

Worldwide Satellite Magazine – April 2017

SatMagazine

High Pressures on the Satellite Launch Industry

Meeting the Needs of the Aviation Community

Smart Devices and Connectivity

Smallsats: Make the Best of Space Tech

High G Vibration and Shock Testing

OTT Watch

Satellite Transponders Overview

An Insight Event

An Open-Source Google Earth

HTS Realities

Antennas for Systems and Devices

Rugged Tablet, Meet SatRadio

First Venture Into VSAT SATCOM

Startups at the Final Frontier

EchoStar XXIII heads to orbit aboard a Falcon 9 launch vehicle. Photo is courtesy of SpaceX.



SatMagazine

April 2017

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SatMagazine is published 11 times a year by Satnews Publishers, 800 Siesta Way, Sonoma, CA 95476 — USA
Phone: (707) 939-9306
Fax: (707) 939-9235
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InfoBeam

Norsat Agreement for Their Acquisition by Hytera Project Corporation

Norsat International Inc. has entered into an arrangement agreement (the "Arrangement Agreement") with Hytera Project Corp. ("Hytera") a subsidiary of Hytera Communications Co., Ltd., pursuant to which Hytera will acquire all the issued and outstanding shares of Norsat for \$10.25 in United States dollars ("USD") in cash per share, pursuant to a court-approved plan of arrangement (the "Arrangement").

All unexercised options and restricted share units will also be acquired under the Arrangement. The proposed transaction values Norsat at an equity value of approximately \$62 million USD.

As previously disclosed by Norsat on March 17, 2017, Privet Fund Management LLP ("Privet") submitted a non-binding letter of interest to acquire the Company for cash consideration of \$10.25 USD per share



subject to due diligence, financing, the completion of a definitive agreement and other conditions. At that time, Norsat and Hytera were in exclusivity with respect to a possible transaction.

Based on Hytera's offer of the same cash consideration as indicated in Privet's non-binding letter of interest, with no further due diligence, no financing conditions and the synergies between Norsat and Hytera including but not limited to a greater global sales presence, access to additional markets and research and development collaboration, the Independent Directors of Norsat's Board of Directors (the "Board") decided to proceed with the Arrangement Agreement.

"After discussions with multiple parties and a comprehensive review of several indications of interest with respect to a strategic transaction, we are very pleased to have reached an agreement with Hytera. We believe this all-cash transaction offers Norsat shareholders immediate liquidity and certainty of value. We thank our shareholders for their patience and support during the strategic review, a process that has ultimately surfaced significant value for all Norsat shareholders," said Fabio Doninelli, Director and Chairman of the Board.

hytera.us/

norsat.com/

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SpaceX First Ever Re-Used First Stage Falcon 9 Lifts SES10 To Orbit

The SES-10 satellite was successfully launched into space onboard a flight-proven SpaceX Falcon 9 rocket at 18:27 EDT pm March 29, 2017, from NASA's Kennedy Space Center, Florida — this is the first geostationary commercial satellite to ever launch on a flight-proven, first-stage rocket booster.

With a Ku-band payload of 55.36 MHz transponder equivalents, of which 27 are incremental, this multi-mission spacecraft is the first SES satellite that is wholly dedicated to providing service to Latin America. SES-10's high-powered beams will augment SES's capabilities across the region providing direct-to-home broadcasting, enterprise and mobility services. SES-10 will replace capacity currently provided by other SES satellites at 67 degrees West, as well as bring additional capacity to Mexico, Central America, South America and the Caribbean.

Pursuant to an agreement with the Andean Community (Bolivia, Colombia, Ecuador and Peru), the satellite will operate as the Andean Community's Simón Bolívar 2 providing satellite capacity for each Andean Member State. The Andean satellite project comes from the shared Member States' interests of having a common satellite network taking advantage of the Andean spectrum resources at 67 degrees West.

"The successful launch of SES-10 on SpaceX's first ever mission using a flight-proven rocket is opening up a new era of spaceflight. We are proud to have partnered

with SpaceX on this journey of innovating and using reusable rockets that will make access to space more efficient in terms of cost and manifest management," said Martin Halliwell, Chief Technology Officer at SES. *"The additional capacity offered by SES-10 is ideal for providing additional TV services with better picture quality as well as faster broadband services – both of which will be welcomed by millions of people throughout Latin America and the Caribbean."*

Gwynne Shotwell, President and COO at SpaceX, added, *"We are thrilled to have achieved the successful launch of a flight proven Falcon 9. This is an historic milestone on the path to complete and rapid reusability. We are pleased to have accomplished this milestone with SES, which has been a strong supporter of SpaceX and innovation over the years."*

SES's (Euronext Paris:SESG) (LuxX:SESG) SES-10 was built by Airbus Defence and Space and is based on the Eurostar E3000 platform. The satellite will use an electric plasma propulsion system for on-orbit maneuvers and a chemical system for initial orbit raising and some on-orbit maneuvering.

spacex.com/

ses.com/



The SES-10 satellite launched into space on-board SpaceX Falcon 9 rocket from NASA's Kennedy Space Center, Florida, to provide broadcasting, enterprise and mobility services across Latin America.

EO-1 Set for Decommissioning

Without fuel, no one goes anywhere — well, this is not exactly true for satellites, as they do move, eventually, into the atmosphere of Earth, where they are cremated as they descend into the planet's atmosphere.



Such is now the future of NASA's EO-1 (Earth Observing-1) satellite after 17 years of faithful service.

Launched in November of 2000 as part of NASA's New Millennium Program, the satellite captured images of Earth and was also a new technologies testing platform. A first for the satellite was also the spacecraft's ability to control itself, so to speak, through the incorporation of autonomous software that allowed for less human intervention and also enabled EO-1 to trail behind the LandSat 7 satellite by about 60 seconds, communicating with one another to target various natural phenomena that ranged from fires, floods, volcanoes and more. The performance by EO-1 opened the door for even better autonomous satellite piloting technology that was implemented in later satellites.

Frank Culbertson, the President of Orbital ATK's Space Systems Group, the company that built this satellite, stated that the company is proud to mark this historic occasion with NASA partners and celebrates the EO-1's incredible 17 year journey. Serving as one of NASA's pathfinder Earth satellites, EO-1 delivered thousands of high quality images providing valuable data for the science community.

EO-1, using two major observing instruments, Advanced Land Imager (ALI) and the Hyperion imaging spectrometer, has provided more than 92,000 images to date consisting of equal amounts of multispectral and hyperspectral imagery. These instruments allowed the EO-1 team to acquire high spatial resolution of events and natural disasters around the world. The Hyperion instrument also allowed scientists to see chemical constituents of Earth's surface in fine detail with hundreds of wavelengths.

What is amazing regarding EO-1 is that here is a satellite that was projected to have a life of about one year — and 17 years later, the satellite continued to function without difficulty, until the fuel became exhausted. Now that's an ROI worth bragging about...

orbitalatk.com/

eo1.usgs.gov/

Hiltron Communications Offers Super-HMM Antenna Mount

Hiltron Communications has added to their product family with a new offering that is based on their HMAM three-axis motorized antenna mount — the new Super-HMM is designed and built to accept substantially larger reflector dishes.

The Super-HMAM includes high-grade drives for azimuth and elevation plus a high-accuracy polarization drive and is fully compatible with Hiltron's standard HACU antenna positioning system.

A combined head and drive are incorporated, forming a three axis motorized system with 180 degrees of azimuth adjustment, 90 degrees of elevation adjustment range and fully adjustable polarization.

Positioning accuracy is +/- 0.02 degrees and position-display resolution is 0.01 degrees.

The antenna control unit and associated motor-control electronics are contained in an IP65-rated weatherproof outdoor housing with a hinged front access port secured by dual key screws.

An emergency cut-off switch is easily accessible. Above the housing is a resolver which is used to measure the azimuth angle of the antenna.

An identical second resolver allows constant monitoring of antenna elevation. Azimuth and elevation drive motors each operate through a reduction gear.

Super-HMAM can be controlled via an IP link 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 position and target position plus a database of potentially accessible satellites.

Once a satellite is selected, precise access parameters can be calculated at the press of a single button.

The entire antenna support system is built to withstand standard atmospheric pollutants and to operate at humidity levels of zero to 95 per cent over a temperature range between 25 degrees (optionally 55 degrees) down to -25 degrees Celsius.

Additional protection can optionally be provided to withstand pollutants such as salt encountered in coastal and industrial areas.

The rotating pedestal mount is made of corrosion-resistant hot-dip galvanized steel.

According to Hiltron sales director Antonio Monteverde, the standard HMAM is extremely robust and designed to operate with reflectors of 1.2 to 2.7 meters diameter on mountain-top transmission sites where wind speeds can exceed 200 kilometers per hour during storm conditions.

Super-HMAM has a newly developed support structure which can survive wind speeds well in excess of this figure, with antenna sizes of up to 4.9 meters diameter. Super-HMAM retains all the features that have made HMAM the preferred choice for two-way VSAT communication or receive only downlink applications in the broadcast, telecommunication and military sectors.

hiltron.de



Successful Seeding for RBC Signals

RBC Signals is a multi-national company enabling an improved commercial-focused model for the delivery and processing of real-time data from satellites in LEO—the company capitalizes on the innovation behind the sharing economy, using the excess capacity of existing ground stations across the globe to provide affordable, low latency services to the emerging class of new space commercial satellite operators.

