpaceX Falcon 9 launch vehicle. Photo is courtesy of SpaceX.

STS Global Volunteers To Do The Dishes For You



STS Global is a satellite communications and telecommunications company that provides custom products, networks and services leveraging mainstream applications with wireless technology for clients worldwide.

According to the company, the foundation of STS Global offers four strong pillars: Time-tested expertise, systems reliability, customer value, and exceptional integrity.

STS Global will be at Booth #852 at Satellite 2016.

- » *Next Generation-Networks—
Design & Integration Services*
- » *Gateways & Hub Stations—Third
Party Equipment Testing*
- » *Media & Broadcast Centers—
Cyber Security Assessment*
- » *Fly-Aways & Transportables—
Certification and Training*
- » *Lifecycle Support 24/7—
Engineering Support*

STS is a proud supporter of member of SSPI's Satellites Make a Better World.

Whether the objective is to broadcast a live event to millions, create systems that provide services to remote locations, transmit crucial data to a battlefield, support a new media broadcast center, or provide secure networks for a large corporation, our complete range of best of breed technologies

and satellite communication solutions are dependably a step ahead.

From better wireless connections to tighter cyber security, STS Global technologies also serve to reassure customers—in the US and overseas—that there is no communication

problem that cannot be solved, and virtually no point on Earth that cannot be reached.

stsglobal.com/

COTM Combo Antenna Rolls Out From KNS

KNS, Inc. announces their first dual band Ka/Ku satellite COTM antenna, expanding their SuperTrack Series that requires no physical labor to change frequencies.

Frequencies are automatically changed by the satellite modem or manually through the control software. This simple to install and operate COTM broadband satellite antenna provides quality, reliable and secure voice, data and cloud applications, for multiple applications, such as trucks, airplanes, Unmanned Ariel Vehicles (UAVs), submarines, helicopters, satellite News Gathering (SNG), Cars, Tanks and much more. The elliptical reflector is low profile and is equivalent to a 0.9 meter antenna.

"Our engineering department developed a totally new type of patent-approved satellite antenna to meet the demanding needs of our customers who require fast, secure

communications on the move," said Noah Chung, Director, KNS, Inc. *"The key to a successful antenna is to provide as much automatic functionality as possible. We, therefore, included in our new COTM antenna automatic tracking that allowed tracking according to input parameters, automatic collection of longitude, latitude, heading, azimuth and elevation data. We even created automatic polarization switching and automatic frequency band feed switching."*

One of the unique features of the automatic switching is the ability to adjust from linear 180° Ku-band to Ka-Band with a selectable Left Hand Circular Polarization or Right Hand Circular Polarization (RHCP) in any combination for roaming purposes. Other important key features include self-diagnosis and monitoring, and satellite re-acquire time of less than 5 seconds, self-diagnosis and monitoring.

The COTM antenna operates under the following frequency: KU-Band - RX: 12.25 GHz-12.75 GHz - TX: 14.0 GHz-14.5 GHz KA-Band - RX: 19.6 GHz-21.2 GHz - TX: 29.4 GHz-31.0 GHz With regards to the Antenna Gain: KU-Band - RX: 39.4 dBi @12.5 GHz - TX: 40.2 dBi @14.24 GHz KA-Band - RX: 44 dBi @20.4 GHz - TX: 47.5 dBi @ 30.2 GHz.

The COTM has been built with ruggedness and durability in mind and has an elliptical carbon fiber reflector and uses dual feed technology—plans are already in the works to migrate their maritime terminals in Q2 of this year.

kns-kr.com/main/

Advanced Avionics From Rockwell Collins To Enhance GoAir Airbus Aircraft

India-based GoAir will feature Rockwell Collins' advanced avionics, including MultiScan™ ThreatTrack weather radar and GLU-925 Multi-Mode Receiver (MMR), on 72 Airbus A320neo aircraft—deliveries will start later this year.

MultiScan ThreatTrack goes beyond hail and lightning prediction within a thunderstorm cell and alerts pilots to these significant threats adjacent to or above the cell.

In addition, the new radar is the first in the industry to feature two levels of turbulence detection—severe and ride quality—which more accurately informs flight crews of the type of turbulence in their path.

Unique to MultiScan ThreatTrack is its patented Predictive Overflight™ Protection, which tracks thunderstorm cells ahead and below the aircraft, measures growth rate, predicts bow-wave turbulence and indicates potential threats in the aircraft's flight path.

Rockwell Collins' GLU-925 MMR is the first certified GPS Landing System receiver and enables high-integrity navigation, including RNP AR, Category III ILS and Category I Global Positioning Landing System approaches.

The MMR also enables GPS position and availability requirements for ADS-B Out mandates.

In addition to ThreatTrack and MMR, GoAir selected Rockwell Collins' ADF-900 Automatic Direction Finder, DME-2100 Distance Measuring Equipment, VHF-2100 Transceiver, HFS-900D Radio, and VOR-900 Omnidirectional Radio.

"The advanced, reliable avionics systems selected by GoAir will translate into safe, smooth rides for passengers," said Jim Walker, vice president and managing director, Asia Pacific for Rockwell Collins.

"In addition, these flight deck technologies are especially important in regions without robust ground-based navigation or weather radar networks."

rockwellcollins.com/

GVF Advanced SATCOM Pro Certification Awarded To Telekom Malaysia

The importance of high-quality satellite Earth station installation, maintenance and operation is being reinforced in Southeast Asian markets through recognition of Telekom Malaysia's personnel as "GVF Advanced Professionals."

The company's engineering group has achieved the designation by completing comprehensive training and Certification for operation and support of VSAT systems. GVF is the non-profit association of the satellite communications industry. The organization has been developing and providing training programs

for thousands of satellite communications professionals for nearly a decade.

In order to qualify for the Certification, Telekom Malaysia's personnel completed GVF-530, 531 and 532 for Basic Technical Operator Certification and GVF-510, 520 and 521 – followed by a Hands On Skills Test (HOST)—for Advanced Satcom Professional Certification. Telekom Malaysia's personnel engaged the training through GVF's online portal at

gvf.org/training.

Telekom Malaysia of Kuala Lumpur entered into the program as part of an international industry initiative to promote best practice. The on-line courses used to support the program were prepared and are being administered by SatProf, Inc. GVF VSAT Installation & Maintenance Certification is the global industry standard for training installers of bi-directional satellite Earth stations.

It was created by a consensus of volunteers serving in the GVF Education & Training Working Group (E&TWG), whose mission is to identify, formulate and share knowledge that is beneficial to the VSAT industry, its shareholders and stakeholders.

"GVF Advanced Certification is a high bar," said David Hartshorn, GVF's Secretary General. "Telekom Malaysia's engineering and technical team has demonstrated that they have the skills necessary to install and operate satellite communications systems with the highest level of technical competency."

gvf.org/

Paradigm's Swarm45 Points The Way



Paradigm's new flat panel Swarm45 provides high data rates together with extreme portability and simple pointing.

Swarm45 will operate on any high-throughput Ka-Band satellite.

The Swarm45 is ultra portable and quick to deploy and stow.

The unit has a total weight of only 14.5 kg (32lbs), so even with packaging, IATA regulations are easily met.

Designed around the PIM (Paradigm Interface Module) terminal controller, the Swarm45 provides everything you need for straightforward setup and pointing, allowing you to be operational in less than 5 minutes.

The PIM has an integrated modem and is designed for simple and intuitive setup and deployment.

The integrated audio and visual pointing aids provide an effective method of acquiring the satellite without the extra bulk of motors and controllers.

The Swarm45's ultra portability and rapid deployment capability make it ideally suited to the military, broadcast, government and disaster recovery sectors.

"With the Swarm45, we are providing the high data rates of VSAT with the same portability and simplicity of BGAN. Our initial customers have been impressed by the flexibility and ease of use that this terminal provides," said Warren Ackerley, Business Development Director at Paradigm.

paracomm.co.uk/

The Robert A. Heinlein Institute For Space Entrepreneurship & Space Innovation Seeks A Home



The International Space University (ISU) is seeking applications from American institutions to establish the Robert A. Heinlein Institute for Space Entrepreneurship & Space Innovation on a campus in the United States.

Once established, the Institute will offer a range of training, conferences, seminars, short courses, public events and research related to entrepreneurship and innovation in space commerce.

From its central campus in Strasbourg, France, the ISU graduates over 200 students a year in its masters of space science and other space studies programs held on the main campus and at locations around the world.

The recent emergence of "new space" companies in the United States such as Planet Labs, Made In Space, SpaceX, Blue Origin, Virgin Galactic and others have sparked wide interest in space entrepreneurship among a new generation of engineers, technologists, and investors.

Many of those leading these new space companies are graduates of the ISU and ISU believes that the new Institute will become an intersection of disciplines for the purpose of identifying creative, innovative, and imaginative solutions to taking advantage of business opportunities in near-Earth space and beyond.

"The Institute will become a global meeting place for entrepreneurs who want to understand the challenges of building a space enterprise," said Chris Stott, a member of the ISU Board of Trustees who is leading the search for a U.S. campus to host the new institute. *"It will be both an international center of study and an incubator of space entrepreneurialism and innovation."*

Dr. Christian Sallaberger, Chairman of ISU, added, *"The U.S. plays a leading international role in the area space entrepreneurship, and the new Robert A. Heinlein Institute for Space Entrepreneurship & Space Innovation will serve to enhance*

ISU's regional footprint in the U.S., as ISU continues to deliver on its mission to provide educational programs of the highest caliber to the global space community."

The ISU is seeking expressions of interest from leaders of educational institutions who want to create, develop, build, program and staff the Institute, named in honor of Robert A. Heinlein, one of the foremost science fiction writers of the 20th century and himself an entrepreneur.

The successful applicant selected to host the Institute will partner with ISU to establish the Institute's programs; hire faculty and visiting lecturers; and create programs and events that attract wide public attention and additional funding and grants.

The ISU has asked applicants to submit outlines by February 29 of how they would house and support the institute.

The field of applicants will then be narrowed, with the finalists responding with more detailed applications. The ISU expects to select the final location for the Institute in September.

isunet.edu/

Beam Communications Has GO! Power

Beam Communications has announced Telstra will sell the innovative Iridium GO!® nationally throughout Australia, starting immediately.

Beam Communications, a wholly own subsidiary of ASX listed World Reach Limited, designed and manufactures the product under an OEM arrangement for Iridium Communications Inc.

"Powered by the world's furthest reaching network, the Iridium GO!® is a compact, rugged and portable device that provides global voice calling and SMS solutions and enhanced messaging and email capabilities

through optimized apps for any Android or iOS device," Beam Communications CEO Michael Capocchi said. *"A major benefit of the Australian designed Iridium GO!® is it enables satellite connectivity to the Iridium satellite network for mobile devices where terrestrial networks do not provide coverage or when they may become unavailable. Simply flip up the integrated antenna and the battery-powered unit connects quickly and automatically to the Iridium low-Earth orbit satellite constellation to extend the functionality of the mobile devices. It's possible to connect and operate up to five devices within this area using the Iridium GO!® application on each device."*

Iridium GO!® supports a range of global communications, including: voice calling, SMS, email, social networking, photo sharing and SOS Alert and Tracking capabilities. Iridium GO!® with a Telstra Mobile Satellite service package is available at Telstra retailers nationally and through the World Reach subsidiary, online satellite phone sales business, SatPhone Shop, satphoneshop.com.

beamcommunications.com/

Panasonic Avionics Signs On With Telesat For Capacity



Artistic rendition of the Telstar 12 VANTAGE satellite. Image courtesy of Telesat.

Telesat and Panasonic Avionics Corporation (Panasonic) announced today that Panasonic has signed another multi-year contract for Telesat satellite capacity.

In this latest agreement, Panasonic has contracted for nearly all the high throughput satellite (HTS) Ku-band capacity covering the Mediterranean, Europe and Middle East on Telesat's new Telstar 12 VANTAGE.

Telstar 12 VANTAGE became fully operational at 15 degrees West in December 2015 and will provide Panasonic with HTS capacity over key aero routes from Western Europe to the Middle East enabling them to bring the very latest in in-flight Wi-Fi to carriers across the region.

Panasonic will also be using the HTS capacity of Telstar 12 VANTAGE to expand their mobile broadband offerings to growing maritime markets in the Mediterranean and European waterways as well as to oil and gas operators in the North Sea.

"It is always gratifying when a knowledgeable industry leader like Panasonic compares a number of satellite alternatives and decides once again that Telesat is their best choice,"

said Tom Eaton, Vice President, International Sales for Telesat.

"Telstar 12 VANTAGE is a powerful high throughput satellite designed to provide customers like Panasonic important operational and commercial advantages. Panasonic's multi-year commitment validates the advanced capabilities of Telesat's newest satellite and we look forward to continuing to deliver to Panasonic the superior technical

performance and outstanding support they have come to expect from Telesat."

"Telesat is highly respected for their ability to design innovative satellites," said David Bruner, Vice President, Global Communications Services at Panasonic Avionics.

"Their cooperation in adjusting the position of the HTS spot beams on Telstar 12 VANTAGE to meet Panasonic's requirements was outstanding. This further optimizes the service for Panasonic and gives us an edge in winning mobile broadband business in the air and at sea.

"Panasonic now has Ku-band capacity on four Telesat satellites and, with this latest contract for nearly all the HTS Ku-band covering the Mediterranean, Europe and Middle East on Telstar 12 VANTAGE, we are well positioned to expand in maritime and energy markets across Europe. Panasonic values our close ties to the Telesat team and we are truly excited to be making use of Telstar 12 VANTAGE—the first satellite with significant HTS Ku-band over the Mediterranean and North Sea."

telesat.com/

panasonic.aero/



The Telstar 12 VANTAGE coverage footprint. Image courtesy of Telesat.

Aerojet Rocketdyne Receives Thruster System Contract From NASA



Aerojet Rocketdyne, a subsidiary of Aerojet Rocketdyne Holdings, Inc. has been awarded a contract valued at more than \$2.5 million from NASA's Advanced Exploration Systems Division to develop and demonstrate a high-power electric propulsion system.

Once fully developed, the technology will help reduce trip times and the cost of human spaceflight to cislunar space and beyond to Mars.

Under the contract, the Aerojet Rocketdyne team will complete the development of a 100-kilowatt Hall Thruster System, including a 250-kilowatt thruster that uses Aerojet Rocketdyne's patented multi-channel Nested Hall Thruster technology; critical elements of a 100-kilowatt modular Power Processing Unit (PPU); and elements of the modular xenon feed system. PPU's convert the electrical power generated by a spacecraft's solar arrays into the power needed for the Hall Thruster.



Photo is courtesy of Aerojet Rocketdyne.

The contract includes system integration testing, and will culminate with a 100-hour test of the 100-kilowatt system at NASA Glenn Research Center in Cleveland, Ohio.

"We look forward to working with our teammates in the development of this high-power, high-efficiency propulsion technology," said Julie Van Kleeck, vice president of Advanced Space and Launch Systems at Aerojet Rocketdyne.

"Our advanced Nested Hall Thruster system will help transform the future of human spaceflight, allowing cost-effective delivery of large cargo to support human missions to Mars, and potentially transport astronauts to their destination faster, more efficiently and at a more cost-effective price."

Aerojet Rocketdyne is also working with the University of Michigan, the Jet Propulsion Laboratory, and Silicon Turnkey Solutions. The contract spans 12 months, with two more

12-month options worth an additional \$4 million total.

Aerojet Rocketdyne is one of 12 industry teams that were named by NASA to help build space and human exploration capabilities for deep space destinations as part of the Next Space Technologies for Exploration Partnerships (NextSTEP) initiative.

The industry teams were selected for their technical ability to mature key technologies and their commitment to the potential applications, both for government and private sector uses, according to NASA.

As part of its commitment to a public-private partnership with NASA, the Aerojet Rocketdyne team has invested almost \$12 million in the technology to be developed.

Current electric propulsion systems operate at 5 kilowatts or below, and there are plans for near-term spacecraft using between 20 to 50 kilowatts, such as NASA's Asteroid Re-direct Mission.

Much higher powers, such as the scalable 100-kilowatt systems being developed on this program, are required for transportation of the large payloads envisioned for sustained human missions to Mars.

rocket.com/

Location Aggrandizement For Geosync Microwave

Earlier this year, Geosync Microwave's President, Arthur Faverio, announced the purchase of a 20,000 square foot building at 320 Oser Ave in the Hauppauge Industrial Park, Hauppauge, New York, within a half mile of Geosync's current facilities.

The new building significantly increases Geosync's manufacturing space which will immediately be used to increase production capacity of its RF SATCOM

products and provide additional engineering labs and offices.

Please refer to the company's website—<http://www.geosyncmicrowave.com>—for the latest in new product announcements and specifications for their advanced SATCOM Up and Downconverters, Test Translators, SATCOM LNAs and LNBs, Precision Synthesized Frequency Converters, Switchover Assemblies, and more.



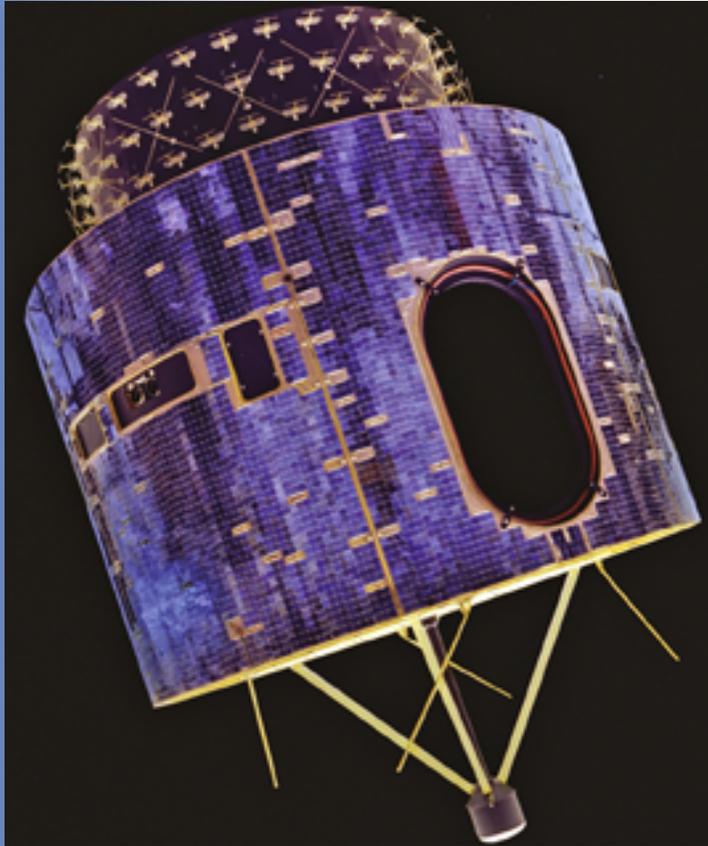
geosyncmicrowave.com/

Old Faithful: The SSL Satellite That Keeps On Going

By David Bernstein, Senior Vice President, Program Management, SSL

For seven hours each day, an SSL-built satellite that was launched 37 years ago continues to provide a communications lifeline to researchers at the South Pole.