The company has now successfully raised \$1.5 million in a seed round. The VC-led round was made possible with participation from investors around the world including the United States, Singapore, the Middle East and China and will allow the company to expand its global network, coverage and capabilities.

RBC Signals' business is driven by macro data-consumption trends requiring higher bandwidth, higher resolution, and on-demand immediacy. RBC Signals' services are aimed to meet the requirements of today's commercial satellite operators, which have shifted along with these dynamics.

To do so, the company leverages the infrastructure and excess capacity of existing ground stations located strategically across the globe to provide real-time data delivery as well as data processing capabilities with a core focus on providing low latency, cost effective services to the emerging class of new space commercial satellite operators.

The recently completed capital raise will expand the coverage and the real-time data processing capabilities of the worldwide RBC Signals ground station network. RBC's global network currently includes 30+ antennas in 20+ strategic locations.

Christopher Richins, co-founder and CEO of RBC Signal, stated that his company is the first and only provider in their market sector that uses a shared economy model to leverage existing ground station infrastructure to deliver and process real-time data.

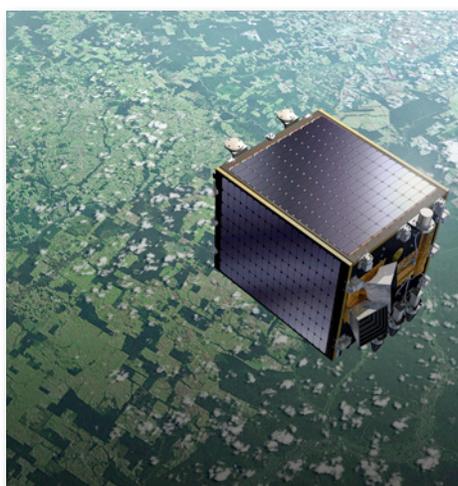
Competitive pricing is critical for commercial satellite operators to make their own business plans financially feasible as the global space sector continues to commercialize."



The other co-founder, Olga Gershenzon, also the CSO of the company added that demand for real-time data from space is growing—increasingly reliable and affordable launch services, along with the affordability of small Earth-imaging satellites, is driving the increased need for efficient and cost-effective real-time data delivery and processing services. RBC Signals is looking to fill this gap in the LEO marketplace.

A multi-national company, RBC Signals is led by space industry veterans Richins, Gershenzon and Rani Hellerman. Richins began his career as an RF Communications Engineer at Sea Launch, where he supported multiple satellite launch campaigns from the ship-based equatorial launch site. After business school, he completed an internship with SpaceX before joining Bain & Company as a management consultant.

Post Bain, Richins held management roles at Arkyd Astronautics (Planetary Resources),



Space Angels Network, Expedia, and Applause. Richins earned an MBA from the Darden Graduate School of Business at the University of Virginia as a Jefferson Fellow, a master's degree in Astronautics from the University of Southern California, and a bachelor's degree in Electrical Engineering from Brigham Young University.

Gershenzon has more than 25 years of practical experience in remote sensing applications including land cover change, disaster monitoring and mitigation, wildlife preservation, and education. She co-founded, co-owned and is a Member of the Board of Directors for R&D Center SCANEX, the leading Russian company in the satellite remote sensing market, offering a complete set of services ranging from acquisition to thematic processing of Earth observation images from space.

She is also Co-Founder of the NGO "Transparent World", a non-profit organization providing non-commercial and educational projects with remote sensing data, and is Chair of the Board of "Earth from Space," an association of suppliers and users of Earth remote sensing data. She holds a master's degree in Meteorological Engineering from the Department of Geography at Lomonosov Moscow State University.

Rani Hellerman is RBC Signals' vice president of International Business. Prior to joining RBC, Hellerman worked at ImageSat International N.V for more than 15 years in technical and business positions and as a vice president of Business Development.

Prior to joining ImageSat, Hellerman held a long career in Israel's Defense Forces, reaching the rank of Colonel. Hellerman has vast experience in the areas of advanced technology and operational requirements, including more than 25 years in Earth Observation business. Hellerman holds a BSc. degree in Electronics Engineering and master's degree in Business Administration (MBA).

rbcsignals.com/

InfoBeam

Off to Geostationary Orbit is EchoStar XXIII, Thanks to SpaceX

While strong winds initially caused a delay, the SpaceX Falcon 9 rocket regrouped and delivered EchoStar XXIII, a commercial communications satellite for EchoStar Corporation, to a Geostationary Transfer Orbit (GTO).

The EchoStar XXIII lifted off from the historic Launch Complex 39A (LC-39A) at NASA's Kennedy Space Center in Florida.

SpaceX will not attempt to land Falcon 9's first stage after launch due to mission requirements. Because the payload is a six ton EchoStar 23 spacecraft, the rocket's first stage won't have enough reserve fuel to attempt a powered descent back through the atmosphere and to then land. This was the first Falcon 9 to fly sans landing gear in almost two years.

EchoStar XXIII is a highly flexible, Ku-band broadcast satellite services (BSS) satellite with four main reflectors and multiple sub-reflectors supporting multiple mission profiles.

Initial commercial deployment of EchoStar XXIII will be at 45 degrees West, and the Satellite End of Life (EOL) Power is 20 kilowatts (kW).

EchoStar operates the world's fourth-largest commercial geosynchronous fleet, with 25 satellites.

Headquartered in Englewood, Colorado, and conducting business around the globe, EchoStar is a pioneer in secure communications technologies through the firm's EchoStar Satellite Services, EchoStar Technologies and Hughes Network Systems business segments.

spacex.com

echostar.com



The Falcon 9 launch of the EchoStar XXIII satellite. Photo is courtesy of SpaceX.

Sentinel-2B Soars and Monitors, From the Soil to the Sky... Copernicus' Earth Observation mission

Arianespace has successfully launched the Sentinel-2B satellite for the European Commission within the scope of a contract with the European Space Agency (ESA).

The launch took place on Monday, March 6, at 10:49 p.m. local time, from the Guiana Space Center (CSG), Europe's Spaceport in Kourou, French Guiana.

This was the third launch of the year for Arianespace and the first in 2017 with the Vega light launcher. This launch also marked the ninth successful launch in a row for Vega, which made its debut at the Guiana Space Center in 2012.

Following the successful launches of Sentinel-1A, Sentinel-2A and Sentinel-1B, this mission marks the fourth satellite in the European Commission's Copernicus Earth observation program to be orbited by Arianespace from the Guiana Space Center.

The Sentinel-2B Earth Observation (EO) satellite mainly focuses on monitoring land masses and coastal zones around the world.

The satellite will be positioned in an orbit opposite that of Sentinel-2A to ensure optimum coverage and data delivery.

The pair of Sentinel-2 satellites will cover the Earth's entire surface in five days. This high frequency means they will capture brand-new views of the Earth, driving considerable progress in monitoring and predicting changes in vegetation and aquatic pollution.

Sentinel-2B combines a multispectral, wide-swath, very-high-resolution optical imaging instrument with a dedicated platform developed by Airbus, a long-standing partner to Arianespace.

This is the 117th Airbus-built satellite to be launched by Arianespace. There are 16

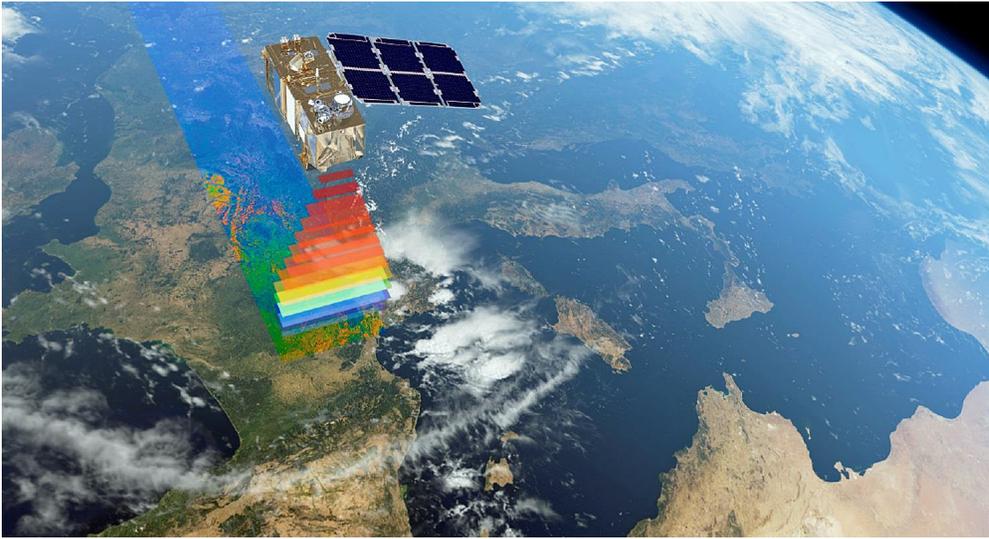
additional satellites from this manufacturer in Arianespace's order book, not counting the OneWeb constellation.

Sentinel-2B is the 61st EO satellite to be launched by Arianespace. These types of satellites represents 10 percent of all spacecraft launched by Arianespace since being founded, and 23 percent of the company's current order backlog (in number of satellites). ESA's Sentinel program includes six families of satellites:

Sentinel-1 will ensure data continuity with the ERS and Envisat radar satellites.

- **Sentinel-2 and Sentinel-3 are designed to help provide a better understanding of how climate change impacts our daily lives.**





Artistic rendition of the Sentinel-2B satellite. Image is courtesy of ESA.

- **Sentinel-4 and Sentinel-5 are dedicated to meteorology and climatology, with a special focus on studying the composition of the Earth's atmosphere.**
- **Sentinel-6 will measure ocean topography, mainly for operational oceanography and climatology.**

With this launch on behalf of the European Commission and within the scope of an ESA contract, Arianespace fulfills its mission of guaranteeing independent and dependable access to space for Europe.

In 2017, Arianespace also will orbit four additional satellites for the Galileo program on behalf of the European Commission and ESA.

After this 55th mission for ESA, Arianespace's order book still includes missions to orbit the following payloads on behalf of the European Space Agency:

- » 8 satellites for Galileo (2x4 satellites)
- » ADM-AEOLUS
- » EDRS-C
- » BEPI-COLOMBO
- » and the James Webb Space Telescope (JWST)

The eight previous missions performed by Vega prior to Flight VV09 included both government and commercial customers.

Looking ahead, the launcher's order book — primarily comprising Earth observation missions — now counts seven launches, one-third of which are for European institutions

and the remaining two-thirds for export customers.

Arianespace is gearing up for the future with Vega C, slated to make its first flight as from 2019. Vega C will:

- » Offer higher performance in terms of payload weight and volume;
- » Handle a greater variety of missions, from smallsats to large optical and radar observation satellites
- » Be more competitive, as a result

Vega is a European Space Agency (ESA) program, financed by Italy, France, Spain, Belgium, the Netherlands, Switzerland and Sweden.

The launcher design authority and prime contractor is ELV/AVIO, an Italian joint venture between Avio (70 percent) and the Italian space agency ASI (30 percent).

Shortly after the announcement that the Sentinel-2B satellite had been injected into orbit, Arianespace Chairman and CEO Stéphane Israël said: "With this third launch of the year, and the first in 2017 for our light launcher, Arianespace guarantees Europe's independent access to space and continues to support actions in favor of sustainable development. Sentinel-2B is the fourth satellite launched by Arianespace for the European Copernicus program.

"I would like to thank the European Commission for their ongoing confidence, as well as ESA, our direct customer for this launch. Congratulations to all our partners

in this latest success: Airbus, which built Sentinel-2B; the industrial prime contractor for Vega — ELV/Avio — which is the artisan at our side in the success of Vega; the European Space Agency, whose support is essential for the Vega program, for which Italy's ASI space agency is the leading financier; CNES/CSG and all companies and staff at the launch base, who continue to support us as we go from success to success; and lastly, congratulations to Arianespace's own teams for the success of this 260th launch from the Guiana Space Center."

The Sentinel-2B satellite was built by Airbus as prime contractor, leading an industry consortium.

Sentinel-2B weighed 1,130 kg at launch and will be positioned in Sun-synchronous orbit at an altitude of 786 km, with an inclination of 98.57 degrees. The launcher carried a total payload of 1,208 kg on this mission.

European Union's Copernicus website

European Space Agency website

Avio Group website — Vega

Airbus Defence and Space website



InfoBeam

For SpaceX — Two Off and Away and Two Come In

February 19 was a great day for SpaceX's CRS-10 mission with both a successful launch and the Earthly return of a launched Falcon rocket.

launch site, about eight minutes after liftoff, all as planned. This was SpaceX's first daytime landing at the site, called Landing Zone 1, at the Cape Canaveral Air Force Station.

spacecraft using the 57.7-foot (17.6-meter) Canadarm2 to reach out and capture the Dragon spacecraft and attach it to the station.

There were more than 5,000 pounds of supplies and payloads, including critical materials to directly support dozens of the more than 250 science and research investigations that will occur during Expeditions 50 and 51 inside the Dragon.

Among the investigations are experiments with the potential to help fight human disease, monitor climate data, and improve autonomous spacecraft docking with the orbiting laboratory.

SpaceX CRS-10 is the tenth of as many as 20 missions to the International Space Station that SpaceX will fly for NASA under the first CRS contract.

In January 2016, NASA announced that SpaceX's Falcon 9 launch vehicle and Dragon spacecraft were selected to resupply the space station through 2024 as part of the second Commercial Resupply Services contract award. Under the CRS contracts, SpaceX has restored an American capability to deliver and return significant amounts of cargo, including live plants and animals, to and from the orbiting laboratory.

A variant of the Dragon spacecraft, called Crew Dragon, is being developed for US-based crew transport to and from the station.

Dragon's return to Earth will be after an approximate one month stay at the orbiting laboratory. About five hours after Dragon leaves the station, the spacecraft will conduct its deorbit burn, which lasts as long as 10 minutes. It then takes about 30 minutes for Dragon to reenter the Earth's atmosphere and splash down in the Pacific Ocean off the coast of Baja California.

For more information about the mission and payloads, please visit nasa.gov/spacex



A launch attempt on the previous day had to be scrubbed just 13 seconds before liftoff out of caution, due to an unexpected reading from the rocket's second stage.

This was the first launch from pad 39A since the orbiter Atlantis blasted off on the shuttle program's final flight in July of 2011.

SpaceX's processing hangar is located at the base of the former shuttle pad at Cape Canaveral, up an incline to the top of the firing stand.

This successful launch featured the upward launch of the payload and then the downward return as the Falcon 9's first stage completed an Earth landing just a few miles from the Florida

"Baby came back," Space CEO Elon Musk wrote on Instagram after the successful landing of the first stage.

The Falcon 9's first and second stages separated about 2.5 minutes into the launch.

As the first stage flew back for its touchdown, a secondary mission objective with the second stage continued to power Dragon to the intended target, successfully achieved 11 minutes after liftoff. Dragon then deployed its solar arrays and began the two-day journey to the ISS.

When the Dragon arrived at the ISS, French astronaut Thomas Pesquet grappled the



The Dragon's successful first stage return.

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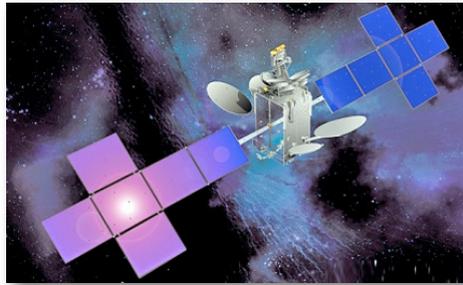
SES Experiences Major Gains with VT iDirect Technology

VT iDirect, Inc. (iDirect) has announced another successful over-the-air (OTA) test of its next-generation DVB-S2X technology—the test was conducted with SES over C-band and achieved 5.7 bps/Hz.

The DVB-S2X forward channel and Adaptive TDMA return channel OTA testing was conducted on the SES-4 satellite and leveraged iDirect's next-generation iQ Desktop Remote, Universal Line Cards and Intelligent Gateway appliance.

VT iDirect recently announced its next-generation DVB-S2X technology, which is based on a powerful, customized ASIC (Application-Specific Integrated Circuit) chipset and powers the new iQ Series family of remotes

iDirect's iQ Series, which will operate in both DVB-S2X and DVB-S2 mode, is targeted for broadband, enterprise, and mobility applications and packaged in desktop, rack-mount, board level and embedded compute form factors that will become available over



Artistic rendition of the SES-4 satellite.

the course of this year. The family of new remotes are software upgradeable to license added network capabilities and higher throughput levels, thereby reducing the cost of ownership, as well as improving flexibility across a broad array of markets.

"With SES launching three GEO hybrid satellites with wide beams and high throughput capabilities this year, efficient bandwidth management is of utmost importance to our customers. We are pleased to see the bandwidth gains achieved over VT iDirect's latest technology and will be looking forward to accelerated bandwidths and more

efficient data services with the new standard," said Steven Cooper, Vice President of Product Development and Network Planning, SES.

Wayne Haubner, Senior Vice President, Engineering & Emerging Technologies, VT iDirect, commented that the company's test with SES represents their first DVB-S2X forward channel testing over C-band and the first ATDMA return OTA testing with the iQ Desktop, which validates the DVB-S2X platform as being able to deliver significant performance and efficiency gains for SES' customers. The milestone also expands the company's momentum as VT iDirect nears beta testing in advance of the commercial launch this year of the iQ Series Desktop and the Intelligent Gateway.

**idirect.com/
ses.com/**

InfoBeam

3D Bandwidth-on-Demand Launched by Advantech Wireless

Advantech Wireless' 3-dimensional BoD (Bandwidth-on-Demand) Scheduling and Bandwidth Allocation System - 3D-BoD™ was released.

Additionally, WaveSwitch™ was released—this is a solution that addresses the complexity of new generation satellite services without degrading service quality. This is accomplished with service modeling architecture that dynamically optimizes waveform assignment to achieve the highest application performance, with minimum satellite bandwidth resources.

Advantech Wireless new ASAT II™ WaveSwitch™ technology is based on a 3-dimensional BoD (Bandwidth-on-Demand) model factoring Bandwidth, Waveforms, and Service Level Commitments and delivers efficient bandwidth utilization.