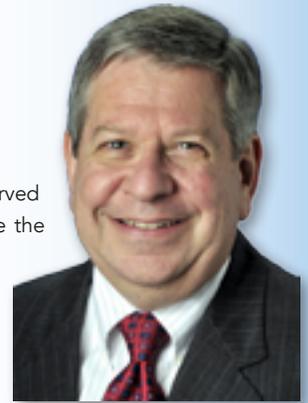
GOES-3 is SSL's longest surviving spacecraft that remains in service, and one of the oldest functioning satellites still on orbit. Manufacturing was completed in 1978 by Ford Aerospace, which in 1990 became Space Systems/Loral, and subsequently became what we know as SSL today.



The GOES-3 satellite. Image is courtesy of SSL.

GOES-3 is one of a series of weather satellites that SSL built under a contract with NASA for the National Oceanic and Atmospheric Administration (NOAA). The GOES-3 mission started when the satellite was successfully launched into geostationary orbit on June 17th, 1978 aboard a Delta 2914 rocket (pictured with GOES-3 on board) from the Cape Canaveral Air Force Base in Florida.

According to NASA, "the satellite had the capability to continuously monitor cataclysmic weather events such as hurricanes and typhoons, relay meteorological data from over 10,000 surface locations into a central processing center for incorporation into numerical weather prediction models and to perform facsimile transmission of processed images and weather maps to WEFAX field stations."



Built for a five year mission, GOES-3 served this purpose for 11 years, more than twice the satellite's contracted life. At the end of this time in 1988, the satellite was scheduled for decommission. That was, until GOES-3 was noticed by an on-going University of Hawaii program called PEACESAT, which successfully negotiated the use of the satellite in 1988 and repurposed it as a communications satellite for their program, which aimed to bridge the digital divide in the Pacific Rim and Basin.

In 1991, four years after GOES-3 started its life as a communication satellite, PEACESAT relinquished their use of the satellite and allowed NOAA to repurpose it for use by the National Science Foundation (NSF). The NSF is an independent federal agency that supports fundamental research



GOES-C on a Delta 2914 before launch. Image is courtesy of NOAA.



The Amundsen-Scott South Pole Station.
Photo is courtesy of Daniel Leussler CC

and education across all fields of science and engineering and is the U.S. government agency responsible for operation of the United States Antarctic Program (USAP).

NOAA allowed the satellite to drift to a location at 105 degrees West in order for the University of Miami in Florida to provide telemetry and command and teleport services for the NSF. The satellite still operates in this configuration today.

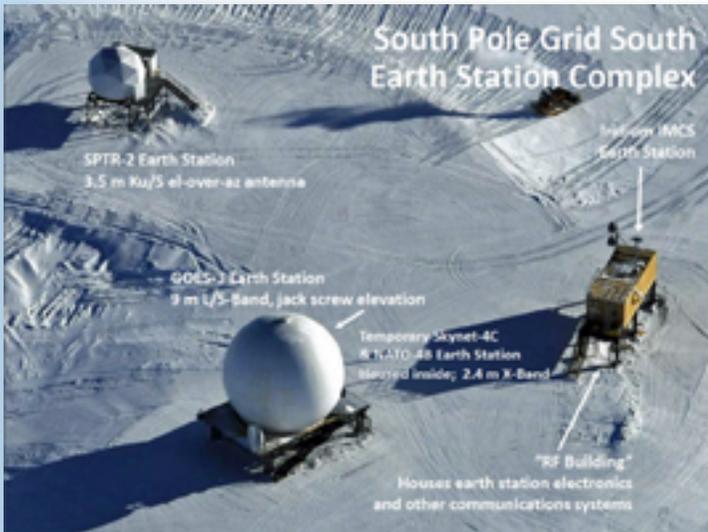


Image is courtesy of the National Science Foundation.

According to Patrick Smith, Communications Manager for the NSF Division of Polar Programs and a 35 year veteran of Antarctic operations, "GOES-3 belongs to a very rare class of operational geostationary satellite that has had its orbit maintenance station keeping terminated for a significant period of time, allowing the satellite's orbit plane inclination with respect to the Earth's equatorial plane to continuously drift to higher and higher angles. This results in the satellite becoming visible for a period of time each day when the satellite is in the portion of its orbit that is inclined below the equator."

GOES-3 uses spin stabilization for attitude control, which requires almost no fuel for maintaining satellite orientation relative to the Earth, and its electronics sub-system is simple and rugged. Although GOES-3 was originally designed and equipped as a weather satellite, Smith explains that communication is made possible "by the use of the S-Band to L-Band translator on the satellite that was originally intended for the broadcast of processed GOES-3 Visible and Infrared Spin Scan Radiometer (VISSR) imagery processed on the ground and rebroadcast to end-users."



9 meter GOES-3 Earth station, prior to enclosure under a radome, circa 2002. The smaller, parabolic antenna to the left on the platform is a 10 foot, fixed, pointed antenna to serve as a contingency backup to the motorized 9 meter antenna. Photo is courtesy of the National Science Foundation.

During its time as a communications satellite, GOES-3 changed hands multiple times and served a range of missions that included public service telecommunications, and atmospheric research. Today, GOES-3 is one of three satellites which provides Internet Protocol (IP) communication capabilities for the Amundsen-Scott South Pole Station in Antarctica.

These satellites work together to provide network connectivity when the other falls out of sight, but even with three satellites available to provide Internet coverage, there is still a 11.7 hour period of the day wherein the South Pole Station is out of sight of the satellites and has no telephone service or network connectivity.



Image is courtesy of the University of Miami.



The South Pole Telescope. Photo is courtesy of Dr. Keith Vanderlinde, National Science Foundation.

GOES-3 is accessible in a seven hour window each day, during which the South Pole team uses it for daily, dependable IP communication services. These services become especially important during the winter when the isolated research team is enshrouded in darkness.

GOES and the other satellites that pass in view of the South Pole Station allow the researchers to share and access information crucial to their scientific experiments. The South Pole Station currently has two large-scale experiments and many active smaller experiments.

The South Pole Telescope, which is managed by an international research collaboration led by the University of Chicago, measures 75 feet tall, weighs 280 tons, and is used to explore dark energy, the phenomenon that may be causing the expansion of the universe to accelerate.

The second large-scale experiment, The IceCube Neutrino Observatory, is the world's largest neutrino detector, encompassing a cubic kilometer of Antarctic ice under the Pole.

The observatory is used to search for massless subatomic particles (neutrinos) from the most violent astrophysical sources, such as exploding stars, gamma-ray bursts, and cataclysmic phenomena involving black holes and neutron stars. Internet connectivity over GOES-3 helps the University of Wisconsin lead international collaboration to remotely manage and operate the IceCube array.

The SSL-built GOES-3 has been used as a weather satellite, an instrument for university-level atmospheric research, a telecommunications relay, and is now being used as a communications lifeline for the important research taking place at the South Pole. As one of the world's leading providers of satellites and spacecraft systems, SSL treasures the value that GOES-3 has brought to the world.

Today's SSL satellites are generally contracted to provide service for 15 years, but many will follow in GOES-3's footsteps to provide reliable service well beyond their expected lives.

sslmda.com/

David Bernstein is Senior Vice President of Program Management at SSL, a full-service provider of communications satellites and space systems. In this role, he is responsible for coordinating all engineering, manufacturing and support disciplines required to deliver SSL's high-power commercial communications satellites to SSL's customers.

Mr. Bernstein has more than 30 years of industry experience and has held several key management positions with the company as senior executive director for SSL's SES programs, executive director of Spacecraft Systems Engineering and executive director for SSL's Thaicom 4 (IPSTAR) program, the world's first dedicated broadband satellite.

Prior to joining SSL, Mr. Bernstein was at TRW, Space & Defense (now Northrop Grumman AS) where he was primarily involved in space communication payloads for U.S. Government programs. Starting as a communication systems analyst he held a number of increasingly responsible positions including Program manager for Government Payload programs and director of Communications Systems Engineering.

Mr. Bernstein earned his bachelor of science degree and master of science degree in electrical engineering and computer science from the Massachusetts Institute of Technology (MIT).

Focus: TWTAs + SSPAs For Ka-Band Satellite Uplink Applications

By Gerard Charpentier, Communications & Power Industries

After 30 years of experimentation and something of a false start by the telecom industry in the 1990s and early 2000s, Ka-band satellite systems are finally coming into their own.

HPA manufacturers have started to reliably provide the high power and bandwidth that broadcasters and Internet providers require, and providers of DSN, maritime and airborne solutions are taking advantage of the light weight and smaller mechanical footprints that Ka-band affords.

This article examines the latest proven high-power amplifier (HPA) technologies currently available on the market.

TWTAs have been the overwhelming choice for satellite uplinks in frequencies above Ku-band for years, largely because Ka-band signals are susceptible to rain fade. Although periodic outages due to rain fade do not cause great concern to some communications service providers, they are unacceptable to broadcasters and Internet providers, which have taken up the lion's share of the satellite communications market, as the applications they provide require signal availability at all times. TWTAs manufacturers are able to provide the high level of power and bandwidth that these applications require, while solid state manufacturers can only provide practical solutions at lower power levels.

Nevertheless, there are some applications providing exciting opportunities for manufacturers of Ka-band BUCs and SSPAs. Maritime and airborne communications applications, which do not require high power to get signals back to large gateway antennas on the receiving end, are ideal for this solid-state product class.



Although signal loss, like rain fade, is a concern for communications providers who need high-power technology, opportunities do exist where the small size and light weight of lower power SSPAs and BUCs can be mounted directly to antennas, reducing signal loss.

Getting Started: Operational Considerations + The Link Budget

Several factors regarding amplifier selection can come into consideration during the system design phase. For example, designers must consider whether the operating environment is benign or hostile; what type of bandwidth the application requires; what the cost of ownership is; what the operations and maintenance requirements are; and, most importantly, how much linear power is required to close the link.

Achieving the required radiated RF power is usually a trade-off between antenna size and amplifier power capability. In most situations, more flexibility is afforded to the amplifier than the antenna, e.g., if more power is needed, it is usually cheaper to buy a more powerful amplifier than a larger antenna. On the other hand, if one large receive antenna is going to handle transmission from multiple sites, then more powerful amplifiers may not be necessary. If the amplifiers need to be sheltered due to a suboptimal climate or if outdoor maintenance is difficult, additional power will be required from the amplifiers to overcome the inter-facility link (IFL) losses that occur between the shelter and the antenna. After these factors are considered, the system designer can begin to make a comparison between suitable amplifier technologies.

Linear Power

Once the general properties of the amplifier have been established, the optimal linear power required for the user's application must be determined and compared to what is available from the various types of technologies. There are generally three possible methods for defining linear power:

- 1) Spectral Regrowth (SR) for single carrier operation
- 2) Third-order Intermodulation Products (IM3) (for two to five carriers, typically)
- 3) Noise Power Ratio (NPR) for multi-carrier and high-order modulation operation (more than five carriers typically)

These different categories need to be further refined depending on the type of modulation used and where and how the intermodulation products are measured.



Efficiency + Operating Costs

If the initial link budget indicates that more than one type of HPA can fulfill the output power requirements, the user may next want to consider each amplifier's operating costs, size and weight, capital cost, reliability and serviceability. One of the critical elements of any amplifier is its efficiency, which always manifests itself in prime power consumption and heat generation, both of which affect the weight and size of an amplifier. Comparisons of efficiency have always been made between TWTAs and SSPAs. The "winner" depends on the required RF linear power level for the application in question.

With the advent of GaN technology, SSPAs are a good choice at higher power levels than can be practicably achieved by GaAs SSPAs. However, TWTAs remain far more efficient than SSPAs at medium and higher power levels, thereby minimizing cooling requirements in the antenna hubs where most Ka-band amplifiers reside.

Ka-band evaluations are complicated by the aforementioned high waveguide IFL losses of up to 3 dB per 10 feet of waveguide. Realistically, no one would ever consider putting an HPA in a distant shelter, because of the resultant loss. Instead, nearly all Ka-band systems are designed with the HPA located within a few inches of the feed, and even then the resultant power loss can be 10 to 20 percent.

This physical constraint means that Ka-band amplifiers must be small and lightweight, since the hub space is limited and installation is usually done manually in a narrow space.

Chart A below shows some of the most reasonable choices for Ka-band TWTAs and GaN SSPAs. In general, the TWTA is the best choice at linear power above 30W based on relative size and efficiency advantages.

Reliability + Life Expectancy

Typically, Ka-band HPAs are either installed in actively cooled radomes or hubs or are installed directly on antenna booms or hubs with full exposure to the elements. Naturally, the HPAs that are installed in cooled and protected locations will experience longer MTBF and longer life.

Based on CPI's collection of extensive field data and more than 15 years of experience in Ka-band development, MTBF for a Ka-band TWTA is 4.6 to 10 years, with a lifetime of nine to 20 years, depending on the type of TWTA and where it is installed. These numbers do not include the 30 to 50 percent extended tube life that CPI's patented LifeExtender™ technology is expected to deliver.

Though GaN SSPAs have not been in the field long enough to provide hard data, theoretical estimates based on reliability numbers provided by FET suppliers suggest that these products promise extremely good reliability, with excellent figures for MTBF and expected lifetime. It should be noted that lower power SSPAs will experience longer life and MTBF, because higher power SSPAs are the result of processes that combine devices in order to achieve their higher output; combining more devices will necessarily reduce reliability and expected life.

Technology Resource

Although the great TWTA v. SSPA debate is not fully relevant at the Ka-band frequency, due to the unique properties of each type of technology, there are still some instances where the user may be faced with a choice between the two technologies based on certain similar product characteristics. In general, however, HPA manufacturers' products are well suited to the latest applications using Ka-band.

When deciding which technology to use, each user must weigh the pros and cons of vacuum-based TWTA technology versus solid-state technology, based on the requirements of the specific application in question. As a provider of TWTA and SSPA technology, CPI can be an excellent resource for users evaluating the best technology to utilize.

*Prime power expense is based on annual 24/7 operation, at \$0.25 per kilowatt hour. This chart is generally arranged from low power to high power, and products are grouped by color at comparable linear power levels.

cpii.com/satcom

Ka-Band ODUs	CPI 125 W TWTA, no lin	40 W GaN SSPA w/lin (comp C)	CPI 125 W TWTA w/lin	80 W GaN SSPA w/lin (comp C)	100 W GaAs SSPA (comp B)	CPI 160 W GaN SSPA	CPI 250 W TWTA w/lin	CPI 550 W TWTA w/lin	500 W GaAs SSPA (comp A)
Linear Power	25 W	25 W	50 W	50 W	50 W	80 W	112 W	288 W	125 W
Weight lbs/kg	29/13	24/11	29/13	24/11	50/23	50/23	32/15	60/27	500/230
Annual Prime Power Expense ¹	\$657	\$438	\$657	\$832	\$3,285	\$2,625	\$1,424	\$2,300	\$15,330

Chart A. Comparison of available Ka-band HPAs at various linear output levels.

A Newtec Perspective: Why Now Is The Time For Operators To Get Onboard With Mobility

By Frederik Simoens, CTO, and Kevin McCarthy, Vice President of Market Development, Newtec

As the next generation of High Throughput Satellites (HTS) are launched, the impact to our industry will be profound.

With abundant capacity and much better economics, these systems will significantly improve existing VSAT services, as well as drive the emergence of new applications. As with any new technology, HTS will also bring new challenges with these opportunities.

Next Generation Space Segment Requires Next Generation Ground Segment

In order to fully realize the benefits of HTS, satellite operators need to upgrade their ground infrastructures and adapt their business models to this new paradigm. With smaller footprints, powerful spot beams and wideband transponders, HTS will require unprecedented flexibility, scalability and efficiency from VSAT platforms.

Essentials For HTS: DVB-S2X + Mx-DMA™

In 2012, Newtec helped pioneer the new transmission standard which improves the efficiency of HTS by up to 50 percent by supporting wideband carriers and more granular MODCODs up to 256APSK.

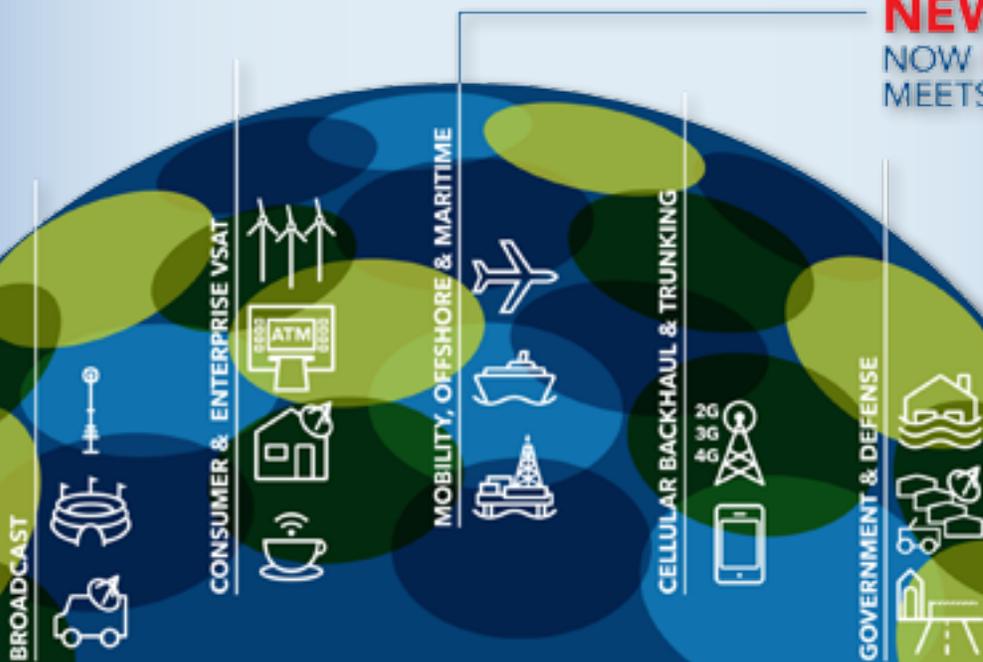
Two years later, Newtec Dialog® was launched, a DVB-S2X-ready, multiservice VSAT platform designed for HTS. With three return technologies (SCPC, TDMA and Newtec's patented Mx-DMA™) and a full line of modems, Newtec Dialog can support a wide range of applications, including mobility.

This is achieved through Newtec's unique Mx-DMA return technology which combines the low overhead of SCPC with the dynamic bandwidth allocation capabilities of TDMA. Mx-DMA assigns dedicated SCPC carriers to each terminal and seamlessly resizes them every second in response to changing demand and weather conditions. It is also fully adaptive, with

YOUR MULTISERVICE & HTS PLATFORM



NEW RELEASE 1.3
NOW MOBILITY
MEETS EFFICIENCY!



40 MODCODs up to 32APSK. Overall, Mx-DMA is up to 50 percent more efficient than TDMA.

Relief Is In Sight For High-End Mobility

While the effects of HTS will be felt across the entire industry, the demanding high-end mobility market will enjoy some of the most dramatic benefits. For the last few years, cruise ships, super yachts, oil & gas rigs and government vessels have been pushing the limits of existing satellite platforms. With thousands of users onboard, some of these vessels are like floating cities, consuming hundreds of megabits of bandwidth as they move around the world.

Until now, these high-end vessels were forced to rely on low-end TDMA services or expensive SCPC circuits that lacked the performance and flexibility to meet their needs. The advent of HTS, along with the next generation Newtec Dialog VSAT platform, will bring much needed relief to this market.

With Newtec's upcoming 1.3 mobility software release and its soon-to-be-released high-performance MDM5000 modem, Newtec Dialog will unleash the full power of HTS for high-end mobility applications.

The First VSAT Modem To Support DVB-S2X

The MDM5000—due to be launched at SATELLITE 2016—will be the first VSAT modem to support DVB-S2X on market. The modem is capable of receiving wideband carriers up to 140 MHz, with throughputs exceeding 200 Mbps. On the return channel, it will support SCPC, TDMA and Mx-DMA, up to 80Mbps.



Expanding The Mobility Market

SATCOM solutions have historically been a natural fit for mobility applications. However, the high cost of bandwidth and large antennas generally limited the market to large, high-end vessels. Fortunately, the evolution of smaller, lower cost antennas, coupled with HTS and ultra-efficient Newtec modems, will expand the mobility market to thousands of smaller vessels. The emergence of multi-band antennas will further improve the economics, allowing next-generation terminals to roam between today's legacy Ku-band networks and lower cost Ka/Ku HTS networks.

Enabling Growth Through Multiservice

Of course, mobility is just one of many applications supported by Newtec Dialog. With many more HTS due to be launched in the near future, the range of applications operators need to address will also grow exponentially. As such, it is of utmost importance that operators can scale their operations and enter new markets, without the need for large investment each time.

This optimal approach to growth can be achieved through Newtec Dialog. With a diverse modem portfolio and three complementary return technologies, this solution gives operators the flexibility to address a wide range of applications. Since its release in March 2014, Newtec Dialog has already been chosen by many customers as a way of streamlining, expanding and future-proofing their businesses.

The latest software release of the platform—Newtec Dialog 1.3—will be launched at SATELLITE 2016, with new features including DVB-S2X on the forward link, Layer 2 bridging and a protocol to enable communication with antenna control units for beam switching.

In addition to mobility, the MDM5000 enhances Newtec Dialog by further providing support for Small-to Medium-sized Enterprises (SMEs), general enterprise networks, Satellite News Gathering (SNG), government, oil & gas and cellular backhaul.

The Optimal Solution

Newtec has always been a frontrunner with its professional equipment portfolio and has a strong reputation of achieving the highest data rates, speed and efficiency. For instance, in 2015 the Newtec MDM6000 Satellite Modem with the all-digital built-in Bandwidth Cancellation (BWC) technology set a world-record by putting 20 Mbps into 2MHz. With the MDM5000, we have taken our reputation for the highest efficiency to a new level to also accomplish this in the VSAT market.

Regardless of which sector operators choose to enter, the MDM5000, with its implementation of DVB-S2X on the forward link and the choice of three technologies—TDMA, SCPC and Mx-DMA on the return link—will ensure the optimal solution for every application and price point and provide the highest efficiency available on the market today.



newtec.eu/

Focus: VSAT Network Maintenance

By Alvaro Sanchez, Sales Director, Integrasys

The Very Small Aperture Terminal (VSAT) market is clearly high volume and provides crucially needed communications to remote areas for a whole range of different services, such as oil & gas, maritime, environmental monitoring, e-learning, disaster recovery and cellular backhaul, to name but a few segments.

High Throughput Satellite (HTS) is making those terminals all the more efficient and, consequently, in even higher demand. That rapid growth means that operators are having to install more and more networks to cope with all of the extra demand. Add to that the fact that VSAT networks already come with their own set of challenges, and you have a new set of challenges that were already unique.

Complex Networks

Maintaining VSAT networks is extremely complex. By its very nature, terminals are often located in remote environments and operate where satellite is the only possible communications connection. In most cases, VSAT networks are also unmanned and left to operate automatically for years—even when they are not operating correctly, many times those on site aren't trained in actually operating the satellite equipment.

These facts bring to the forefront a variety of concerns. First, at installation, the installer often needs to travel long distances and then spend a considerable amount of time carrying out the VSAT installation. Also, if any mistakes are made at this stage, which is often the case, even more time is required for someone to return to the site and correct those errors while the VSAT keeps operating with poor performance, degrading the overall service and causing interference.

Of course, the complexity of VSAT networks is not limited to installation. Errors can easily occur during operation, either due to human error from onsite personnel or other factors that are beyond the operator's control, such as atmospheric conditions. This problem can also lead to satellite interference.

In a world where VSAT networks can be huge, if one single VSAT is mispointed or saturated, that can have an impact on the entire service performance, especially on adaptive power adjustment and HTS networks.



Correcting Errors

Currently, when those errors are detected, which is usually once interference has occurred, someone must travel to the site and analyze and correct the error.

As with installation, this can require a substantial amount of time and resources, from traveling to the site and then with the additional time necessary to correct the error.

An added complication is that many VSAT networks are also mobile. Take maritime, for example, or the military, where the unit is constantly on the move. In those cases, the VSAT may have been perfectly installed and pointed; however, every time relocation occurs, those same misalign problems can occur, once again.

Often the personnel accompanying the unit won't be highly trained in satellite communications, but even when they are, there is a constant job of realignment to ensure the equipment is always optimally operating and without satellite interference.

In most cases, for someone to spend vast amount of time dealing with the equipment while in the field, especially in a military situation, is simply not practical. Yet, at the same time, ensuring a continuous connection can often be crucial to a mission's effectiveness.

Smarter Tools

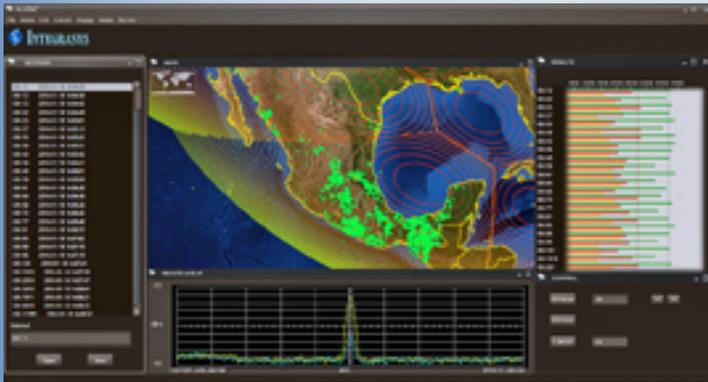
The best and most efficient way to manage the complexity of VSAT networks is through the application of smarter tools. At Integrasys, the company launched the Satmotion Pocket tool some time ago.

Satmotion Pocket ensures fast, accurate, and efficient installation of VSAT networks and has proven to be an invaluable tool for many networks, greatly reducing installation time and errors for customers by easing the installation process.

The VSAT industry now needs to get smarter after installation to ensure the network continues to operate accurately and without degrading performance or causing interference. Integrasys found that most Network Management Systems assume that satellite terminals are reachable and therefore aim to optimize network performance or detect terminal malfunctions based on satellite feedback.

However, errors at the premises, such as antenna de-pointing or signal level variations, usually result in a VSAT connectivity break. Once again, this requires a technician to re-visit the site to resolve the problem.





Integrasys' Alusat screenshot.

Integrasys was approached by the VSAT industry to develop a tool to enable the use of Satmotion Pocket technology at the Network Operation Center (NOC). That result is Alusat, which maximizes the overall network performance and minimizes the maintenance time, effort, and interference by automating the checks and corrections from the NOC.

Alusat

Alusat (*Always Up Satellite Terminal*) is an automated tool that combines traditional equipment management with spectrum monitoring and measurement in a new way to accurately derive the remote terminal RF status. In certain conditions, Alusat can also recover out-of-service or service-degraded terminals.

Alusat is deployed at the NOC site and automatically checks the uplink and downlink health of the VSAT population at radio level, also collecting relevant configuration and performance information.

The operator determines the different thresholds for Rx and Tx and actions that are to be taken automatically by the system in different circumstances. Alusat then checks out all of the terminals in the target community to detect failures, raise any necessary alarms and perform any pre-determined actions when needed, as well as using the Rx and Tx measured values of copolar power, crosspolar isolation, adjacent satellite interference and 1dB compression point.

This technology is critically important for networks with adaptive power adjustment capability, as this tool is able to automatically calibrate the saturation point in the overall network from the NOC.

Alusat is an evolution of the company's existing Satmotion Pocket tool and coexists, sharing the same hardware, allowing the hub operator to evaluate the overall network performances with a single click, just in case anything has happened to change the status following accurate installation through the use of Satmotion Pocket remote commissioning.

Making Life Easier

In a world where VSAT networks are becoming more prevalent and complex, making life easier for the VSAT network operators is extremely important. In an ideal world, all staff would be trained to the highest standards, but even then, maintenance tasks are quite time consuming.

The more automated the processes and error detection, the more efficient those networks can be and the fewer errors and interference will be experiences. This, then, makes life better for the entire industry and more profitable for service providers who benefit from these VSAT tool automations.

integrasys-space.com/



The Technology Innovation of the Year Award at the 2015 VSAT Global Series Industry Awards was received by Integrasys.

The Need For Robust Tools To Succeed In The World Of HTS

By Steve Good, Vice President, Marketing, Comtech EF Data

The satellite communications market is undergoing a drastic change as satellite operators' different High Throughput Satellite (HTS) strategies come to life, moving from concept to launch to commercial availability.

These new and innovative satellite designs provide service providers with the opportunity to generate new revenue sources through different economic models. A drastically lower cost per bit delivered to end users provides the potential for service providers to continue to differentiate in the competitive markets they service today while providing the opportunity to address new markets.

However, with this opportunity for commercial growth comes significant challenges that can only be overcome with a robust tool set that focuses on maximizing end user Quality of Experience (QoE) while meeting these new healthy economics.

In the world of traditional wide beam designs, two distinctly different markets arose:

- A high-end market that required always-on connectivity at dedicated throughputs
- A low-end market that was addressed through inexpensive remote kits and bandwidth sharing to load balance space segment costs across multiple remotes, thereby providing a lower overall cost per remote



For both markets, space segment was priced at the proper rate (in MHz) in the proper band (C-or Ku-band) to allow service providers to reach the correct application-based price (in Mbps) per vertical. Likewise, ground equipment was designed and priced around these per-vertical "sweet spot" economics. A service provider would combine these two elements, coupling the proper space segment with the proper ground solution to provide the desired economics and service levels for its end users, whether they are high-end or low-end.



A third market, the middle market, has come to the forefront. Companies servicing the middle market experienced a spike in traffic demand by their end users, who were requiring enhanced services with significantly more throughput to support a different application mix—one dominated by multimedia content requiring ever-increasing bandwidth.

This demand is being driven by medium and high resolution video and remote applications-aware networks that require the performance levels provided by terrestrial alternatives. Unfortunately, many ground equipment toolsets designed for the low-end market are not able to support these higher bandwidths.

Likewise, many high-end solutions are not tooled to provide the economics that are required by the middle market. As a result, new platform options arose to meet these demands by combining the performance levels required by the high-end market and the potential economics of the low-end.

In parallel, new innovative HTS designs were announced and are now being implemented to provide the total solution package to meet the demands of this growing new market subset.

The pairing of innovative ground equipment with more powerful and flexible space segment options provides the opportunity for growth if the proper tools are leveraged on the ground. These tools include higher order modulation and coding and, the inherent traffic processing capability of the platform teamed with the chosen satellite access technology.

Just as important in the complex new operational world of HTS are other aspects of a ground equipment solution's toolset, specifically traffic handling capabilities, the levels of network management possible, the need for detailed network analytics along with issue prevention and resolution. Lastly, but not least importantly, a satellite solution must be able to expand gracefully, with remotes being brought onto the network easily and skillfully with minimal interference being generated at each remote.

In this new world of HTS, service providers need to re-evaluate their approaches to the market(s) they serve and ensure they are equipping themselves with the proper tools to unleash the potential that HTS offers and be able to reach the promised economics. While most ground solutions designed around wide beam designs can be used with new smaller spot beam designs, few are optimized for operation on these new spacecraft. Success will come to the service provider that chooses the proper instruments on which to grow its business cost effectively.

Overall network efficiency has moved beyond higher order modulation and coding methods to intelligent traffic handling and dynamic bandwidth and resource allocation. The Mbps/MHz ratios that are required to penetrate new markets come from teaming higher order modulation and coding with compression techniques and intelligent traffic handling.

The addition of dynamic bandwidth allocation to these elements can reduce the price per Mbps to an end user from \$1,000 per Mbps down to \$500, \$200 or even \$100 per Mbps, depending upon traffic type and end user service level requirements.

In general, HTS offerings combine four main attributes to produce the healthy new economics that the satellite community requires. These include:

- *More bandwidth per beam*
- *An increased number of beams per satellite*
- *Increased downlink performance*
- *Increased uplink performance*

New spacecraft designs provide the ability to transmit significantly higher throughputs for a given connectivity. These designs allow the delivery of hundreds of Mbps at a time through a single channel while dynamically sharing bandwidth through intelligent traffic handling at these extremely high speeds.

Ground equipment solutions designed to leverage these larger bandwidth beams must have the ability to process and optimize traffic flows of different priorities at these significantly higher data rates to ensure maximum resource utilization. A highly intelligent traffic handling engine is essential here to ensure that end users are provided the levels of service that they require. Different protocols must be handled intelligently, with more important traffic flows being given priority over others. In addition, lossless compression techniques further maximize the total net efficiency of each link.

It is now well known that frequency re-use is the mechanism that provides HTS designs with their substantial increase in bandwidth per spacecraft. This is implemented through a substantial increase in the number of beams per satellite. This significant increase in the number of beams creates a challenge for the service provider to cost economically scale ground infrastructure to support a given geographic coverage.

A service area serviced by a single wide beam may require five, ten or twenty beams in a small spot beam environment. The larger the geographic coverage, the more beams are that will be required and growth to new areas typically requires the addition of several new uplinks.

A ground equipment solution for this type of design must provide scalable growth paths to tie costs to revenue as the number of beams in use increases. Network information and control are keys to success. Network management and real-time network analytics are essential to maximize resource utilization and minimize downtime. In addition, interference mitigation becomes a much higher priority within an HTS environment due to the fact that frequencies are being highly re-used and improper remote equipment access as a network expands can quickly decrease the overall capabilities of a small spot beam design.

Higher order modulation and coding methods can be leveraged to take advantage of the third attribute, the increased downlink performance that HTS designs offer. Service providers must arm themselves with a platform engine that leverages higher order modulations and more powerful coding teamed with decreased carrier rolloffs and near Shannon Limit physical layer performance. Ground equipment engines must be able to keep up with these higher potential throughputs to ensure traffic flows properly, filling the transmission pipes accordingly.

The increased uplink performance of the innovative new spacecraft designs enable a user to significantly increase the number of Mbps that can be transmitted through a given remote kit. Because satellite antennas receive much less ground noise from earth (the "T" in a satellite's G/T parameter), signals can be transmitted at significantly lower levels towards the satellite.

Alternatively, significantly more Mbps can be reliably transmitted with the same signal level towards the satellite. A new efficiency parameter that is referenced in HTS design is Mbps per Watt, which clarifies how many Mbps can reliably be sent through a given amplifier on the ground.

Care must be taken, however, to ensure the chosen remote ground equipment is tooled to handle this potential fourfold or eightfold increase in Mbps and packets per second. Using a ground device that cannot take advantage of this attribute leaves money on the table for the service provider.

Increased revenue per site can be prohibited through throttled remotes that can't process packets fast enough and/or costs will need to be incurred to visit remote site to upgrade existing remote kit in the field to support these higher throughputs.

Cost effectiveness comes through an intelligent and efficient utilization of resources. While all roads do not lead to HTS as wide beam designs will continue to be the best fit for simultaneous content distribution to thousands of sites or connecting tens of sites that are very geographically diverse, platforms must be future-proof.

It's important that a service provider equip itself with a toolkit that can be used on existing wide beams for certain applications while also having been optimally designed to take advantage of the new performance levels of HTS. This method protects the service provider's investment while providing maximum potential for future revenue growth.