Advantech Wireless practices bandwidth management techniques in order to optimize bandwidth management availability to support multi-service and varied SLA (Service Level Agreement) delivery.

With multi-service traffic flows, a variety of applications, different traffic density rates, and varying bandwidth peaks, WaveSwitch™ achieves service quality and user experience to customers in the bandwidth efficient means by combining the power of all three waveforms in a real-time manner.

Oscar Glottmann, CMO Satellite Networks Business Unit at Advantech Wireless said,

"With HTS bandwidth abundance and lower costs, vendors must address new SATCOM systems requirements for multiservice and the seamless integration of SCPC high data rate capabilities with MF-TDMA VSAT high oversubscription capabilities into a single platform. For the first time, based on 3D-BoD and WaveSwitch technologies, Advantech Wireless delivers on-the-fly waveform switching between MF-TDMA, Adaptive SCPC (ASCPC™) and real bi-directional SCPC in its new generation ASAT II multi-service VSAT platform. Together with our multiplatform VSAT Modems supporting the three waveforms, ASAT II delivers unparalleled satcom multi-service capabilities."

advantechwireless.com/?s=WaveSwitch&post_type=product&sentence=1

InfoBeam

Sky Brasil-1 and Telkom 3S Sent to Spatial Slots

Two new arrivals were welcomed by Arianespace in mid-February in preparation for a March launch, all the while concluding the VA235 launch that occurred directly on time... directly to the second.

Liftoff of the mission, designated Flight VA235 in Arianespace's launcher family numbering system, occurred on February 14 at 6:39 p.m. in French Guiana (21h39 UTC). The two relay platforms were deployed into geostationary transfer orbit during the 40 minute mission.

Certainly this was a busy day for, earlier, Arianespace had welcomed Brazil's SGDC geostationary defense and secure communications satellite as well as South Korea's Koreasat 7 telecommunications satellite. Both built by Thales Alenia Space are slated for a dual launch on March 21 via an Ariane 5 rocket.

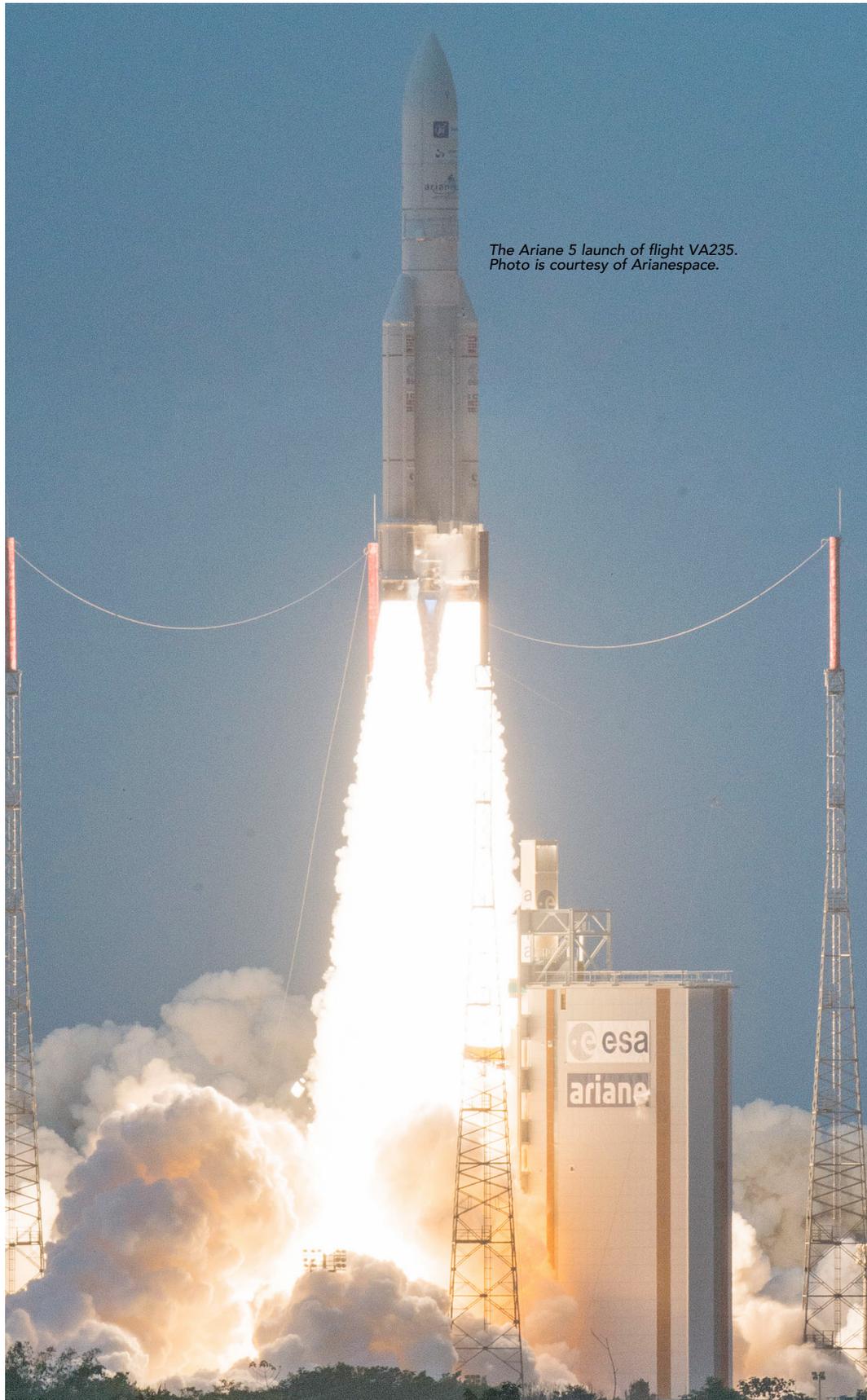
Released first during Flight VA235 was SKY Brasil-1, developed by AT&T/DIRECTV through the DIRECTV Latin America subsidiary to expand DTH HDTV programming.

The 6,000 kg satellite was produced by Airbus Defence and Space in Toulouse, France, using the spacecraft manufacturer's Eurostar E3000 platform. The satellite is fitted with 60 Ku-band transponders. Arianespace's order book includes 17 more Airbus Defence and Space satellites for launch.

SKYB-1 was positioned at 43.1 degrees West and covers Brazil, providing services to 12.5 million subscribers in Latin America, primarily Venezuela, Argentina, Chile, Colombia, and Brazil.

SKYB-1 is the tenth satellite launched by Arianespace for the operator AT&T/DIRECTV. The previous launch was on May 27, 2015, with Sky México-1 and DIRECTV 15 launched, also via an Ariane 5.

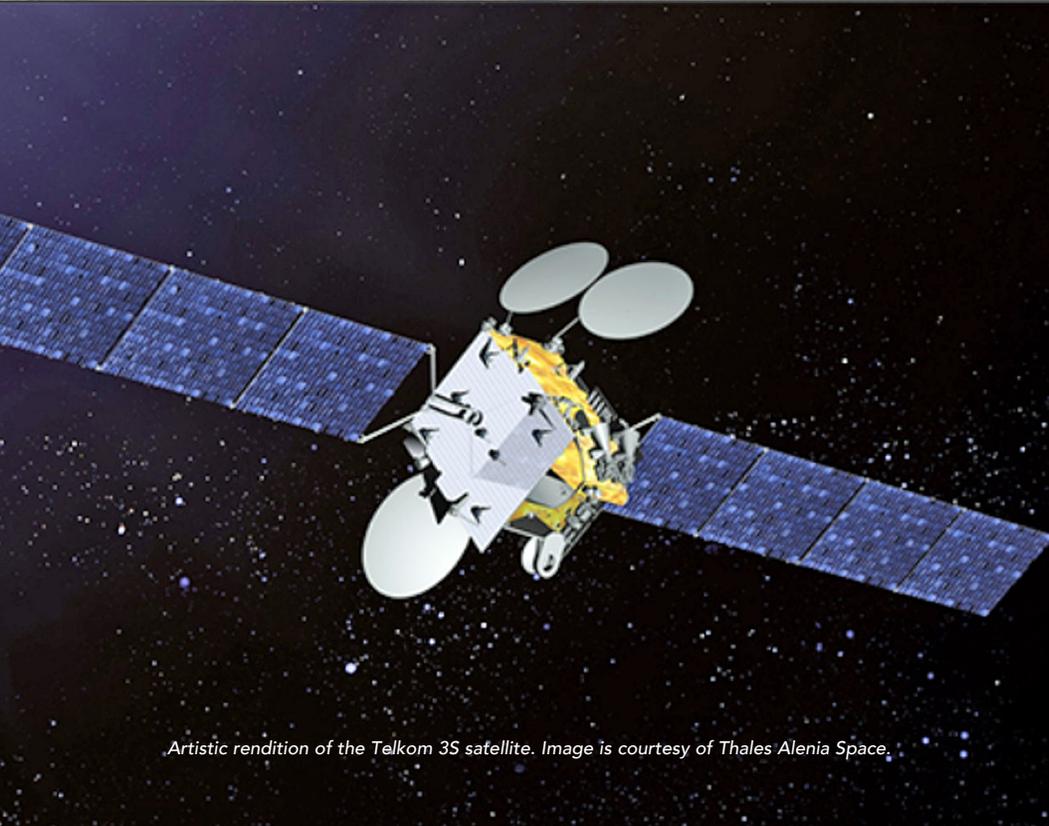
Approximately 12 minutes after SKY Brasil-1's separation, Telkom 3S deployed. This satellite is designed for the delivery of HDTV services as well as mobile communications and Internet applications for Telkom Indonesia.



The Ariane 5 launch of flight VA235. Photo is courtesy of Arianespace.



Artistic rendition of the SKY Brazil-1 satellite. Image is courtesy of Airbus.



Artistic rendition of the Telkom 3S satellite. Image is courtesy of Thales Alenia Space.

The 3,550 kg craft was built by Thales Alenia Space, Toulouse, and Cannes, France, based on the Spacebus 4000B2 platform.

Telkom 3S is the third satellite that Telkom Indonesia enlisted Arianespace to launch after negotiating a contract with Thales Alenia Space.

Telkom Indonesia is an Indonesian state-owned company that supplies telecommunications, information, media and entertainment services (TIMES) to millions of customers throughout the Indonesian archipelago.

Positioned at 118 degrees East, Telkom 3S will provide C-band coverage of Indonesia and Southeast Asia, while extended C-band beams will cover Indonesia and part of Malaysia. The satellite is also fitted with Ku-band transponders that are dedicated to national coverage.

Telkom 3S is the 146th satellite built by Thales Alenia Space to be launched by Arianespace.

Flight VA235 is one of up to as many as 12 Spaceport missions to be managed during the year by the Arianespace's launcher family, which also is composed of the medium-lift Soyuz and lightweight Vega. Of that total, as many as seven liftoffs in 2017 will use Ariane 5s—developed and built by Airbus Safran Launchers as production prime contractor.

Arianespace opened its 2017 launch activity on January 27, when a Soyuz vehicle orbited Hispasat 36W-1 on a trajectory that injected the telecommunications satellite into geostationary transfer orbit.

arianespace.com

thalesgroup.com/en/worldwide/space

airbusdefenceandspace.com

InfoBeam

An ESA and ISRO Concordance

Cooperation is afoot between two major agencies, those being the European Space Agency (ESA) and the Indian Space Research Organization (ISRO)—Senior Scientific Advisor for the ESA, Mark McCaughrean, divulged this is the plan for additional collaborations by both agencies for upcoming space missions.

Certainly the ISRO's successful launch of 104 satellites has proven to be a highly positive event for the Indian space agency, with McCaughrean stating that the ISRO precision in placing satellites as well as cost reduction played an important role in furthering cooperation between the two bureaus.



The ISRO's workhorse launcher, PSLV-C37, carrying 104 satellites, lifted off from the first launch pad for its 39th flight at Satish Dhawan Space Centre in Sriharikota at 9:28 a.m. on February 15, 2017.

With the ESA planning 15 space missions in the not-too-distant future, to include a 2018 launch of the Bepe Colombo to Mercury, and in 2022 JUICE heading to Jupiter, collaboration certainly seems to be in the cards for the agencies.

Let's not forget that ESA had previously collaborated with ISRO on the Chandrayaan-1 mission to Moon and has engaged in collaborative projects with 22 countries that have included the US, China, Russia, Japan and India.

ESA's Bepe Colombo mission will be the first probe to Mercury in 2018 and is a joint mission between ESA and the Japan Aerospace Exploration Agency (JAXA) and will be challenging for the spacecraft to remain in a stable orbit around Mercury, as the Sun's substantial gravity pull will pose a significant challenge in accomplishing such a monumental task.

Bepe Colombo will then be followed four years later with JUICE (Jupiter Icy moons Explorer), with the plan calling for this spacecraft to make detailed observations



Artistic rendition of the Bepe Colombo spacecraft, courtesy of ESA.

of the giant gas planet, with three years of examination being called for by ESA, to include the planet's three moons: Ganymede, Europa and Callisto.

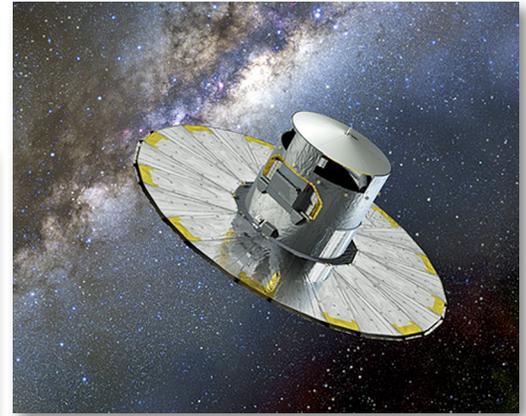
Regarding ESA's Gaia mission, McCaughrean said that this is an ambitious space mission that will scan a six-dimensional map of the Milky Way Galaxy of about one billion stars—that's approximately one percent of the Galactic stellar population.



Artistic rendition of the JUICE spacecraft. Image is courtesy of ESA / Medialab.

Also being prepared is the Euclid mission, which will observe billions of galaxies and will map out and measure dark matter and dark energy which constitutes roughly about 80 percent of the mass of the Universe.

Studies on dark matter reveal that the universe today is expanding faster than in the past and such expansion is possible only if the Universe contained enough energy to overcome gravity (the dark energy).



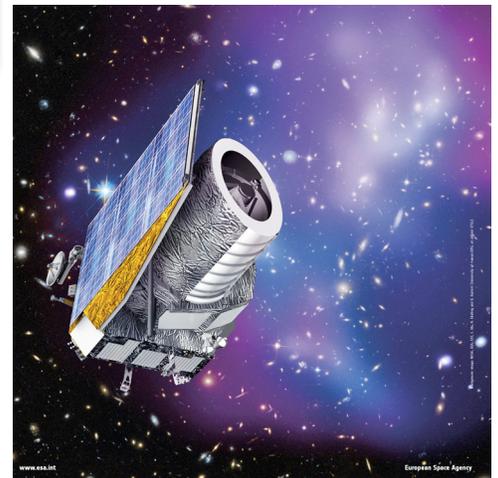
Gaia is an ambitious mission to chart a three-dimensional map of our Galaxy, the Milky Way, in the process revealing the composition, formation and evolution of the Galaxy. Artistic impression is courtesy of ESA-D. Ducros.

To assist in gravitational waves detection, the government of India is working on a proposal to establish a LIGO detector, all part of a plan to decipher the enigmas of black holes and the Universe.

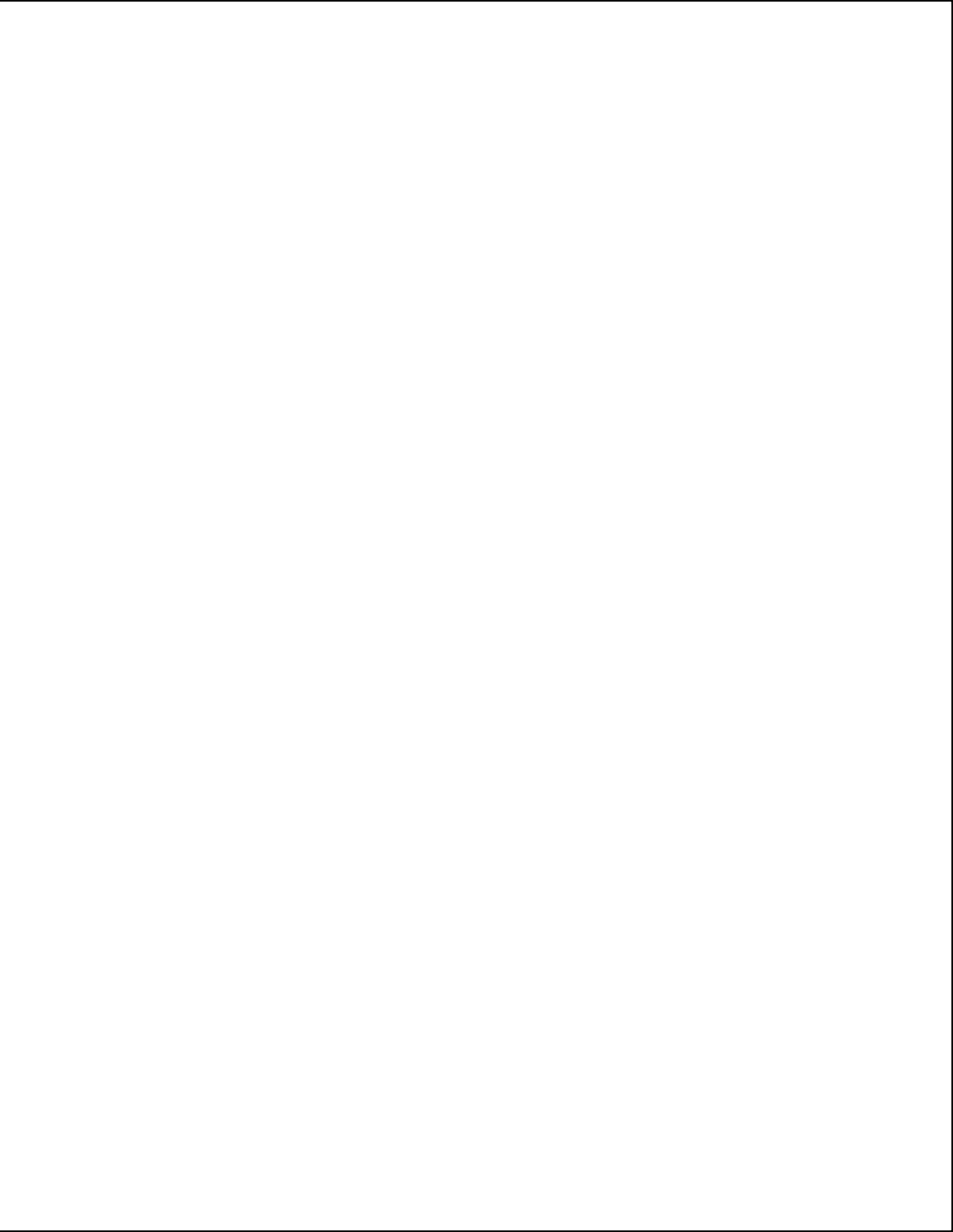
According to McCaughrean, ESA also has a program to build their own gravitational wave detector by the year 2030—this is called the Laser Interferometer Space Antenna mission, hence the aforementioned acronym, and will be using laser technologies to observe and measure these waves.

esa.int/

isro.gov.in/



ESA's Euclid spacecraft.