From network design and implementation to steady state operation on traditional wide beams or new smaller spot beams, intelligence is crucial to maximizing an end user's QoE, maximizing resource utilization and minimizing downtime. It starts with powerful iterative network design tools that allow a service provider to analyze anticipated traffic loads over satellites with different performance characteristics to quickly predict overall link and network performance.

These tools provide the service provider insight into the best satellite access method to use for a given end user set, be it low-end, high-end or middle market. Understanding the total costs of ownership over a three or five year project are key to ensuring that the proper application-based per Mbps price can be generated.

During network implementation and steady state operation, whether the access technique be dedicated or shared, a network management tool that gathers real-time resource loading and traffic analytics allow the service provider to quickly react and reassign resources to maintain these per Mbps price points is key.

The correct remote commissioning tools are required to minimize both time and money of deploying new remotes onto the system while meeting interference isolation thresholds.

In summary, it is essential for a service provider in the highly competitive satellite communications market to maximize an end user's Quality of Experience at the right application-based price per Mbps.

This QoE will vary depending upon the target market, whether the user requires a low-end, high-end or mid-range service offering and because of this, a solution for one type of user is almost always not a good fit for another type of user.

While HTS offerings provide the promise of compelling and healthy new economics, these promises cannot be met solely by the spacecraft itself. It is only through the coupling of purpose-built ground solutions equipped with the right tools with these pronounced application-based price decreases be achieved along with the targeted QoE.

comtechefdata.com/

Steve Good is Vice President, Marketing for Comtech EF Data. Good leads the divisional marketing functions, objectives and initiatives based on long-term product and profitability goals. A satellite industry veteran, he has 20+ years experience in a variety of positions in which he has bridged sales and engineering organizations to create and implement marketing plans around product, pricing, placement and promotion strategies. During his career, he has held senior management, marketing, product management and engineering positions with Intelsat, Verestar, Viacast and Hughes Network Systems. Also a former member of the Comtech EF Data team, Good previously held the position of Vice President, Sales Engineering.

Good holds a Bachelor of Science in Electrical Engineering from Penn State University. He also holds a number of advanced degrees, including a Master of Science in Electrical Engineering from Johns Hopkins University, a Master of Business Administration from the University of Maryland and a Master of Science in Computer Engineering from Virginia Polytechnic Institute.

A Globecomm Perspective: Crew Connectivity... A New Paradigm?

By Trevor Whitworth, Senior Vice President, Sales and Marketing, Globecomm Asia

Despite some recent suggestions to the contrary, demand for crew connectivity remains a strong driver of the maritime communications market.

The Maritime Labor Convention is among the factors encouraging service upgrades and higher spending. However, there are other fundamental forces at work and across our industry. Shipowners and operators, managers and crewing agents need to understand what is occurring and how to manage this change in a positive way.

The economics of maritime communications are evolving quickly. Solutions providers such as Globecomm are seeing this first hand and adapting to the landscape so that the new demands can be successfully met.

The phone in our pocket and the tablet in our bag or on our desk means communications are approached in a new way. This is an exciting change, one that brings the potential for much better quality of experience, higher mobility and more flexibility.

In spite of the challenges of communicating at sea, the demand for access via multiple mobile devices is no different than that demand is on land. For communications providers, this means some of the ways contracts with buyers have been approached is going to change—in some cases, that change has already occurred. For shipowners, managers and crew, expectations of greater availability are not necessarily dependent on higher costs or faster bandwidth. Even so, their expectations come with some unintended consequences.

From Too Slow To Very Fast

The background for crew communications has been a slow and steady evolution. From expensive and inconvenient phone calls to scratch cards for crew phones to access via Internet cafes, all have witnessed the increasing demand and usage of voice and data. The next stages have moved quite quickly—from limited web browsing to chat, messaging and social media tools which are usually identical to those that are used on land.

As the interest increased, thanks to the spread of landside Internet access, suppliers have found increasingly innovative ways of squeezing the maximum connectivity out of the minimum bandwidth. Simultaneously, user packages are moving away almost entirely from a pay as you go model to fixed price bundles that only penalize if the data limit is exceeded.

When the first HTS services start to become available this year, availability will increase again as new satellites dramatically step up in the bandwidth that will be available to users. There is a lot of interest around HTS, not least because of the large amounts of money invested in the technology.

Some observers are already talking of a bubble, in which a huge amount of potential supply searches for a market that may not be ready or willing to pay for it. And, more than likely, prices will be higher, at least initially, which leads many to question how much take up can be expected in shipping.

Too Many Underserved?

We should be clear when discussing demand that MLC 2006 does not specifically mandate crew communications, though it does specify some of the conditions under which crew should be allowed access. MLC 2006 is known as the “seafarers’ bill of rights” and was adopted by government, employer and workers representatives at a special International Labor Conference (ILO) in February of 2006.

Even so, too many crew are still underserved and the MLC provides a convenient tool for them to argue for better access—and for providers to deliver connectivity in a way that works for the owner and the employee alike. What MLC has achieved is to raise the profile of the debate about what could and should be available and has heightened the perception that crew welfare is central to a safe, sustainable and profitable organization.

I am informed that more and more often that crews are becoming much more demanding about their need for access. Only two years ago, most of Globecomm’s customers were subscribing to low volume 50 MB data plans. Today, many are opting for four or eight gigabyte plans, even though their business requirements have hardly changed over that time, which is a reflection of how much more demanding crew have become.

The fact that many owners are adding to their Opex in what for many is a dire market further amplifies that message and can only be a reflection of the need to recruit and retain good quality crews. The host of connectivity options available to shipping means that growing expectations have to be managed. Where cost used to be the defining factor, access is now the most critical. Mariners want to communicate and they are increasingly creative in the ways that they accomplish that need.

A recent survey by Futureautics for satellite operator Intelsat found that access to connectivity is a key determinant for the vast majority of seafarers when selecting which company to work for. The trend towards Bring Your Own Device (BYOD) is becoming the defining feature of crew communications. Now that gaining access to connectivity is becoming easier, the next most important factor is privacy.

Privacy has real impact for solutions providers and employers alike. We are entering the world of Facebook, even though, until recently, we have been completely unprepared to meet this kind of demand. When you consider that 1.4 billion people use Facebook every day, and there are 1.5 million seafarers, it makes sense to note that this traffic is on the rise.

The trouble is, we are not in the Facebook market. There has always been little enthusiasm on the part of owners to invest money at a scale necessary to meet seafarer demand. That’s simple economics and until the ‘disruptive innovators’ find a way to provide connectivity for free or cheaply, the economics appear to be stacked against, plentiful, low cost, high bandwidth communications for crews. Or so you might have thought.



A New Paradigm?

The question all should consider is not just about the cost per megabyte or the monthly cost of communications, per se. The bigger issue to consider is whether the market is being overtaken by events. The connectivity that crew require is arguably no more similar to what it was three to five years ago than what it was 20 years ago. All that time, providers have been working toward delivering expensive, asset heavy services and trying to make them into solutions that best fit the need. Systems are squeezed and circuits that are already designed for a low bandwidth environment now need to extract the maximum service at the lowest cost.

Things have certainly changed. It was never the case that one size fitted all—these days it doesn't even get anywhere close. The advent of cheap smart phones, cheaper tablets and the incredible growth in the use of apps means that 'Internet browsing' is continually swapped, in the traditional sense, in favor of using our own devices to access apps, services, shopping, chat, voice over IP, games and content. This is being accomplished on our own devices—all that is required is the router and WiFi signal.

That crews are increasingly using apps like Viber, What's App and WeChat and are happy to use their devices to chat, message and surf is important for all of us and there is a happy coincidence at play here. More and higher quality connectivity is becoming available, often at more affordable prices. At same time, 'App Culture' is delivering the desired level of functionality to end users without the need for huge amounts of bandwidth.

For the satellite operators, that may not be all good news. Even for solutions providers, this demands even more creative solutions in the way we provide services. However, for ship and crew managers, there is definitely a clear dividend. The connectivity crew want can be provided—perhaps at lower cost than previously thought.

Crews lives can be made more connected. What we have found as crew have increasingly embraced social media apps, is just how unsuited these are for use over satellite. Such apps can be inefficient consumers of bandwidth because they are designed for land-based networks. As a result, Globecom has designed and developed our own and probably won't be the last to do so.

Where Do We Go From Here?

Just as with the spread of the Internet ashore, this connectivity is not going to stand still. We are caught in a demand-driven cycle where even the 'new rules' such as Moore's Law will soon be overtaken and desire for connectivity will continue to grow.

Shipowners and managers also need to be aware of what will change when this new connectivity is brought onboard their ships. From across the generational divide, it is too easy to criticize the young people who spend more time looking at screens than they do conversing—but that is the reality.

Our first-hand experience with crews clearly shows that the onboard culture varies from ship to ship. Some vessels are very much team-based, with social interaction strongly encouraged—others are not, even if the crew are of the same nationality. The risk is that by enabling crews to enjoy the

same mobile access to the Internet as is enjoyed on land, we increase the isolation that many experience by encouraging them to spend more time interacting with their devices than with other people.

Young seafarers want to do both—they want contact with home but they also want to learn—they want to speak and listen to their peers and colleagues. In an industry already under pressure from growing regulation, increased paperwork and procedures, the need is for greater interaction and better mentoring.

A more controversial topic is whether, having enabled all this access to your crew's devices, there is actually an argument for restricting access, as well. Owners must decide what their priorities are, what they will pay for and what crew must budget for themselves. There are safety factors and the need to make certain that crew get their mandated hours of rest. Some owners already have a policy of restricting time online in order for crew to balance Internet access with sleep and other non-work activity.

There are other, more existential threats too, such as radicalization and cyber security. Should the shipowner have the right to know what websites the crew are visiting, who they are emailing and what the content of those emails is? As crew become more and more connected, is there a need to draw a line between the right to privacy and the need for monitoring and perhaps control of access? Too few owners give their crew any kind of cyber security training before enabling Internet access but this, together with clear IT and usage policies, are absolutely essential.

What Happens Next?

Solving these problems is the next big challenge for service providers and shipowners alike. Perhaps, though, the industry will provide an answer of its own. Just as we manage the transition from web surfing and email to social media, there is another wealth of content around the corner—news, sport, movies and other entertainment—which the providers are all too keen to sell to crews. How much take up there is of services of this sort remains to be seen, but from what we have observed in communications there can be no doubt that even if the customers are not always right, they are still king.

There is no point in network operators and solutions providers developing new products and services if these are not the ones being requested. Recent history suggests a need to listen much more carefully to what seafarers are asking for—and to provide it in the most efficient and cost effective way.

The social media revolution should have taught us to listen to and anticipate the needs of users and not to imagine that we, in our wisdom, know what is best. The fact is that the change is already happening around us and the speed of change will only continue to increase.

When challenged to be creative, we must be prepared to respond and address these new demands, not just with new services, but with new approaches and a mindset that reflects the new paradigm of crew communications.

globecommsystems.com/satellite-network/locations-asia.shtml

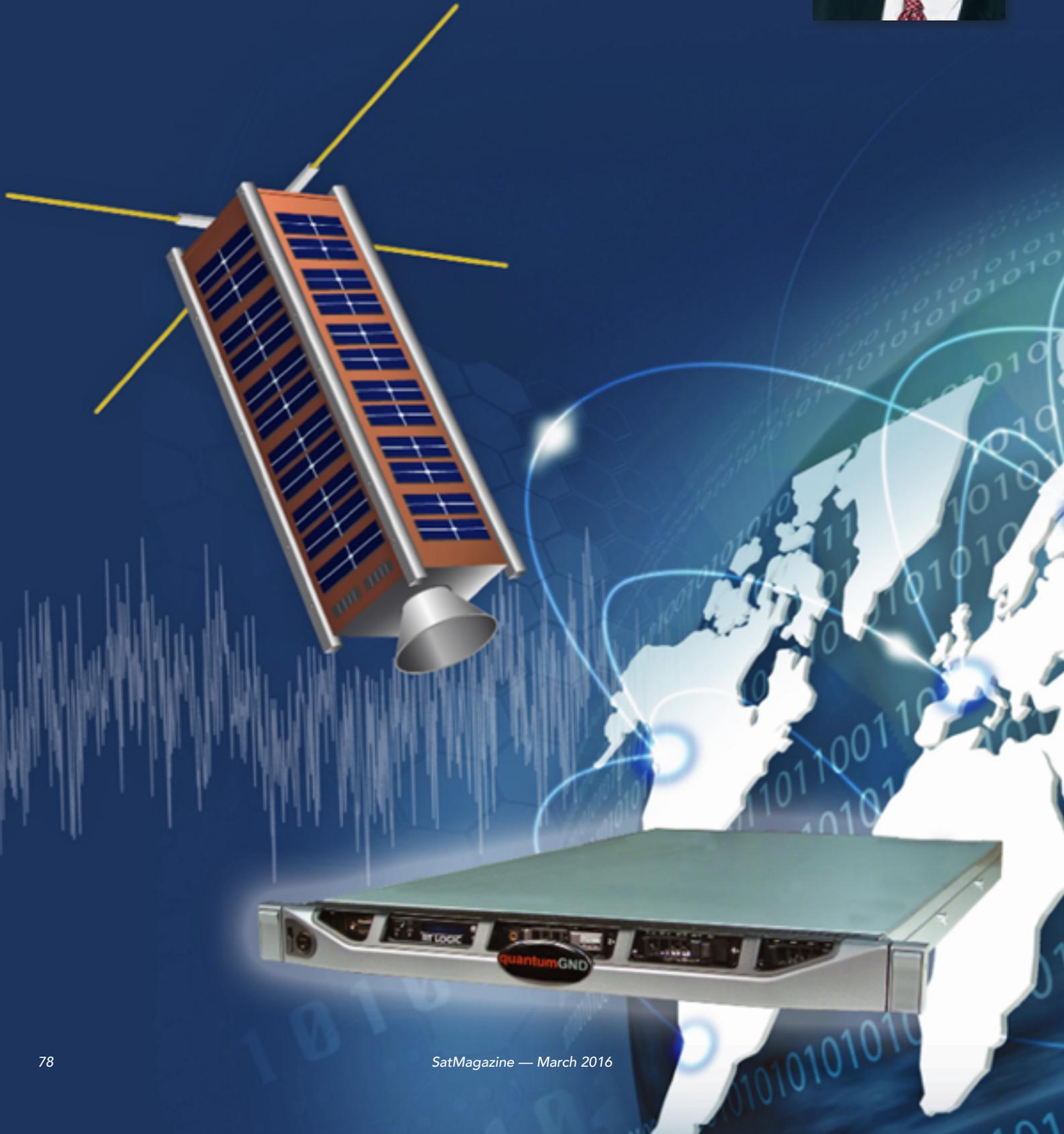


Brave New (Smallsat) World

By Stuart Daughtridge, Vice President of Advanced Technology, Kratos Technology and Training Solutions

Small satellites (smallsats), from single satellites to constellations, demand new and innovative methods of manufacture, launch and control.

The growth of the smallsat industry has been driven by design and manufacturing advances that have reduced satellite size, production costs and time



by orders of magnitude and by new and cutting-edge launch technologies that are driving down launch costs.

Now, with a new and consolidated approach to smallsat Command and Control (C2) and RF Signal Processing, ground costs and complexity are being driven down.

SMALL VS. LARGE SATELLITES...VIVA LA DIFFERENCE

Similar to larger, traditional satellites, smallsats require command and control software, data processing, networking and RF signal processing. The primary difference between smallsats and larger satellites, as related to the satellite control system, is the value of the asset in space.

A smallsat might have an in space value of \$500k to a couple of million dollars—a larger satellite can have an in space value of \$100M million to \$500M for commercial satellites and more than \$1 billion for some government satellites.

How one manages a <\$1M asset that can be replaced within 12 months is quite different from how one manages an asset that costs >\$100M and will require two to four years to replace.

Additionally, large satellite ground systems are usually procured as a program, with requirements, design reviews, formal acceptance test programs, and so on.

Smallsat ground systems, on the other hand, are procured much like commercial software—acquirers evaluate what is available on the market, purchase the product that best meets their needs, install that product, get trained and start using it.

If the ground system does not fulfill all their requirements, they can use the product APIs to add the required features to address the smallsat's needs. This is a different model and approach and, as a result, a most noticeable different price point.

Initially, early smallsat operators would build their own satellite C2 systems. However, as the industry matured, smallsat operators came to understand that the effort required was more complex and time-consuming than they had initially imagined.

They began to realize they could buy Commercial-Off-The-Shelf (COTS) C2 systems for a fraction of the cost of developing their own product, with significantly lower recurring maintenance and support costs.

AUTOMATION CRITICAL TO SMALLSAT SUCCESS

Smallsat operations are more open to automation as their business models require significant automation of their satellite operations.

First, smallsat operators are less risk adverse and are much more willing to push the boundaries on automation, as the risk is much smaller and easier to recover from should such not offer success.

Second, because of the relatively low cost of smallsats, their business models often cannot even afford a 24/7 operations team to manage the satellites—this absolutely requires a viable level of lights out automation. For most of them, their satellite operations are simple enough to make automation relatively easy to implement and manage.

Stovepipe systems are less of an issue for smallsat owners/operators as they have leaner and more automated infrastructures, at least as related to the satellites and their operations.

As many smallsat operators are new to the market, they are not burdened with legacy systems and procurement policies. As a result, everything is integrated by design from the start, because everything needs to be automated and must work as a single system.

FROM SINGLE SATELLITE TO FLEET OPERATION

Ground system selection takes on an even greater importance for companies that plan to grow from a single satellite operation to a smallsat fleet, and even more so as their fleets grow larger.

With larger satellite fleets, satellite management becomes far more complex and satellite operators will continue to look for ways to improve operations through virtualization, centralization, and automation to keep recurring system and operations costs controlled and manageable.

With this in mind, Kratos leveraged the company's extensive history in satellite command and control (C2) systems to develop an end-to-end C2 solution specifically for smallsats. This solution, quantumGND, is comprised of the satellite C2 system and software based TT&C modems that include the ground radio processing as well as Front End Processors (FEPs).

The result is a solution that digitizes the signals at the antenna and performs all the signal and data processing in software applications running in highly automated, self-contained virtual environments. Additionally, Kratos has integrated a virtualized flight dynamics application and an advanced Monitor and Control (M&C) system for managing the ground equipment, network and enterprise management.

A fully integrated product stack results, one that delivers a fully integrated, highly virtualized, fully automated low cost end-to-end fleet management solution.

The smallsat boom will help mainstream new technologies and will also help to drive greater automation into the satellite ground infrastructure business.

For example, the smallsat market is an area where we have been able to push and get faster adoption of new technologies, such as software modems, higher levels of automation and a fully virtualized ground infrastructure.

These new technologies/products have been proven in the smallsat market and are getting interest from some larger satellite operators, as they can clearly see the cost and operational advantages of:

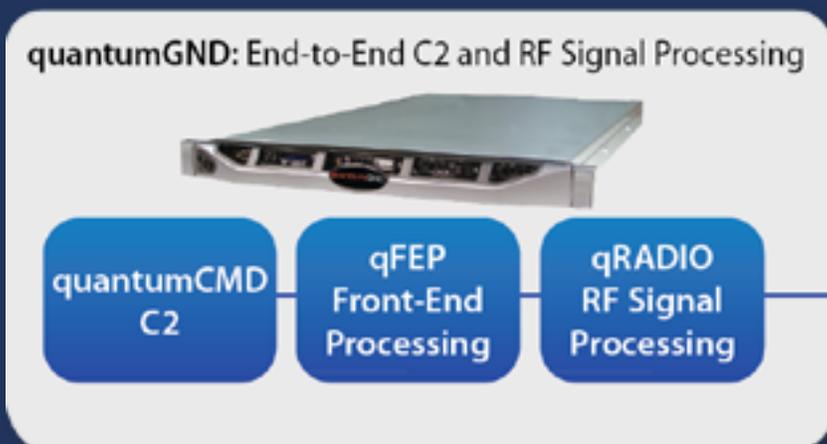
- Digital IF ground systems infrastructure
- Software only TT&C modems
- Virtualization of ground infrastructure
- HTML5 Web based clients workstation
- Greater integrated automation

Finally, it is important to understand that new smallsat companies don't necessarily consider themselves satellite companies. They consider themselves imaging companies, data analytics companies, weather companies, but not satellite companies. To them, the satellite is a sophisticated sensor maneuvered and used to capture data from a unique vantage point. The smallsat businesses and their business identities are built around what they can then do with that acquired data.

Being a long-time satellite industry person, that was a really interesting revelation for me. This is a good change that will benefit the entire industry.

kratossts.com/products/satellite-and-space/quantumgnd

Mr. Daughtridge has been with Kratos-Integral Systems since 1999, and in the satellite and aerospace industry since 1986. Prior to his current role, he held several senior management positions, including SVP & GM of the Integral Systems Products Group, SVP & GM of the Integral Systems Commercial Group, as well as Program Manager of several major commercial programs. Before joining the Company, Mr. Daughtridge held various management and engineering positions with Orion Satellite Corporation, Intelsat, and Spacecom. Mr. Daughtridge holds a Bachelor of Science from Lafayette College.



SatBroadcasting™: UHDTV Is Coming... But Where Is It Going?

By Simen Frostad, Chairman, Bridge Technologies



It's an ill wind that blows nobody any good... this old saying means, more or less, that there are always people who can benefit from any turn of events, however negative such may seem at first glance.

The converse is true, as well: every silver lining comes with a cloud. When some glittering new technology appears on the horizon with the promise of a brighter tomorrow, it almost always follows that someone, somewhere, is going to have a hell of a headache.

To turn another popular motivational maxim on its head, every opportunity is a challenge. Everyone in the industry knows that a new format brings benefits (benefits that are the reason for its arrival on the scene), but also causes disruption to established ways and workflows and creates technical headaches, too. Sometimes the challenge goes as far as upsetting existing business models and threatening their economic viability.

Faced with these moments of evolutionary pressure, the standard human reaction tends to be to look the other way, get the head down and continue trying to make the old ways work just a little bit better, rather tussle with the slippery new challenger and find a way to wrestle it to the canvas.

With Ultra High Definition TV (UHDTV), the benefits are easy to grasp, and it's easy to assume that consumer demand for UHDTV will make this technology the norm for television viewing.

That scenario presents a real challenge to the industry that has to get UHDTV pictures to the viewer—and that's a real challenge to all parts of the industry, not just to the satellite sector. UHDTV and high dynamic range (HDR) content represents a heavy load for infrastructure to lift, and at the moment there are not too many shortcuts for developing the capacity to cope with a model where the default TV format is UHDTV.

Better use of existing bandwidth is a start, and an important focus for attention. In this regard, the widespread movement toward IP packet distribution without the overhead of the MPEG wrapper that has been de rigeur until recently promises some gains. Indeed, until as recently as the last 18 months, IP transport streams without the wrapper were almost inconceivable; now, the wrapper is being discarded with alacrity across the industry.

The promise of more efficient formats and standards that will help make UHDTV a little lighter on the infrastructure is there as well, and it's notable that ATSC 3.0 has evolved rapidly to the point where in its latest form it represents a complete packet distribution standard.



MPEG-Dash similarly offers important potential gains, and then there is H265, which could achieve 50 percent better performance than its predecessor. The impetus is to work off every possible ounce of fat, but at the same time the gains made are more than offset by the proliferation of channels, where for example brands such as National Geographic have grown from a single channel on launch, to ten today.

While reducing the overhead by shedding encapsulation seems like a good idea, there's more than 25 years of industry experience and stable operation with it—casting it aside will cause confusion, sweat and toil. But it's an ill wind... troublesome though this disruption will be, for manufacturers—like Bridge Technologies—whose job it is to help the industry cope with change, uncertainty and complexity, it all adds up to more demand for our expertise.

The ubiquity of satellite is one of the reasons why we've put so much recent R&D into developing our satellite monitoring solutions, based on the VB272.

There's no hiding from the essential conundrum though. More channels and higher definition formats means that pressure on infrastructure will rise to unprecedented levels.

Or will it?

It will not have escaped anyone's notice that TV consumption habits are changing dramatically. In fact, 'TV consumption' is now really only one component in a smörgasbord of media behaviors available to today's consumers.

As research emerging from many sources is showing, TV watching in the conventional sense is almost a thing of the past for the younger sections of the population in many of the more developed parts of the world. These audiences will of course become older but with age their viewing habits are unlikely to revert to the model of previous generations, which was formed when linear television was the only game in town.

Media consumption behavior is becoming radically different and the trend toward less viewing of linear TV, and more viewing of other forms of media—short-form clips and service on-demand—much of it accessed through other sources than the conventional broadcaster, has profound implications.

The eventual impact of these changes is really unknowable but perhaps it would be safe to say that this is not a transitional phase in the sense of a transition from the old world of linear broadcasting to another model that will prevail for decades without much further change. Instead, we may be now in a period of continual change and rapid evolution that will not slow down or settle on some kind of new 'normal.'

If that's the case, what are the implications for the industry—and particularly for the satellite sector—in terms of ultra-high definition? If linear TV consumption is no longer in the mainstream, the pressure to deliver channels in UHD TV is no longer so great.

The industry is, in any case, still a long way from delivering much UHD TV to consumers. However, if consumers are less and less interested in the conventional TV viewing experience, the demand for live, linear delivery of content is waning, and waning dramatically according to the research. Therefore, the idea that today's 300 channels of HD must be urgently replaced by 300 channels of UHD TV is mistaken.

The new patterns of consumption will, of course, continue to change, and the situation will probably look quite different again in another 18 months. However, what we can say with certainty today is that linear TV is becoming much, much less important, and that on-demand viewing is replacing it as the mainstream method of consumption. This, allied to the strong preference in the younger demographic for short-form clips, means that the distribution and serving of content will be achieved in very different ways.

We can assume that there will be far more distribution of content to local caches, from where it will be served to viewers on demand, with IP and OTT doing the heavy lifting. Satellite's unrivaled ability to achieve wide area distribution will therefore come into sharper focus in a kind of data-casting rôle, getting the content—some of it HD and some in UHD TV—to the caches from which users will access it.

With good buffering, there will be a high quality experience of 4K for the viewer, and it will be perfectly compatible with the consumption patterns that are now taking over from linear TV watching.

bridgetech.tv/



Satellite + The Internet Of Things (IoT)... Where's The Opportunity For Ku-Band?

By Stein Harstad, Managing Director, TSAT

There's a coming explosion in the number of M2M- and IoT-enabled devices — a whopping 50 billion "things" online by 2020, according to Cisco.

Many of these devices will be dedicated to personal use and, for the most part, will be supported by terrestrial communications. However, the Internet of Everything (IoE) will also be the Internet of Everywhere (IoE).

The proliferation of wireless sensors and devices networks will extend well beyond urbanized and rural areas, where there is tremendous opportunity for satellite service providers to get in on the deal. According to NSR, the M2M and IoT over satellite market will increase to more than 5.3 million terminals by 2024.

M2M + IoT Versus SCADA

M2M and IoT differ from traditional SCADA applications in that SCADA is about real-time monitoring control, reporting and alarms to improve operational efficiency. IoT expands on this by focusing more on data aggregation from a greater number of sensors (and not always latency sensitive) for predictive (what's going to happen) and prescriptive analytics (when, why, what to do). This data creates value across multiple applications to make organizations and societies smarter, safer and more efficient.

L-Band Versus Ku-Band

L-band has traditionally been viewed as the preferred option for narrowband connectivity, due to the small amounts of data transfer and, hence, low airtime charges. Ku-band, however, will play a growing role as the M2M and IoT phenomenon gains momentum.

As data is generated from billions of sensors, there will be a need to aggregate and backhaul that data from remote locations to the core network. For many M2M and IoT applications, L-band will be a less attractive proposition given data volume.

With Ku-band, service providers can leverage the large number of open Ku-band satellites, which traditionally offer lower spectrum cost than L-band. Ku-band remote terminal equipment can operate on any open Ku-band satellite platform, offering full end-to-end control, including the ability to select spectrum providers on the basis of best coverage and cost.



Key Market Opportunities For Ku-Band

Ku-band networks will be required to support a growing array of market applications. We'll examine several here...

Smart Energy. The primary focus here is the oil and gas market. The global demand for oil and gas is growing, with exploration and production moving into new and more demanding locations. Worldwide regulations are becoming more stringent with respect to health, safety and the environment.

Furthermore, recent volatility in pricing is forcing the industry to take a renewed look at initiatives that improve operational efficiency and reduce cost. Such initiatives entail greater use of smart sensors and devices that enable the increased automation and use

of advanced business analytics. These sensor and devices in turn generate steeper communications requirements.

There are a wide range of applications in oil and gas that Ku-band can effectively enable. These include monitoring and transmitting sensor data concerning drilling control, wellhead production, pipeline monitoring, distribution logistics and asset security.



Smart Power. Global electricity demand is on the rise, and much of that power will be generated from non-renewable energy sources. From a sustainability and environmental perspective, there is a universal recognition that more energy must come from renewable energy sources such as solar, wind, wave and thermal energy.

The integration and efficient use of all the energy resources and efficient use of the grid infrastructure implies greatly expanded communication requirements for smart sensors, smart meters and smart controls.

Ku-band networks can efficiently handle a variety of electricity grid automation and metering applications such as substation SCADA automation; advanced distribution automation; aggregation and backhauling of smart meter data; and security and access controls at critical power generation, transmission and distribution substation facilities.

Smart Water. The world's water resources are under pressure from increased population growth, expansion of business activity in the developing world, rapid urbanization, climate change and depleting aquifers from heavy agricultural irrigation. Public agencies and water system operators will need to manage their resources and infrastructure smarter. These initiatives entail greater use of smart sensors, smart meters and smart devices that enable increased automation and use of advanced business analytics.

Ku-band supports several key applications related to water management—for example, the real-time collection of data from rain and storm water harvesting feeding into reservoirs; managing water levels in dams, rivers and reservoirs to prevent flooding; monitoring and controlling equipment at purification and pumping stations; real-time metering of water flows in water pipeline networks; detection of leaks or breaks in pipelines and just-in-time remote shut-down to minimize loss; just-in-time irrigation in agriculture by monitoring soil moisture content; and security and access controls around dams and reservoirs.

Where Is TSAT Focusing Their Efforts?

TSAT is focused on the emerging needs and opportunities related to narrowband connectivity. The TSAT platform is optimized for the transport of M2M and IoT data by supporting popular IoT protocols and by easy integration with low power wireless sensor technologies for expanded wide area coverage.

The platform lends itself well to large corporate end-users that desire to own or manage their own infrastructure to meet internal connectivity requirements, and for service providers that desire to own and operate dedicated networks on behalf of large or small end-users.

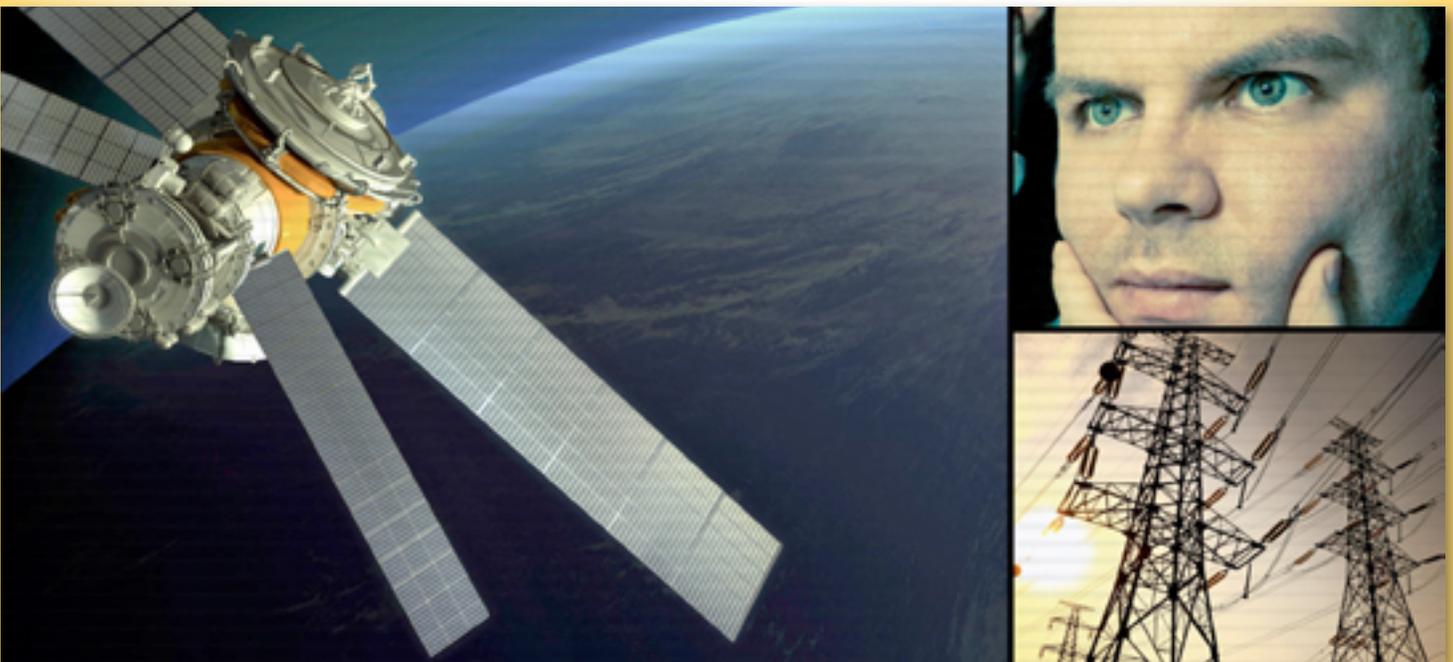
Service Providers' Best Approach To The M2M + IoT Market

Service providers must tailor their offering to specific market segments. This can include value added services that simplify M2M and IoT application development and device management, as most end-users are not familiar with employing satellite for their connectivity needs. Offerings presented as cloud-based services have increased appeal within certain segments.

M2M and IoT represent a significant market opportunity for satellite. Service providers need to start planning their strategies now before an already crowded market becomes too packed to penetrate.

tsat.net

Stein Harstad is the managing director of TSAT AS. Stein has more than 20 years of experience in satellite communications in executive roles within research and development, sales and marketing, product management and strategy formulation and deployment.



SatBroadcasting™: The Art Of Using Video To Manage Video

By Roger Franklin, Chief Executive Officer, Crystal

Have you ever wished you could press playback on an event that occurred in the past? Perhaps to prove a point you're trying to make, or, as in the case of 20/20 hindsight, a lesson you're attempting to teach?

While we may not have the luxury of pressing the rewind button on life, in the world of broadcasting, the ability to record what is happening in a network management system and then browse, search, and download those events is, indeed, a reality.

Video is the meat and potatoes of the broadcast industry. Masses of videos are created every day for distribution across multiple networks, not to mention the numerous acquisitions of third-party video content that occur. Broadcasters must seize the incredible opportunity to record what is happening in their systems to, not only improve the customer experience, but also for tasks like managing compliance, training employees, and performing post-mortems.

Managing Compliance

Regulations are everywhere and ever-evolving. Satellite broadcasters must adhere to them. Take, for example, SCTE-35, which relates to digital program insertion in broadcasts. In addition to training on the standard itself, it is extremely helpful to show operators exactly how this standard relates to their specific system.

Reviewing system recordings and conducting regular checks of those recordings will help to ensure that everything is functioning properly and is in compliance with regulations, such as the aforementioned SCTE-35 and countless others.

Don't forget—compliance also pertains to internal systems and practices. If a broadcaster receives a complaint, those regular compliance checks will be a useful starting place, enabling them to pinpoint what went wrong. By re-visiting those recordings, broadcasters can check specifics around a complaint; for example, whether or not an advertisement was inserted in the correct place or region. If a mistake was made, the broadcaster can then take the necessary actions to resolve the complaint with the customer. If, on the contrary, fault lies somewhere else, the recording could prove the case.