InfoBeam

A Milestone for Rocket Lab

Rocket Lab, a smallsat launch services company, has surmounted their first milestone and has delivered their first Electron rocket to the Rocket Lab Launch Complex 1—this was accomplished late on Tuesday evening and marks the start of the all-important pre-flight checkouts.

The rocket was trucked to the Mahia Peninsula from Rocket Lab's Auckland facility. Over the coming weeks, a series of tests and checkouts will be conducted at the site before the rocket, named It's a Test, is signed-off to fly.

The launch, which will be the initial orbital launch attempt from New Zealand, is the first of three planned test launches before Rocket Lab begins providing customers with commercial satellite launches.

Rocket Lab will use Electron to launch satellites used to house imaging and communications technologies. Rocket Lab's customers use these satellites to provide services including optimized crop monitoring, improved weather reporting, Internet from space, natural disaster prediction, up-to-date maritime data and search and rescue services.

Electron is an entirely carbon-composite vehicle that uses Rocket Lab's 3D-printed Rutherford engines as the main propulsion system. Electron is capable of delivering payloads of up to 150 kg to a 500 km Sun-Synchronous Orbit (SSO)—the target range for



Rocket Lab's Electron launch vehicle at the Mahia Peninsula launch site. Photo is courtesy of Rocket Labs.

the high growth constellation-satellite market. Customers that have already signed on to fly on Electron include NASA, Planet, Spire and Moon Express.

Rocket Lab's Launch Complex 1 is located on the tip of the Mahia Peninsula, New Zealand. The complex is the first orbital launch site in New Zealand and the first privately operated orbital launch site globally.

The remote location of Launch Complex 1 — particularly its low volume of air and marine traffic — is a key factor in enabling unprecedented access to space.

The geographic position of the site means it is possible to access a large range of orbital azimuths—satellites launch from Mahia can be delivered to a wide range of inclinations to provide services across many areas around the world.

Peter Beck, Rocket Lab's CEO, reported that this event is an important milestone for the team and for the space industry. In the past, it has been countries that go to space, not companies.

Through the innovative use of new technologies, the Rocket Lab team has created a launch vehicle designed for manufacture at an unprecedented scale—the ultimate goal is to change the ability to access space.

Since commencing this project three years ago, the team has accomplished an incredible amount—the vehicle has gone through rigorous qualification and acceptance testing, Rocket Lab Launch Complex 1 has been completed and major tracking infrastructure has been installed in remote locations.

rocketlabusa.com



The Rocket Lab's Mahia Peninsula launch site in New Zealand. Photo is courtesy of Rocket Lab.

NASA Image Library Consolidates 60 Collections for Public Access

NASA has officially launched a new resource to help the public search and download out-of-this-world images, videos and audio files by keyword and metadata searches from NASA.gov—the NASA Image and Video Library website consolidates imagery spread across more than 60 collections into one searchable location.

NASA Image and Video Library allows users to search, discover and download a treasure trove of more than 140,000 NASA images, videos and audio files from across the agency's many missions in aeronautics, astrophysics, Earth science, human spaceflight, and more.

Users now can embed content in their own sites and choose from multiple resolutions to download. The website also displays the metadata associated with images.

Users can browse the agency's most recently uploaded files, as well as discover historic and the most popularly searched images, audio files and videos. Other features include:

- **Automatically scales the interface for mobile phones and tablets**
- **Displays the EXIF/camera data that includes exposure, lens used, and other information, when available from the original image**
- **Allows for easy public access to high resolution files**
- **All video includes a downloadable caption file**

NASA Image and Video Library's Application Programmers Interface (API) allows automation of imagery uploads for NASA, and gives members of the public the ability to embed content in their own sites and applications.

This public site runs on NASA's cloud native "infrastructure-as-a-code" technology enabling on-demand use in the cloud.

The library is not comprehensive, but rather provides the best of what NASA makes publicly available from a single point of presence on the web.

Additionally, this is a living website, where new and archival images, video and audio files will continually be added.

images.nasa.gov

InfoBeam

Terraformation to Create a Lake for Martian Inhabitation

The Lake Matthew Team has just announced the Mars Terraformer Transfer (MATT), the first practical terraformation invention—with MATT in 2036, a commercial satellite is planned to terraform a region of Mars to create a persistent lake for use by mission crews... the invention is patent-pending and available for licensing.

Inhabitation of Mars is a goal shared by many national space agencies and aerospace firms. The physical and financial challenges are daunting; however, they can be ameliorated with terraformation, Martyn Fogg's notional "process of planetary engineering" in support of life. Terraformation need not engineer an entire planetary surface. A city-region is adequate for inhabitation. MATT hits this mark.

MATT details methods for a 2036 terraformation, which will be completed in good time to assist early mission crews. A commercial satellite executes the mission plan: a Shepherd, guiding a selected celestial small-body impactor to a selected target site. A DE-STARLITE-class fiber laser provides the shepherding impulse.

The laser and other commercial instruments deflect, analyze and restructure the small body, over some years, for optimized impact on Mars. The mission plan is straightforward, specific and feasible. Currently, at least six US firms have the demonstrated capability to build the required Shepherd spacecraft using off-the-shelf hardware.



The impactor injects heat into bedrock and produces meltwater for a lake that persists for thousands of years within the warmed impact site. The challenges of crewed missions are thereby ameliorated and the achievable scale of inhabitation is increased.

Prior designs of habitation structures (habs) were limited to thousands of cubic meters. MATT habs can scale to millions of cubic meters — stadium scale, or greater. The site's treated lake water is sufficient to cover and protect subaqueous domes. Such habs are not pressure vessels; therefore, the size-limiting

scaling laws of pressure vessels do not apply and habs can scale to match ambitions.

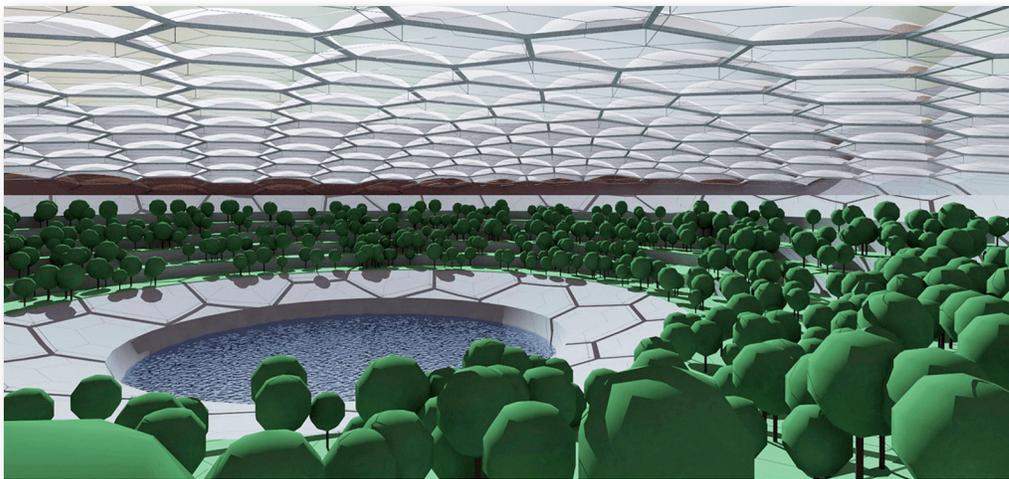
With scaling, the first Mars habs transition quickly into settlements, with the capacity for self-sufficiency, even the provisioning of expeditions worldwide. This cuts the mass of Earth-shipped cargo as well as the expense of crewed missions.

Scaled habs can also house commercial offices for telerobotic open-pit mining of rare and rare Earth metals. High-grade ore deposits are likely abundant in the Martian near-surface, mainly in the preserved mass of protoplanetary-core asteroids such as 16 Psyche.

Such asteroids would enrich ancient Martian impact sites with metal ores, rendering Mars the greatest treasury of accessible rare and rare Earth metals in the solar system. MATT opens this treasury.

MATT is necessarily a strategic invention, designed to accelerate Mars exploration, settlement and commercial development.

All recovered resources are controlled by the licensee, pursuant to the US Commercial Space Launch Competitiveness Act.