Training Employees

Using video to train employees is common place across many industries and is becoming a popular means to ensure all employees receive the same message. According to the Brandon Hall Group, as many as 95 percent of companies use at least some video for learning. This makes a lot of sense in

a world where online video accounts for 50 percent of all mobile traffic and 78 percent of people watch videos online every week. In fact, according to Nielson, video is the most popular content consumed globally.



Video is a great alternative to hard-copy training guides and may, in fact, be more effective for visual learners. According to an article in *Elearning Industry*, studies show that humans only retain 10 percent of heard information after three days, as compared to 65 percent when you add visuals. Video also enables you to demonstrate real-world scenarios in a way not possible with other training methods. When it comes to the broadcasting industry, your employees are already clearly passionate about video. Why not train them using the same vehicle?

Performing Post-Mortems

We all know drill—"This call will be monitored and recorded for quality assurance." Call centers have long since recorded calls made to and out of the center, subsequently using them for training purposes. In some cases, they use these recordings to de-escalate issues. They review these recordings and perform a careful post-mortem, determining appropriate actions and changing procedures to avoid a repeat offense.

Think for a moment how useful that recording could be in the broadcast world. The Network Management System is already recording content and user commands, so performing such a post-mortem at any stage will be relatively straight-forward. Not to mention, the operator's memory about what they did isn't always going to be totally accurate, in the same way a call center operator won't remember every conversation they had in perfect detail. Reviewing these recordings will help the team decide what can be done differently, or automated, to avoid future issues.

Embracing Video's Alternative Values

Video is everywhere—to broadcasters, video is everything. Why not harness video's power for capabilities other than entertainment? Managing compliance, training employees and performing post-mortems calls for reliable, on-call techniques—and video is the perfect solution.

www.crystalcc.com/

What is SCTE-35? Ad time slots are sold by broadcasters to advertisers and is the basis of revenue generation. Ads are not, generally, produced and then hard coded into a TV program. Rather, they are placed into the programming "on the fly." This requires a method whereby the broadcast stream itself recognizes the time slot for the advertising. SCTE-35 is the standard for the signal that is used to alert the transport stream that an insertion opportunity (a Digital Program Insertion) is available.

Every day, billions of dollars of content flow through systems that rely on Crystal technology. Mr. Franklin's unique background as both a software engineer and a business owner drives Crystal's use of leading edge technology to solve real world business problems.

Roger specializes in identifying operational inefficiencies and designing intuitive, responsive, and reliable solutions to correct and capitalize on these opportunities. He has been involved with Crystal since its founding in 1986 and holds a Bachelor of Science in Applied Mathematics from the Georgia Institute of Technology. Since early 2009, Roger focuses on ways to mitigate and prevent RF interference, which includes chairing the IRG Carrier ID working group and developing a Carrier ID Detection System.

Crystal's roster of customers includes News Corp/FOX, Time Warner / HBO / CNN, Disney / ESPN / ABC, CBS, NBCU, Discovery, PBS, Starz, Viacom, Lockheed, Intelsat General.



A Globalstar Perspective: Going For Growth

By Jay Monroe, Chairman + Chief Executive Officer, Globalstar

The energy at Globalstar continues to grow as the company kicks off 2016.

First and foremost, Globalstar looks forward to the near completion of the second-generation ground network so that the customer base can leverage enhanced product technology that provides improved call quality and data speeds that are up to 25x faster, all while maintaining the industry's most competitive pricing.

A new agreement with Yippy, Inc. will also ensure that Globalstar subscribers have access to that company's industry leading software platform to provide a broadband-like mobile data experience over satellite.

Years and a billion dollar investment in the making, users in industries such as Government, Energy, Marine, Forestry and Emergency Management will be able to use Globalstar's superior network and revolutionary products that

were previously not available to MSS customers, all at an accessible rate that will allow our company to expand to areas of the world that currently have sub-par communications means.

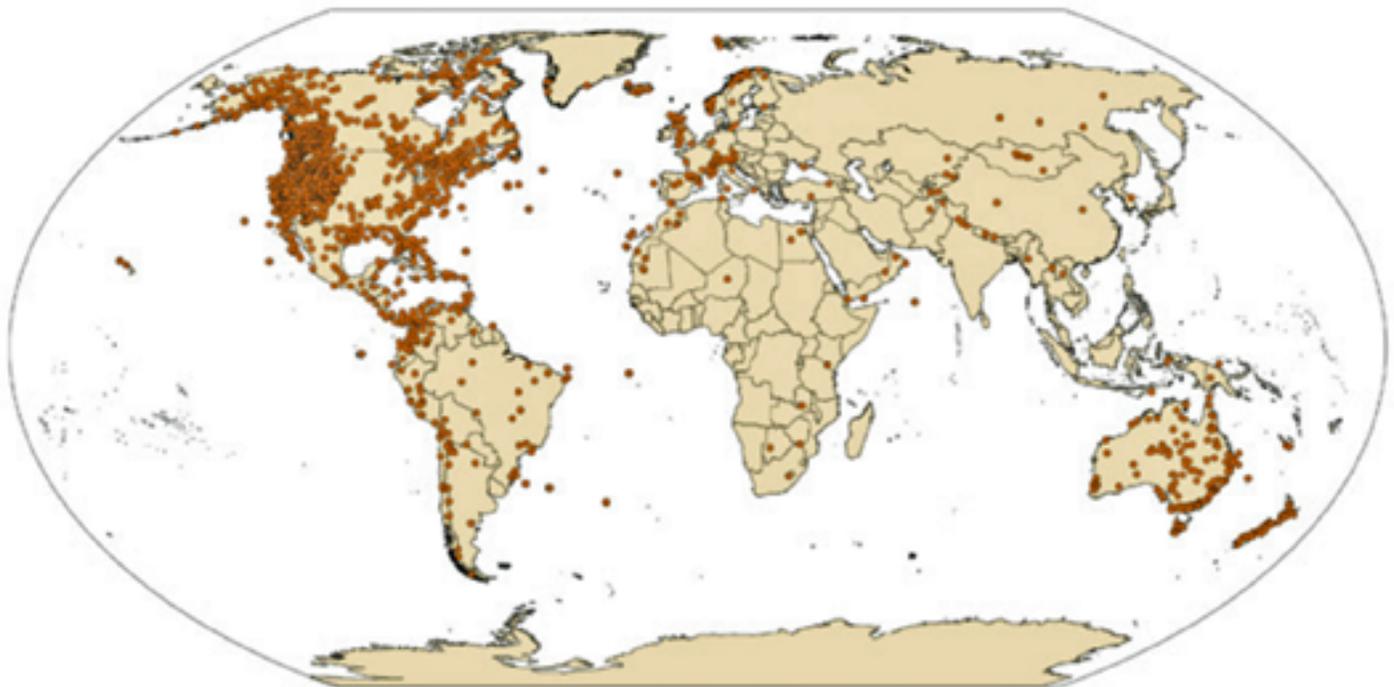
This year, customers will be introduced to a host of new products that achieve a significant improvement in cost, size, functionality and data speeds. The next iteration of the company's Sat-Fi will be smaller, more feature-rich, portable and affordable.

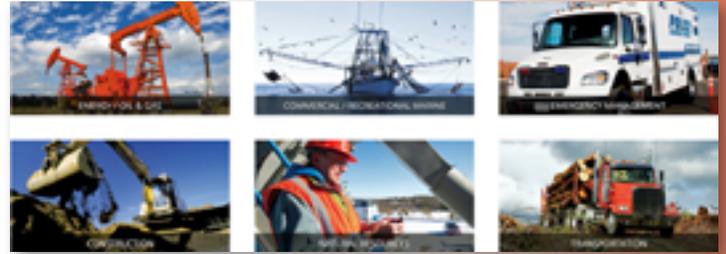
Additionally, there has been an increase in customers who demand connectivity beyond cellular using their existing device (*i.e.*, smartphone or tablet). The biggest impediments to making this a reality have historically been a combination of cost, ease of use, power (lack of battery capabilities) and form factor. The new Sat-Fi addresses all of these issues at a tenth of the cost of the first-generation Sat-Fi hotspot.



4,000 RESCUES AND COUNTING

THOUSANDS OF RESCUES MADE. COUNTLESS LIVES TOUCHED.





Globalstar's award winning, life saving, SPOT technology will continue to improve. SPOT recently initiated its 4,000th worldwide rescue. On a [November] Saturday in Alabama, retired firefighter Michael Herrera was on his dual-sport dirt bike when he took a hard fall in a remote location. Although initially disoriented, his experience as a first responder told him that his internal injuries were more serious than he could view. He then reached for his SPOT Gen3 and pressed the S.O.S. button.

Within 40 minutes thereafter, an ATV and ambulance were on site. At the hospital, the determination was that he had suffered a broken collarbone, three broken ribs and a partially collapsed lung. After surgery, we're happy to report that Michael is recovering and we were proud to host him at our corporate headquarters last December.

The M2M tracking market continues to evolve and the company's market share will continue to grow with products such as STX3, the smallest and most power-efficient M2M transmitter of its kind. It's been rapidly embraced by the industry and our talented VAR network, who have started rolling out innovative new solutions that help organizations of all kinds better manage their assets.

Further, we expect our consumer tracking application, the \$99 SPOT Trace, will continue to gain steam as the market learns of this compact, concealable solution to track cars, boats and other high-value personal assets.

With improved product and service offerings, Globalstar is in a better position than ever before to continue to expand our global footprint, including further expansion into South and Central America, Africa and Asia.

The percentage of gross additions coming from foreign markets serves as a significant indicator of the success of the company's operations abroad; these markets now account for one-fifth of the total worldwide subscriber base and we expect this percentage to increase to approximately 50 percent over the next three years.

Finally, we look forward to the successful completion of the Terrestrial Low Power Service ("TLPS") spectrum proceeding before the Federal Communications Commission to provide consumers a superior terrestrial broadband offering. TLPS will improve wireless broadband access in the 2.4 GHz band for consumers by spreading the traffic in the band over four, rather than three, non-overlapping channels.

The benefits will be particularly important in America's schools and libraries given their high-density environments with substantial and growing wireless usage demands.

Globalstar has committed to provide up to 20,000 free TLPS access points to public and non-profit schools, libraries, community colleges and hospitals. This commitment along with the Commission's proposed rules, can help ensure that these often underfunded organizations have affordable, high-capacity broadband that meets the needs of their communities.

The Washington School for Girls in the Anacostia community in Washington, DC, was among the first to receive these free access points. One of the major challenges facing the students had been a lack of access to technical resources.

Additionally, prior to the rollout of TLPS, the school experienced heavy congestion during peak periods, which led to problematic connectivity during online standardized testing. Now, eighth grade students use TLPS Channel 14 on TLPS-enabled Chromebooks daily, while the sixth and seventh grade students on the same floor continue to use Channels 1, 6 and 11 with full compatibility.

The success Globalstar anticipates during 2016 and beyond has been years in the making. I am proud of the team in place to start this next chapter. The company will continue to innovate in the MSS industry and focus on expanding product depth and geographical presence worldwide as high value connectivity continues to be delivered by Globalstar to an ever-connected world.

globalstar.com/

findmespot.com/

Focus: Can Big Data Solve Satellite Interference?



By Marin Coleman, Executive Director, the Satellite Interference Reduction Group (IRG)

The term 'Big Data' is being increasingly used across multiple industries, but there hasn't really been much of an explanation about what it actually means, as the term has different interpretations for the various parts of the industry.

At IRG, we are just starting to learn how Big Data may be used to benefit interference mitigation. This is an enormous concept, as the name denotes, but if we can learn how to use it properly, collect the data and ask the correct questions of that data, we can use it to make decisions, solve problems and educate users.

To obtain a better idea of what Big Data means we need look no further than the Internet and the billions of people—and things—that are connected to it. Data is literally everywhere, to a point where it can seem quite overwhelming. By 2020, the United Nations Economic Commission for Europe forecasts that the amount of data on a global scale will reach approximately 40 Zettabytes. Imagine using this data with new processing techniques so that we can solve future interference scenarios at a faster rate than has been possible in the past.

What if, through predictive analytics and being able to connect the dots quickly, value can be extracted from that data? The more we can quickly and effectively analyze the data, accuracy is gained and used to evolve decision-making and problem solving. There is so much data out there so, we should start to use it in a positive way.

Extracting Value From Big Data

First of all, core and relevant data must be collected. Our industry probably has such information securely locked away and in a variety of different formats that make this idea difficult at this point in time, especially in the case of a subject such as interference. However, it is the first step and the collection of data will be a continuous process and automation will also play its role.

Big Data allows prediction and solution through statistical analysis and we can learn so much from the data that we have access to through a technique called Deep Learning. Deep Learning is an emerging technique that, when applied, enables computers to identify items of interest from large quantities of data and to then identify relationships between that data—the techniques that may then be applied are able to extract meaningful information.

What does this mean for satellite interference, and how does Big Data fit in? IRG is highly conscious of this shift to Big Data and has also recognized the benefits that such can offer to the satellite industry, as it has already accomplished in multiple industries. It is important that IRG doesn't 'miss the boat' in terms of taking advantage of the positive effect that Big Data analytics could potentially have on the problem of satellite interference, but we need to start working on this in earnest—now.

The frustrating issue of satellite interference is something that still causes problems to users of satellite systems. However, this is also an issue that is being aggressively tackled by both industry bodies and companies. Highly experienced engineers continue to work tirelessly to make the business of identifying and eradicating interferers a great deal easier than has been

managed in the past. Interference is often completely unnecessary, yet holds consequences for the industry in terms of disruption and money.

Pinpointing the source of the problem means a sharp increase in using resources and personnel, and excessive pressure to quickly resolve the problem. The vast majority of instances of interference come down to improper installation of ground equipment, lack of training, poor ground equipment manufacturing, and a lack of adherence to industry standards and guidelines. However, as we have seen, specifically in recent times, political motivation can also lead to incidents of malicious jamming—and this is extremely challenging to deal with.

Could analysis of all satellite interference and additional relevant data that probably exists within the Internet help us to fundamentally address the interference issue? If we retain every statistic, incident and detail of satellite interference, data storage will grow and we can then apply Deep Learning methods to that information in order to help us to predict and resolve future incidents and potentially stop them from occurring in the first place.

By collecting such statistics, adding the analysis from interfering signal characteristics to the Data store, certain "signatures" could be extracted that could lead to possible auto-classification of interference types and better user-friendly tools to progress our mission of mitigating interference.

IRG has started to build a repository of these basics, such as articles, statistics and presentations, that inform us about satellite interference. Granted, a small start; however, everything the group has presented since 2011 (and some from earlier events) is now located in one place and the data continues to grow. This can be found via the IRG website (satirg.org) or directly at <http://data.satirg.org>.

This is just the beginning and there is a great deal that the industry must learn before it can begin to employ Deep Learning to any Data. At Satellite 2016, IRG will be participating on a panel that will ask the question "*Can Big Data Tackle Satellite Interference Challenges?*" Industry discussions such as this one are vitally important so that we may address how we move forward and whether Big Data can actually be a pivotal tool in solving the issues of interference.

Deep Learning and predictive analysis are evolving rapidly and, as our understanding develops, is set to play a much deeper role across all industries. It is important that the satellite sector seize upon this opportunity, as it could provide yet another critical solution to the industry-wide challenge that is constantly presented by interference.

"Can Big Data Tackle Satellite Interference Challenges?" takes place on Wednesday, March 9, at 2:15 p.m. in Room Annapolis 1-2.

satirg.org/

Turning Network Data Into Business Value

By Rajanik Mark Jayasuriya, Vice President/Assistant General Manager, Satellite Networks Business Group, ST Electronics

A gap exists today between network data and business value—and the answer to filling that gap goes beyond the network management system and into an intelligent system that sits at the core of your business.

Today, a typical network management system is associated with the monitoring and management of a satellite service provider's network, but succeeding in today's changing network landscape requires more... networks are growing in size and are highly diverse, with multiple pieces of equipment operating over a broad range of disparate access technologies. This growing network communications footprint is accelerating the volume of business data that needs to be integrated and the rate at which such must be interpreted.

This means that a system is needed that provides an intelligent view into all types of networks, one that delivers proactive alerts on network service degradation across multiple platforms and uses historical data to study and analyze network usage as network performance is optimized. With such capabilities, the potential of the network data now sits at the heart of an entire business.

Agilis has built the Agilis RealTime Advisor™ with such capabilities in mind. This web-based system enables deep visibility into hundreds of systems and equipment across the entire network. With this deep visibility comes the intelligent analysis of the data to help drive important decisions; decisions that have a tangible impact on the business.

Get Real

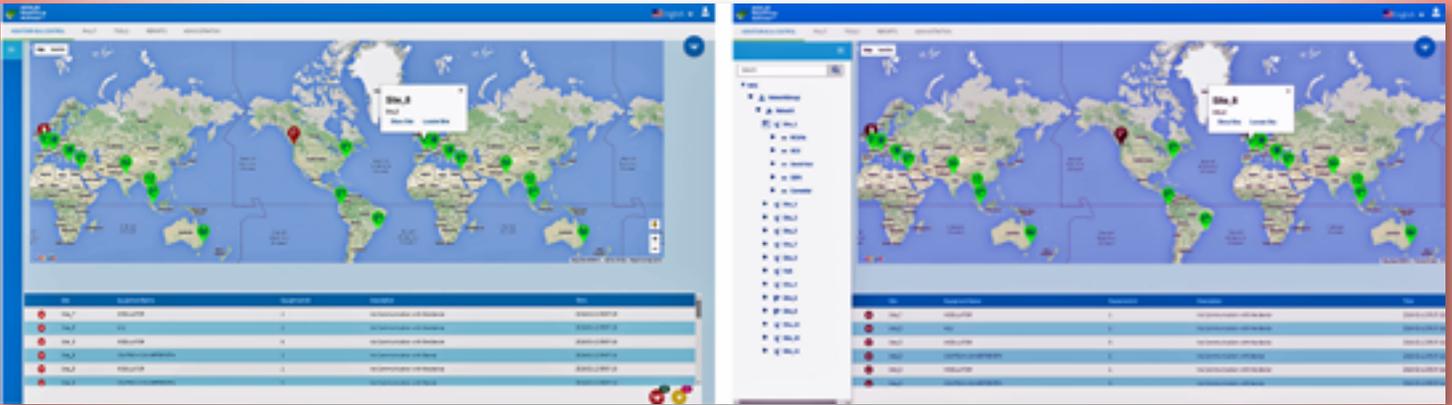
Getting true results starts with having real-time information. As networks grow increasingly diverse and complex, that means more data is coming in from multiple sources, and all at a much more rapid pace than ever before experienced. The fact that this data must be tied ever closer to the business means that the ability for rapid decision-making is a crucial need.

Take service management, for example. Network infrastructure must be monitored from the customer perspective. This comes with the management of service level agreements (SLAs), coupled with customized reports and service provisioning.

With the Agilis RealTime Advisor, this can be done at any time from any location and translated into your regional language. Having this level of sophistication means faster recover times in terms of network failure, which ultimately leads to the ability to meet SLAs with a high rate of effectiveness.

Part of this process comes with always being alert to every condition on the network. This comes in the form of immediate alerts on RF subsystem failures, along with real time carrier status alerts. The RF subsystem failures can be confirmed with the RF carrier data, captured by the carrier monitoring system. Additionally, spectrum data proves to be helpful in this function, supplementing additional details related to the issue for the customer.





Location Tracking views provide highly graphical displays of all VSAT terminals, including MES, ship borne, and fixed, all on a global map view.

This also extends into field operations, where being reactive to situations is the name of the game today. This is where a mobile application that allows for the remote monitoring of networks comes into play. This provides the option for strategic support to network operations from anywhere in the world without the need to be permanently stationed at the Network Operation Center (NOC). This significantly reduces manpower costs, bandwidth and provides maximum convenience to the user.

Real-time data is the first step in getting to true business value.

Get Smart

Now that real time data is in hand, all must be brought together in a manner that helps valuable conclusions to be formed, conclusion that help business goals.

One example is the ability to expand and adapt to multiple nodes, which allows for the rapid configuration and management of multi-vendor networks. This means the system can change configurations when moving from one area to another, or in those instances when a satellite is pointed from one area to the next area. The system intelligently stores this information, meaning no reconfiguration of the network is necessary.

Overall, from the perspective of managing hybrid networks, the system can help pinpoint an alarm and map it to the correct equipment/network element with the ability to restore the network using configuration fallback. Because the system manages all different types of equipment, configurations can be easily swapped as needed, including redundant systems.

The ability to respond to network failure should never be reactionary. An intelligent system understands the network, identifies potential points of failure and makes intuitive adjustments. Responding to failures in terrestrial communication systems, the system will automatically switch over to the satellite communication system. When equipment does fail, customers will know which piece failed and the reason behind the failure. In all, a new range of flexibility is provided.

This level of intelligence also takes capacity planning to the proactive level. By tapping into historical data, network usage can be studied and analyzed for the purposes of optimizing network performance. As networks grow increasingly complex, intelligence at the systems level becomes the best tool in preparing for anything that comes into play.

Business Value

Networks are expanding across multiple access technologies, producing a wide volume of data that must be turned into business value. Simply being able to monitor your networks is no longer enough for success.

Through an intelligent system such as the Agilis RealTime Advisor, the network operator is able to provide high availability services with better QoS to customers.

The intelligent views of the system allow for a far quicker resolution of issues, thereby meeting the SLAs, as well as the ability to rapidly deal with changing demands like evolving weather patterns or other catastrophic hits. Success today requires real-time data and intelligent analysis across the entire network in order to provide deeper visibility and overall control to the business.

agilissatcom.com

Rajanik Mark Jayasuriya is currently the Vice President/Assistant General Manager for the Satellite Networks Business Group (SNG) of ST Electronics. Mr. Jayasuriya has extensive knowledge in the satellite industry having worked in the industry for over 20 years. Mr. Jayasuriya holds multiple patents for technology advancements. In addition, his vast experience in the commercial and government satellite and telecommunications markets range from product design, engineering, operations, sales and system integration.

In his current role, Mr. Jayasuriya's team delivers backbone communications solutions to key global defense and commercial organizations. Under his leadership, SNG has distinguished itself in the industry for supplying sophisticated, customized solutions to solve unique business challenges. Previous to this position, Mr. Jayasuriya held the position of Regional Vice President for iDirect Asia (an ST subsidiary). In this role, he managed sales operations across Asia resulting in opening the key markets of China, India, and Vietnam for iDirect products.

Mr. Jayasuriya has a Master of Science degree in Electrical Engineering from the National University of Singapore and a Bachelor of Communication and Electronic Engineering degree from Royal Melbourne Institute of Technology.

An ORBCOMM Perspective: The Push Into 2016

By Marc Eisenberg, Chief Executive Officer, ORBCOMM

Coming off the success of the company's most significant year to date, ORBCOMM is moving forward with a fast start to 2016.

From new customer wins, to executing on large customer deployments such as HUB Group and Wal-Mart, to the integration of three acquisitions, to continued innovation and exciting product launches, as well as the completion of the OG2 satellite constellation, ORBCOMM's momentum is accelerating like never before.

2015 closed out with a bang—actually a blast—with the second and final launch of ORBCOMM's OG2 satellites on December 21, 2015, from Cape Canaveral Air Force Station in Florida, completing our advanced next generation constellation for the company. SpaceX executed a virtually flawless launch slotting ORBCOMM within a fraction of a degree of the intended orbit.



The SpaceX Falcon 9 launch of ORBCOMM's OG2 satellites.

Just over an hour after launch, all 11 OG2 satellites established connectivity at ORBCOMM's Gateway Earth Stations around the world. This mission is historic on many levels. This was the first launch of SpaceX's upgraded, full thrust Falcon 9 rocket, and tallies up as the largest number of identical communication satellites launched on a single mission. This launch also marked the first successful landing of SpaceX's reusable Stage 1 booster at the highest altitude to date—definitely an exciting day for all in the space industry.

However, ORBCOMM is most proud of the fact that we now have the only fully funded, fully operational, next generation satellite network purpose-built for the global M2M industry. Validating the company's leadership in this sector, Compass Intelligence recently named ORBCOMM the M2M Satellite Service Provider of the Year for the third year in a row.

With the OG2 satellite constellation now in full commercial service, customers gain significant enhancements, including improved network performance and increased coverage at higher latitudes. These new OG2 services translate into a higher level of service and reliability for our customers as well as even more opportunities for ORBCOMM through expanded global coverage, increased market reach and the many new applications we can support.

In addition, all of the OG2 satellites are equipped with ORBCOMM's Automatic Identification System (AIS), which transmits vessel identification and position and will soon offer customers nearly 24x7 coverage and visibility of the vessels they are monitoring. While the OG2 constellation is a key enabler of our M2M and IoT solutions and one of our strongest assets, the next mission is ensure the world knows that the company offers much more than ORBCOMM's satellite connectivity.

ORBCOMM has spent the past several years transforming the company into a leading provider of full, end-to-end solutions that can cover every touchpoint in the M2M ecosystem.

From global satellite and cellular network services to hardware, web applications, software and device management, ORBCOMM owns the unique ability to provide the most complete set of products, applications, professional services and capabilities for a multitude of vertical markets.

ORBCOMM is comprised of an incredible team of more than 500 employees worldwide, including the M2M industry's largest technical team with nearly 300 engineers focusing on the continual development of ORBCOMM's M2M and IoT solutions. This includes internally developed, versatile hardware solutions, intuitive software enablement platforms as well as end-to-end solutions from device to dashboard.

This is a huge asset for ORBCOMM and our customers to have all of this and more in-house as it reduces costs and time to market and achieves increased scale in multiple key areas of the business. ORBCOMM makes it easier than ever for enterprises, both large and small, to deploy solutions and gain a strong ROI, whether they are looking to save on fuel, improve asset turn times, lower maintenance costs or optimize asset utilization.

The diverse portfolio of connectivity options tells quite a different story today than was possible even just a few years ago, when ORBCOMM was known solely for selling connectivity on the ORBCOMM network. The characteristics of various solutions may require different networks to support them. Today, ORBCOMM offers multiple modes of cellular connectivity at competitive price points through our relationships with seven Tier One wireless carriers. In addition, with our strategic partner and industry leader, Inmarsat, ORBCOMM also offers global satellite services for three satellite networks —ORBCOMM, Inmarsat and Globalstar.

By connecting all of these cellular and satellite networks through the ORBCOMMconnect subscriber management portal, customers find it easy to select the proper connectivity for their application and to cost-effectively manage and provision their assets across multiple networks.

The company continues to make great strides in our partnership with Inmarsat, which allows customers to buy seemingly identical modems for use on the ORBCOMM and Inmarsat networks.

These modems leverage the same footprint, the same pinouts, the same programming environment and the same power input. The interchangeable format allows users to develop one application and leverage two networks, sharing scale and reducing price points.

These modems provide customers with unrivaled ease of use, flexibility and quality of service based on their unique application needs, including message size, delivery speed, geographic coverage and regulatory requirements.

The ORBCOMM and Inmarsat modems are available today for integration into a wide variety of M2M hardware solutions and will be available through both distribution channels. Announcements regarding additional collaborative efforts in the near future will be forthcoming.

Looking at the breadth and depth of our solutions portfolio, it is clear that ORBCOMM is more than the leader in satellite-based M2M but also a leader and innovator in the global M2M and IoT industries. We look forward to another exciting year ahead as ORBCOMM continues to grow our current 1.6 million subscribers and to further expand our market and geographic reach.

With the company's flexibility, dynamic capabilities and global footprint, ORBCOMM is delivering products and solutions that are revolutionizing how some of the world's largest enterprises do business.

Marc Eisenberg is the President and CEO of ORBCOMM and has been since 2008 after joining ORBCOMM in 2002. In his tenure as CEO, ORBCOMM has grown over 500% in revenues and has become a leader in the M2M industry as well as positioning itself as a full solutions provider. Before joining ORBCOMM, Mr. Eisenberg was a Senior Vice President of Cablevision Electronics Investments, where he was responsible, among other duties, for selling Cablevision services including video and Internet subscriptions through its retail channel. Previously, as Senior Vice President of Sales and Operations at the consumer electronics company, The Wiz, he was responsible for more than 2,000 employees and \$1 billion in annual sales.

orbcomm.com/



ORBCOMM's Interchangeable Satellite Modems can utilize either the ORBCOMM or Inmarsat Networks.

Focus: A Terabyte Of Data To The Connected Car

By Tom Freeman, Senior Vice President, Land Mobile, Kymeta Corporation

Kymeta and Toyota are teaming up to cross an overpass—an overpass away from the technical limitations of using the current cellular network for connected car, and into a world that delivers an unprecedented value in capacity, coverage, security and cost.

The Kymeta Connected Toyota Concept vehicle seeks to provide a first-of-its-kind connected experience to every vehicle, regardless of location or speed, and at a fraction of the cost of today's cellular systems.

Who Is Kymeta?

Dr. Nathan Kundtz is the founder, CEO, President, and mastermind behind Kymeta. An innovator in the field of metamaterials, Dr. Kundtz is frequently cited for his research at Duke University on metamaterials and the development of novel design techniques—such as transformation optics—to meet real-world needs.

The success of his work has ultimately led to the formation of Kymeta Corporation. Since 2012, Kymeta has made incredible technological leaps in the field of metamaterials. It has culminated the power of its mTenna™



technology for key partners, such as Toyota, to provide a low maintenance, inexpensive and incredibly powerful antenna solution that can be embedded into the roof of a car.

Solving The Cellular Network's Limitations

When you're looking at data consumption trends, the need for more is the one constant. This will continue to be true into the foreseeable future as well, as high-quality content becomes more pervasive. What we watch and experience will become richer, and thus require more space.

Twenty years ago, if you used a dial-up modem to email your friend a 'selfie' taken with today's smartphone, it would take at least 40 minutes to upload. Today, the average connection speed is about 1,200 times faster, allowing the same 'selfie' to upload in one second. In tomorrow's world, the customer will only expect more – demanding quicker access to data and the ability to consume increasingly richer multimedia.

Why is it that today you can get such fast speeds in your house or apartment but not to your car? This is because your house is in a fixed place, connected by wires and fiber optic cables.

Our challenge, and the reason we've teamed up with Toyota, is that we're looking to connect things that do move. It is obvious that you cannot do this with wires and cables, but what isn't obvious is how current technology and wireless availability will meet the projected demand.

Some people believe that current cell tower infrastructure can meet the demand for data to your car—but we disagree. We're certain the wireless spectrum being used by cellular towers will not allow enough space to connect moving things.

More Spectrum, More Possibilities

When embedded into the roof of a car, Kymeta gives you and your automobile access to data that exceeds the speeds going into your home today. Coverage for every day consumers of a connected car will extend beyond local LTE hotspots for uninterrupted global coverage.

By using multicast technologies for economy and a natural resource that is highly limited on the ground but widely available by satellite—called frequency spectrum—it's possible. Massive amounts of data can be delivered at much faster speeds to global components.

Cell phones today can only 'see' one cell tower at any given time, but a Kymeta mTenna™ can 'see' up to 300 satellites, in various orbits, on the same frequency. Moreover, today's 4G/LTE connected car can only offer unicast solutions for software or firmware update—meaning only one update can be made at a time. Kymeta provides a solution for multicast which can update a fleet of cars on the road at one time.

Kymeta taps into this 'fixed spectrum' that was previously only available to the large, 'esthetically challenged' dishes most people recognize as providing satellite TV to their homes. However, by using Kymeta's mTenna™ technology, which creates a flat, lightweight, mobile, nimble and essentially invisible antenna, we now have the ability to access this 'fixed spectrum' while on the move.

The mTenna™ embedded in the Kymeta Connected Toyota Concept vehicle aims to provide a terabyte of data, per month, per car. This amount easily allows plenty of data capacity for rear-seat infotainment, telematics, software updates and autonomous driving.

Additionally, the beauty of using Kymeta's mTenna technology is that it's future proof. When you don't use mechanical components for an antenna, it has the ability to be compatible with future systems like LEO and MEO constellations to deliver huge increases in data to the car, even before the systems and constellations are off the drawing board. This is a significant point—it's like saying that the flip-phone you purchased in 2006 is completely compatible with and would support the throughput of the 4G system in 2016.

Our vision is to see every car on the road equipped with Kymeta's breakthrough technology. Access to satellite connectivity will become the norm. Cars will be equipped with software defined systems and have the flexibility to set capacity levels depending on individual needs.

Just-in-Time Capacity

The flip side of space capacity is vehicle capacity. With Kymeta's tiling technology, antenna numbers and sizes can be mixed and matched to meet regional, market and price-point requirements.

Think of the Kymeta system like Legos™—if more capacity is needed, more blocks can be added. In the Kymeta Connected Toyota Concept vehicle, one 15.24 cm (6 inches) antenna will be equipped with the minimal receive only capabilities along with options to add more solar panels for stronger transmission power. Just-in-Time capacity means that one system can deliver maximum manufacturing flexibility to meet different market conditions.

The Overpass

It was only 20 years ago that dial-up was king. Now, think of how you live today—consumption levels have skyrocketed and the cellular network can no longer sustain its demands. A major proof point is evaluating connectivity speeds at stadiums or major tradeshows where data levels drop significantly due to an uptick of devices fighting for available spectrum.

If you pick up any magazine or literary article about the autonomous car, you'll notice a huge focus on mobility. Experts will tell you that the data needed to enable truly autonomous cars can't even begin to be carried over today's LTE networks. By working closely with satellite industry partners, Kymeta is able to deliver speeds and capacity more than 100 times what your monthly cellular plans can offer.

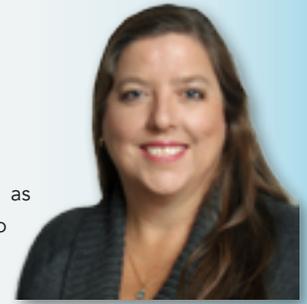
Once we accept that data consumption demands will only continue to climb, and that connected cars will need an exponentially larger amount of data to operate, the only practical way to deliver enough bandwidth to satisfy that data demand is through satellite connectivity.

This is precisely why Kymeta and Toyota have come together. We've partnered to create an overpass to provide a fast track to the future of the connected car.

kymetacorp.com/

Liquid Cooling For HPAs Is Back, And... It's SuperCool

By Mark Schmeichel, Vice President of Engineering + Technology, and Heidi Thelander, Senior Business Development Director, both with Comtech Xicom Technology



Two broad trends in SATCOM uplinks are driving the need for liquid cooled SATCOM amplifiers: the amplifiers keep getting more powerful to support higher data rates, and higher frequency bands being used to take advantage of greater available spectrum.

Higher frequencies mean more loss incurred in the waveguide run and components between the output of the HPA and the feed input (Figure 1). Placing the amplifier closer to the feed enables you to buy less power or use more of the power you've bought.

With higher power needed for increasing data rates, you don't want to waste RF power in long waveguide runs, and your HPAs may generate more heat than before, making it more challenging to cool them up close to the antenna feed.

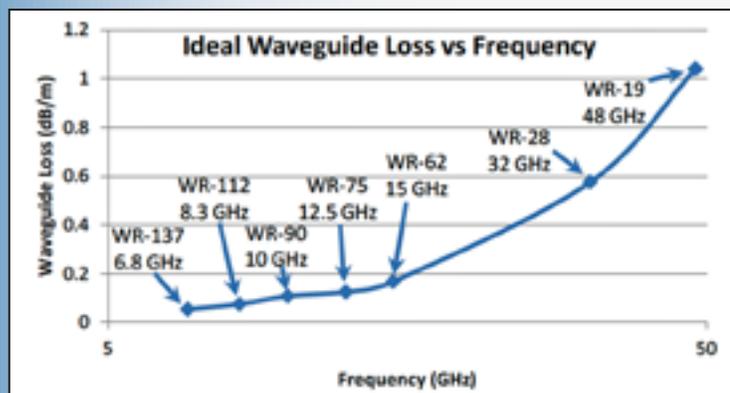


Figure 1. Higher frequency bands drive the need for HPA placement close to the feed.