Artistic rendition of the MATT subaqueous hab design, rough geometry, 300 m scale. Image courtesy of Lake Matthew team.

LakeMatthew.com.

Cloud Constellation's SpaceBelt™ Receives Patent

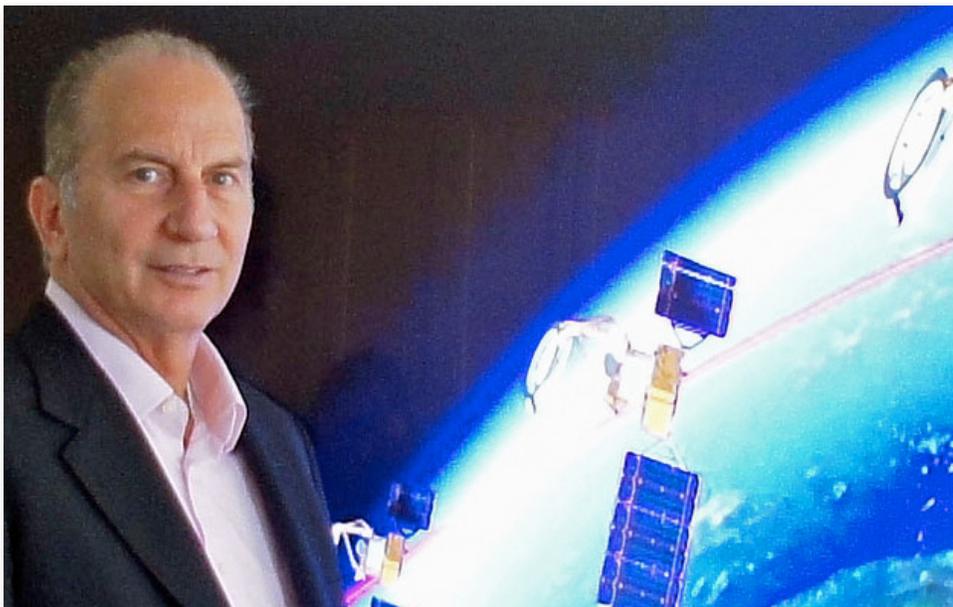


Cloud Constellation's SpaceBelt™ has been awarded a US patent from the United States Patent and Trademark Office for a technologically advanced global communications platform operating at Low-Earth-Orbit (LEO),.

Their platform enables the transport and/or storage of large blocks of data quickly and securely without exposure to any terrestrial communications infrastructure.

A step into the future with SpaceBelt offers a unique and safe way to provide a secure platform for cloud storage and high speed transmission of sensitive data around the world without regulatory constraints.

The deployment of satellite-based secure storage will protect critical data from unauthorized access while supporting global communications at reduced latency of today's multi-hop networks.



Cliff Beek, President of Cloud Constellation Corporation

- **Provides data security in space:** Organizations of all sizes are exposed to leaky Internet and leased lines, along with jurisdictional hazards. SpaceBelt provides an all-in-one space-based global cloud network that protects critical information to secure sensitive data from hijacking, theft, monitoring and sabotage.
- **Ensures high throughput with major infrastructure savings:** SpaceBelt avoids traditional terrestrial "hops" by transporting data across its high-speed communications platform in space.
- **Avoids regulatory constraints:** SpaceBelt utilizes existing and future satellite assets to reach customer origination and endpoints.
- **Facilitates jurisdictional compliance:** Hosting data on SpaceBelt has the potential to comply with international data sovereignty protection requirements
- **Solves a multitude of diverse storage security requirements:** Circumventing today's major cybersecurity crisis, SpaceBelt protects critical and sensitive data for a diverse range of organizations, including cloud service providers, large telcos, network data security firms and systems integrators.

Cliff Beek, president of Cloud Constellation explained that over the past three years his team has achieved a significant design capability that enables them to leverage the industry's vast investments to further SpaceBelt's market position.

He added that being awarded this patent is an important milestone as Cloud Constellation continues to accelerate its strategic growth initiatives, and that this validation underscores their commitment to build a unique platform that will begin the next evolution in space-based communications.

SpaceBelt.com

Huge Pressures On The Satellite Launch Industry...

The Forrester Report

By Chris Forrester, Senior Contributor



Hot topics at the recent Satellite 2017 show in Washington, D.C. included discussions regarding new satellite constellations.

Just days before the show, the Intelsat+OneWeb 'merger' was announced (and financed by Japan's Softbank). This deal ensured that OneWeb's plans, plus those of other would-be constellation operators, were highly important topics for delegates to this event.

However, this show unveiled a major surprise that was associated with Amazon founder Jeff Bezos, who was a star guest, by confirming that Paris-based Eutelsat would use a debut commercial flight of Blue Origin's New Glenn re-usable rockets to launch a geostationary satellite in the 2021 to 2022 time-frame. Delegates saw Bezos dramatically fill a missing chair on stage with Eutelsat CEO Rodolphe Belmer, which will be the first commercial user of the Blue Origin's New Glenn rocket system. The 2021-22 launch target gives Eutelsat plenty of time to identify and order a suitable (probably) all-electric satellite and mission.

Cynical comments—and there were a few—suggested that, while the industry constantly grumbles about "paper satellite" and their pesky filings, this was still a "paper rocket," with much still to be done before billionaire Bezos and his team manage to get a satellite off the ground.

However, the agreement between Eutelsat and Bezos came as a welcome revelation to the show, but in truth, Eutelsat has always been aggressive in seeking out a good discount for a launch—even back in the Giuliano Berretta

days, that company was quick to book a test flight or a debut option on a rocket—invariably at a bargain-basement price.

"It's very important to us to build up this kind of spirit because the relationship between a launch agency and a satellite operator needs to be intimate," said Belmer. And the New Glenn vehicle is potentially nothing if not flexible. "The two-stage variant of New Glenn has quite a bit of capability: it can take 13 metric tons to GTO, 45 metric tons to LEO, and the booster stage is designed for operable reuse. The BE-4 engine is designed for a 100-flight lifetime. We put a lot of effort into letting the vehicle fly back with aerodynamic surface control instead of with propulsion," he said.

According to Bezos, the rocket's design is what allows the vehicle to operate with solid availability, even in high wind conditions. However, Bezos stressed that his team have a speedy 'return to use' target of just 24 hours. Bezos said the New Glenn rocket would be one of the largest vehicles in service, which is one in the eye for Arianespace.

Bezos explained that his trio of rocket designs (Blue Origin, New Shepard and New Glenn) each have different missions. The core Blue Origin/New Shepard versions are designed for 'tourist' flights to sub-orbital space and has "more than 1,000 people" working on the project. He emphasized the core thinking behind the systems and compared and





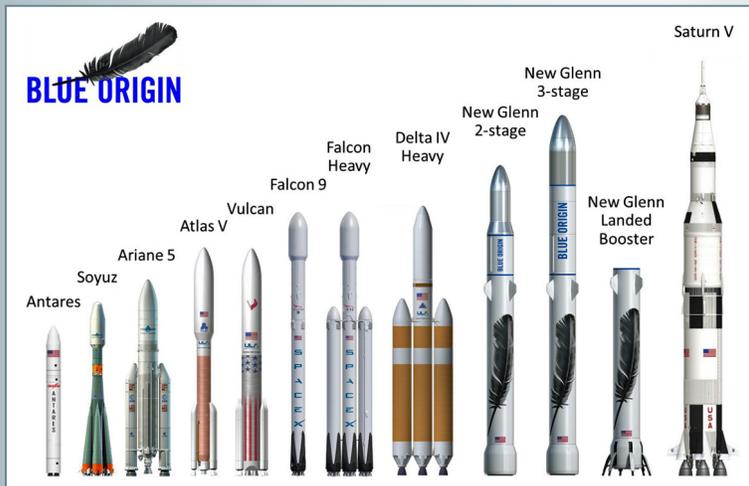
Amazon founder Jeff Bezos and Eutelsat CEO Rodolphe Belmer on stage together at the DC show.

contrasted a rocket with that of a modern aircraft, which would never be thrown away after a single use.

"New Shepard is a true re-usable vehicle. Propellant costs are vanishingly small. The other thing we need is practice."

Bezos showed demo clips of how a cargo or crew capsule could re-land at just 1.3 mph. A rocket's (unmanned) landing looks much more violent but, in fact, comes down at 4.8 mph.

Blue Origin has now flown five times—and the costs of maintenance after each flight? An amazing \$10,000.



His rationale for continuing with Blue Origin's development is that it is directly relevant to the New Shepard and then to the New Glenn rockets. *"New Glenn is directly relevant to this audience and would be a 2-stage vehicle, designed of carrying up to 13 metric tonnes to geostationary transfer orbit, and with a 100-flight lifetime, and would land downrange onto a floating ship. These rockets will be fin-stabilized as will the landing ship for stability."*



Gwynn Shotwell, SpaceX's president/CEO (pictured above), who also spoke at the show, told delegates that her company will likely launch six 'pre-flown' rockets this year (the first was SES-10, scheduled for around March 27). *"And we'll bring this rocket back, too,"* Shotwell said.

But SpaceX has suffered major delays following a catastrophic explosion on September first when the firm lost a rocket as well as the Amos-6 satellite.