The Liquid-Cooled Solution

Many current teleport or gateway uplinks are implementing antennas with outdoor TWTAs placed in hubs on the back of the antenna to keep the waveguide runs short. The resulting challenge of cooling the interior of the hub is significant, requiring large air conditioners that require frequent maintenance and are often the least reliable component of the terminal. New liquid cooling, as implemented in certain high power SATCOM uplink amplifiers, simplifies design and eliminates operational problems for hub-mount systems:

- No air conditioner in the hub—the number one maintenance and reliability problem
- No air flow requirements or ducting for HPAs in hub – simplifies layout, creates space, allows HPA placement closer to feed
- Eliminate most hub maintenance—no HPA fins or fan filters to clean or replace, no HPA fan failures, no air conditioner regular maintenance
- No HPA noise at the hub —remote the radiator or cooling element to a location with better environment and easier access and keep the neighbors (and the techs) happy
- No variation with temperature—closed loop flow control provides constant baseplate temp even in extreme environments, reducing gain variation and extending life

Other terminals use indoor HPAs, such as Klystron amplifiers, because they want to control the environment for the amplifiers to extend their life, or because they are near residential areas and cannot have the noise of the fans and air conditioning equipment running 24/7.

These implementations spend a lot of energy and money on air conditioning the indoor environment, along with the building and rack space for this RF equipment. Not to mention the power wasted in long waveguide runs. Liquid-cooled HPAs can:

- Dramatically reduce thermal load on general air conditioning system—frees up air conditioning for other uses including expansion of baseband equipment
- Create the option to move HPAs outdoors even in urban or extreme environments with quiet, sealed units, no fins/fans to clean/maintain and no temp variation on HPAs
- Significantly reduce power consumption and thermal dissipation vs Klystrons with liquid-cooled indoor or outdoor TWTAs that draw much less power at lower output RF power

The Workings

These new liquid-cooled HPAs (see Figures 2a through 2e on the next page) are identical to the standard air-cooled TWTAs except for replacing the standard baseplate, fins, fans, and ducting with a new baseplate containing the tube which carries the cooling liquid through the plate (Figure 2a, next page).

This makes it easy to create the new liquid-cooled product from an existing one, simplifying material management and manufacturing, while also keeping complete isolation of the cooling liquid from the RF and power supply electronics which are in separate, sealed compartments (Figure 2b, next page).

The layout of the tube in the plate is custom designed for the thermal dissipation of the specific amplifier model (Figure 2c, next page), and is designed with margin to comfortably cool the TWTA with a fairly low flow rate (Figure 2d, next page).

The ends of the cooling tube are connected to a pair of dripless connectors which are color coded for the input and output of the unit (Figure 2e, next page).

These do not leak even when disconnected under pressure, and they connect to matching color-coded mating connectors attached to hoses to and from the rest of the cooling system.



Figure 2a. Xicom SuperCool™ Liquid-cooled TWTA is the same as air-cooled in RF and power supply.

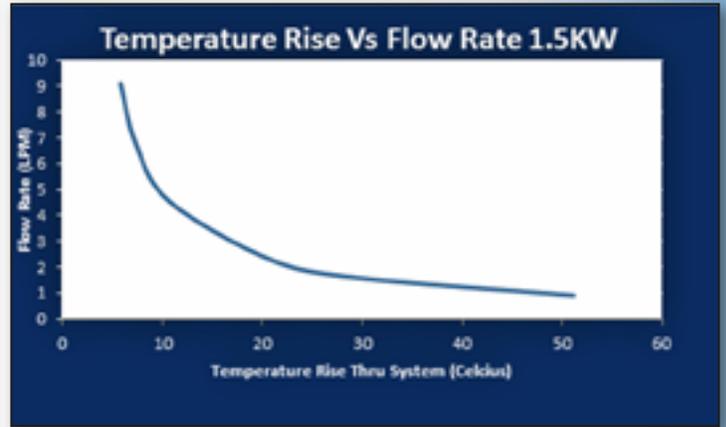


Figure 2d. 1.5 kW SuperPower TWTA thermal design allows relatively low flow rates (5 l/min = 10 degrees C rise)



Figure 2b. Baseplate and cooling are the only differences.

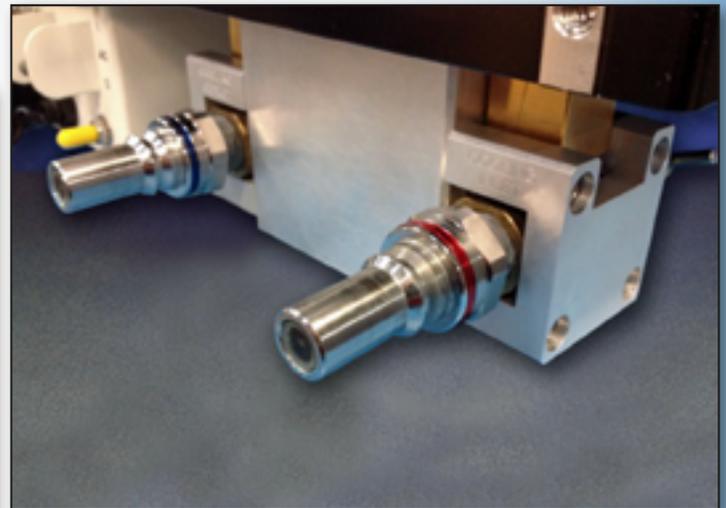


Figure 2e. Dripless connectors prevent leaks and messes.

- No interaction of liquid with RF or power supply electronics
- Fool-proof dripless connectors that click to connect, are color-coded, can be disconnected under pressure drip-free, and are easily replaced if needed
- Efficient amplifiers and thermal design for low flow rates allow for low cost and easily available pumps
- Baseplate temperature monitoring in critical spot for feedback to loop flow control
- Easy upgrades to replace air-cooled HPAs—same waveguide to mounting points; only changes are new cooling liquid interfaces and no air low requirements

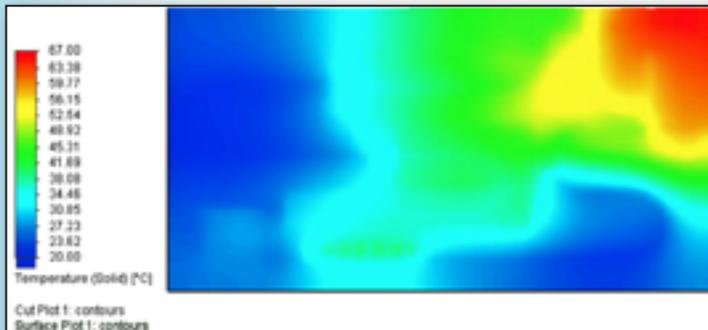


Figure 2c. Thermal design of baseplate is custom for each amplifier to ensure margin

Cooling System Design

The HPA is only one part of the cooling system; the rest can vary widely depending on the installation location, available resources, and constraints. Many larger facilities have chilled water on site for air conditioning, and a small portion of the chiller's capacity can be used to cool the HPAs.

Other terminals will require a dedicated liquid-to-air cooling system. These dedicated systems can be implemented as either above ambient heat exchangers (Figure 3a, next page) or as temperature controlled chillers (Figure 3b, next page).

There are many approaches to the overall cooling system described in detail in the System Design section. These easy to use and implement liquid-cooled TWTA's offer a host of benefits to the system designer including:



Figure 3a. Above-ambient liquid-to-air heat exchanger.



Figure 3b. Refrigerated liquid-to-air chiller.

The heat exchangers have no refrigeration cycle and are therefore simpler, more economical, and easily controlled. Most applications for the new liquid-cooled HPAs can easily work with a simple heat exchanger. However, they have a limited cooling capacity, especially in cases where the ambient air temperature is relatively high.

For these cases, a refrigerated chiller may be selected to allow for maintenance of the baseplate temperature much closer to the ambient air temperature. These systems are more complicated, cost more, and may require more maintenance. However they can still be quite compact, as they can support a wider temperature range of operation.

Figure 3 above.
There are two primary dedicated cooling system types.

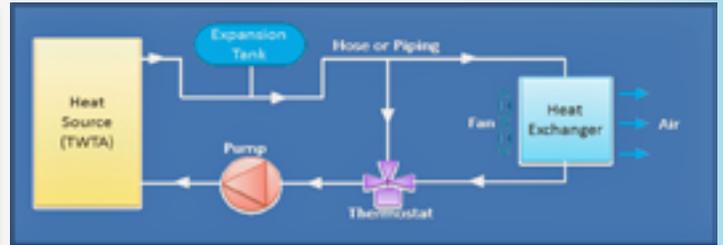


Figure 4. Passive control liquid cooling systems are simple and economical

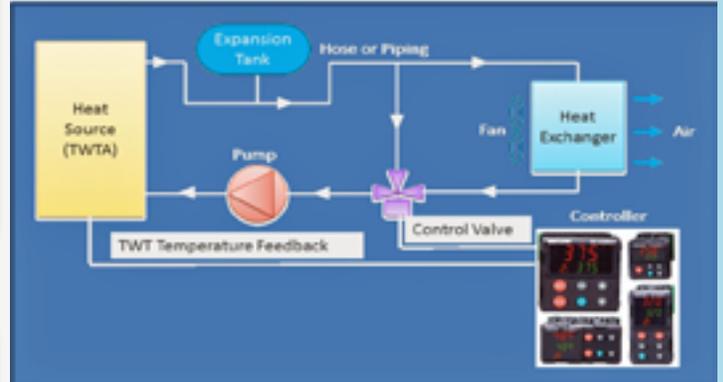


Figure 5. Active control valve modulation liquid cooling systems are higher performing.

Cooling systems can be controlled passively with a thermostat which measures the liquid temperature and adjusts flow through the heat exchanger to maintain the desired temperature of the coolant (Figure 4, above).

This approach using all passive components is similar to automotive engine cooling systems, and is both simple and economical. The primary alternate of active control valve modulation (Figure 5, above) uses a controller and more precise temperature feedback available from the critical portion of the HPA to control the valve that adjusts how much of the liquid passes through the heat exchanger. Active control requires some additional engineering but provides better temperature control of the TWTA's RF components.

There are many redundancy options for liquid cooling systems, and each system designer must consider their availability and maintainability requirements along with operational considerations when choosing one.

The basic 1 for 1 redundant system (Figure 6a, next page) provides a separate cooling system for each of two redundant HPAs. This requires no complex design, but does not lower cost through shared elements or improve system reliability through shared redundant systems.

For sharing of one of the larger elements in the system, a single heat exchanger can be used for both HPAs while maintaining dedicated pumps and thermostats (Figure 6b, next page). This can reduce the system's space and cost without impacting reliability.

Further consolidation and improved redundancy can be accomplished by tying redundant pumps together with a single heat exchanger and thermostat (Figure 6c, next page) so that either pump could support operation of either HPA. Thus, some additional plumbing improves availability.

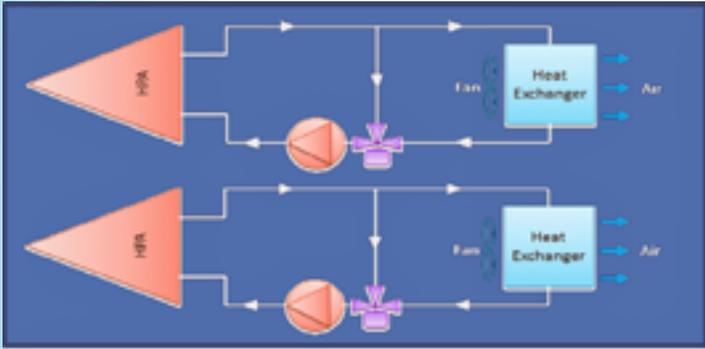


Figure 6a. One-for-one redundant cooling systems.

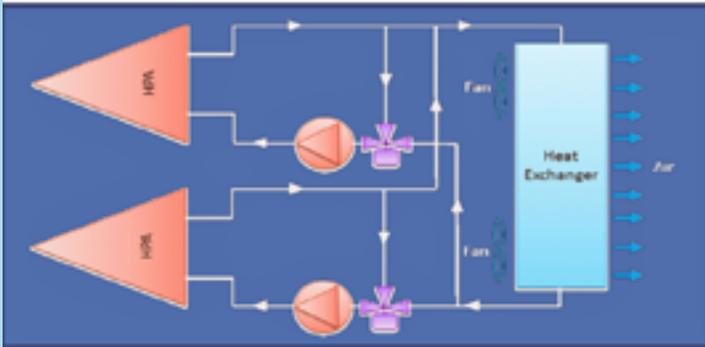


Figure 6b. Single heat exchanger with dedicated pumps and thermostat.

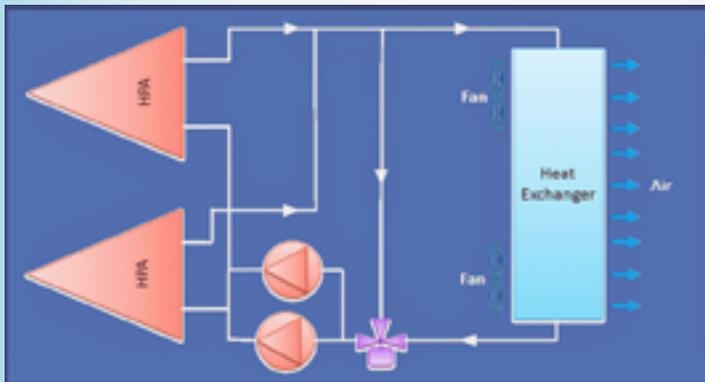


Figure 6c. Single heat exchanger and thermostat with redundant pumps.

Figure 6, above...
Common redundancy options for cooling systems.

Cooling System Equipment

The key types of equipment in the above-ambient heat exchanger type cooling systems are widely available and not expensive. There is a lot of



Left: Figure 7a. Combined heat exchanger, pump and fan.
Right: Figure 7b. Heat exchanger with built-in fan.

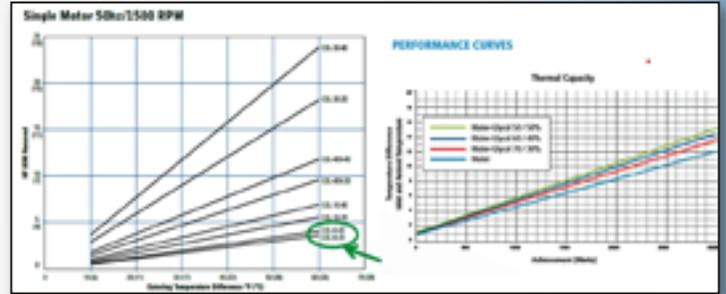


Figure 7c. Manufacturer's charts for sizing heat exchanger for thermal load.

Figure 7. Images above and at the base of left column.
Available heat exchanger types easily handle HPA thermal loads.

flexibility in the available equipment to adapt to the requirements of any implementation such as high pressure needed for pumps installed a long distance from or well below the operational HPAs.

The heat exchangers specifically can be indoor or outdoor rated for placement near the hub either in a shelter or out of doors, and are available in sizes rated to thermally dissipate from 1 to over 10 kW. Heat exchangers can be purchased in combinations including integrated fans or even integrated pumps as well (Figure 7a and Figure 7b).

The exchangers come in standard sizes, and must be selected for the thermal load (HPA), but the manufacturers provide easy to read charts to support this (Figure 7c).

HPAs are at the low end of standard thermal loads for these; a typical TWTA could be cooled with a standard combined exchanger size of 13x16x27 inches.

Pumps for cooling systems have improved significantly and are built for reliability. Available pumps have magnetic drive to eliminate bearings as a failure item and have no shaft seals to increase MTBFs. There are pumps with high flow rates available for applications with multiple HPAs, and there are pumps with high head pressure to support long distances between the heat exchanger and the HPA and also heat exchanger locations well below HPAs (Figure 8, below).



Left: Figure 8a. Magnetic drive high flow rate pump.
Right: Figure 8b. Magnetic drive high head pressure pump.

Figure 8. Available pump types and capability offer flexibility for different applications.



Figure 9. Drip-free connectors make connections fast, clean and reliable.

Drip-free connectors are one of the most exciting advances in these cooling systems (Figure 9, above).

These connectors have been designed to allow easy, no-tool connect/disconnect for quick HPA changeout, and are dripfree even when disconnected under pressure.

This eliminates spillage during installation and service without any extra time for the technician.

They are available with hose barb or NPT thread interfaces for use with hoses and pipes, and there are even rotating joints available for connection to rotating assemblies such as full motion antennas.

Finally, connections between cooling system elements are typically a combination of piping and hoses to adapt to the implementation.

There's a large range of flexible hoses from the hydraulics industry that handle a wide temperature range and include UV rated offerings for outdoor installations.

Rigid piping is typically used for longer distances and support. Metal piping provides greater support at greater cost while plastic piping costs less and is easier to work with—but provides less support

Depending on site requirements, rigid piping can be buried or above ground, and can run long distances—10's or 100's of meters—for which you can use insulated piping to reduce impact on heat exchanger thermal load.



Figure 10. A wide range of pipes and hoses are available for installation flexibility.

Liquid-Cooled HPAs Are Here To Stay

The many significant advantages of liquid-cooled SuperCool TWTAs make it straightforward to decide to use liquid-cooling in new terminals that have large RF power requirements, and make it a viable option for existing terminal upgrades.

Whether to reduce or eliminate maintenance issues, simplify hub design, eliminate a large thermal load from indoor HPAs, or reduce noise in your neighborhood, you will probably find yourself thinking about using these.

Whatever your reason for wanting to look at liquid cooling, white papers on reference cooling system design and additional technical support are available.

The cooling system equipment needed is readily available and not costly, so expect to see more and more teleports and gateways implementing liquid-cooled HPAs in the near future.

xicomtech.com/

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The New Liquid Cooling

Old-style liquid cooling brings thoughts of complex assembly processes, unexpected leaks, liquid among the electronics, and complex pressure problems.

Forget all that!

New liquid-cooled systems are here from an unexpected source ... data centers. With massive energy consumed and heat produced in today's giant data centers, liquid-cooling is a must for thousands of servers packed like sardines into cavernous rooms maintained at cool air temperatures.

Air conditioning—this would be a nightmare with air-cooled servers, so they turned to liquid cooling. But for it to work in such a massive context, it had to be both inexpensive and highly reliable.

So they made it happen... dripless connectors, isolated cooling from electronics, reliable primeless pumps and more.