"We do anticipate re-flying about six vehicles and with pre-flown boosters this year, which should take some of the pressure off of production," Shotwell said.

Launching both the 'pre-flown' versions, as well as all-new rockets, almost side by side is vital if SpaceX is to recover some of their lost backlog—and their reputation. While all observers recognize the inevitable delays created by the September first loss, there are plenty of critics—off the record—who complain about the lack of transparent information—and even misinformation—from privately-held SpaceX.

Also key to an increased launch frequency are repairs to the extensively damaged Launch Pad 40 at Cape Canaveral which must be brought back into use. SpaceX had used the nearby Launch Pad 39A for their recent Florida launches—and used this Pad for the successful launch of EchoStar-23 in March.



Launch Pad 39A at Cape Canaveral.

Shotwell told delegates that the Pad 40 repairs will be completed by this summer. *"Once we've got two pads we should have plenty of capacity,"* she said.

She also explained that inspection and refurbishing of the rocket now being used by SES took roughly four months to complete. That, she said, will in time drop to two months, and eventually to a single day, helped by continued investment in the design and build of the core Falcon-9's first stage.

"I think Elon's [Musk] given us 24 hours, maybe, to get done what we need to get done, and it's not a million people around a rocket scurrying like a beehive or an anthill. That vehicle needs to be designed to be re-flown right away," she said.

Bezos had also stressed that a dramatically speedy turn-around time was key to his strategy. The schemes really need to be successful.

Among the existing operators, the show was replete with established satellite operators, all talking about their LEO/MEO plans, as well as those would-be players who also used this event to boost their own ambitions.

As highlighted, the Intelsat+OneWeb+Softbank 'merger' was, without a doubt, the 'talk of the show'. Intelsat's CEO Stephen Spengler reminded delegates that Intelsat was a founding investor in OneWeb.

"We made an initial investment in 2015 establishing a partnership with them to develop both Geostationary Earth Orbit (GEO) and Low Earth Orbit (LEO) services together as well as certain market segments. So, we have worked very closely with them over the last couple of years. As time has moved on, I think we have become increasingly convinced that there is a real opportunity to bring a new set of services to the marketplace that leverage both LEO and GEO network architecture and all of the services that could be associated with those.

"OneWeb and Intelsat recognized that we shared a vision for delivering affordable broadband on a global basis. I think that industrial logic developed pretty quickly. For an agreement of this type, there are a lot of details and a lot of work to put it all together," he added.

Spengler explained that SoftBank will have a nearly 40 percent ownership of Intelsat at any given time. "In this transaction, they are investing \$1.7 billion into the new company. That is going to be used to fund a liability management/debt exchange exercise over the next 90 days. That transaction is a contingent part of the deal that has to be achieved for the deal to be completed."

Even Mark Rigolle, CEO at LeoSat (and very much a futurist with his Polar orbiting/Laser satellite system), was happy to talk about a possible merger and the need to be open-minded, "Don't be surprised if there's an announcement one day that we're combining," he stated.

However, while there was enthusiasm for this new LEO activity (from SES and Telesat of Canada, among others), there were also significant worries expressed over the four days of the show, not the least of which were from operators already standing in line for launches on the now, very crowded, manifests of SpaceX, Proton and even Arianespace.

Paul Estey, EVP/engineering, manufacturing and test operations at SSL, typified the comments of many, saying, "The launch vehicle is a bottleneck to getting both the LEO constellations running and GEO back in shape. Long term, I don't know if there really is a good solution yet. All the guys building LEO constellations [and] darkening the skies are going to suck up all the launch capacity."

Giles Thorne, equity analyst at investment bank Jefferies, in his review of the show's first day, said there was still plenty of skepticism over OneWeb's prospects.



Artistic rendition of the OneWeb constellation. Image is courtesy of OneWeb.

"Skepticism that OneWeb can get the regulatory approval, overcome the spectrum coordination and develop the adequately priced antenna to make OneWeb technically feasible—no-one is saying it won't happen, but none are saying it definitely will. Strong reiteration from Intelsat of the industrial and strategic logic of merging the two businesses," Thorne said.

Another operator happy to talk LEO/MEO was Saudi Arabia's Arabsat



VIPs at OneWeb Satellite's Ground-breaking ceremony in Florida, March 16:

CEO Khalid Balkheyour, who said that despite rapid recent and current expansion plans, the company will, this year, look closely at further potential developments into LEO or MEO spacecraft. Balkheyour said Arabsat has expansion in mind, and not just in the firm's traditional geostationary satellite role.

"We have Request for Proposals (RFP) out now. One new RFP is for Arabsat 6D and is under evaluation now, and this will be new mission and be placed at 44.5 degrees East, targeting data and it will be a high-throughput satellite for us and our partner (Taqnia Space of Saudi Arabia). It will hopefully launch by 2019.

"We are constantly reviewing where we should go, where we should invest. There is no doubt for us that data, in all its forms, is important for the future. And this could take many forms, including backhaul and OTT. And this might include not just geostationary.

"We are looking at LEO and MEO, and very seriously. We cannot afford to miss the developments. How much we can invest and how we might invest is part of the strategic study now being worked on. We have not finalized our strategy. In general, we think it is better to partner for many obvious reasons, not in the least to gain knowledge from one another, and to share the market and risk. The minute you enter the LEO or MEO market you are then global. But this isn't easy. We need the infrastructure on the ground, as well as the landing rights and other regulatory obligations. At the beginning, it would be wise to partner, but we are not yet in a position to make a decision. We have to make a decision soon, and we expect to present to our Board this year."

Although not formally present at the Washington show, SES also chipped in with their five cents worth on the topic of LEOs. Despite being committed to an extra eight O3b satellites being launched between this year and 2018 (into LEO), CEO Karim Michel Sabbagh was happy to be upbeat on 'new technologies.'

"We are very focused on how we want to deploy our time and resources. When I think about video, enterprise, mobility and government, we have a unique development path through our capabilities system, particularly when accounting for the upcoming GEO and MEO launches over the 2017-2020 window," he said.

"Net, we will continue to look at LEO as a possible augmentation if validated. We have an open business model and an open innovation model. We are curious about how can we move the needle in terms of new capabilities we could build in the future, irrespective of the orbit. We don't pretend to have all the answers in-house and to be able to build everything on our own. This is not the way we think about our business."

We now know that OneWeb has far greater ambitions than their initial demand for as many as 900 satellites. Brian Holz, CEO at OneWeb Satellites (the j-v between OneWeb and Airbus), at the March 16 ground-breaking at the company's new Florida manufacturing facility, talked openly about fulfilling 2,000 satellites from the new \$85 million plant.

Then there's Google who, with SpaceX, are apparently working on a new, global-scale communication system that includes an LEO satellite constellation (over 4,000 satellites) and ground stations. Google has figured out the entire process to use the satellite constellation to provide high-speed, low latency, low-cost Internet directly to customers across the globe.

Remember that Google last year invested \$1 billion in SpaceX in return for a reported 10 percent stake in the rocket business. This is very likely to give it—at least—certain pre-emption launch rights when their fleet comes together. Soon after the investment was made, the inventor who was listed on the patent, Mark Krebs, moved from Google to SpaceX. Then, in November of 2016, SpaceX filed an application with the Federal Communications Commission (FCC) to launch 4,425 satellites.

Here comes the big question: Who is going to launch all this hardware into space? The less-than handful of existing players (Arianespace, SpaceX, United Launch Services/Delta, International Launch Services/Proton, Bezos/New Glenn) are going to be busy. Yes, there are Chinese rockets, as well as a growing confidence from India's rocket industry—Japan's capability should not be ignored. There's also the various Richard Branson/Virgin aircraft/air-launch schemes.

However you slice and dice demand, the bottom line is that, potentially, thousands of satellites will need to be launched between now and 2025. Perhaps Bezos and SpaceX's Elon Musk are truly sitting on a gold mine.

SatMagazine and MilsatMagazine Senior Contributor Chris Forrester is a well-known broadcast journalist and industry consultant. He reports on all aspects of broadcasting with special emphasis on content, the business of television and emerging applications. He founded Rapid TV News and has edited Interspace and its successor, Inside Satellite TV since 1996. He also files for Advanced-Television.com.

In November of 1998, Chris was appointed an Associate (professor) of the prestigious Adham Center for Television Journalism, part of the American University in Cairo (AUC), in recognition of his extensive coverage of the Arab media market.

Meeting The Future Needs Of The Aviation Community:

A Cobham SATCOM Perspective

By Willem Kasselmann, Vice President Aero, Cobham SATCOM

This is an era of exciting growth for aeronautical satellite connectivity, with a new generation of technologies now in the advanced stages of development ready to handle the specific requirements in the airline industry.

New solutions are set to transform the quality and security of cockpit communication and information shared between pilots, air traffic controllers and airlines. The push for broadband in the cabin is well known, but the flight deck is increasingly looking at its use of streaming data for tasks such as air traffic control, aircraft operation and cabin crew operations.

Wireless connectivity can support a host of applications in the cockpit, from enabling on-line use of modern EFBs to accessing real-time weather reports, flight planning and chart information. For the providers of mobile satellite systems, there is now an opportunity to change the airline industry from an environment where an aircraft, to a large extent, remains the only workplace without an Internet Protocol (IP) data link for professional communications.

As a leading designer and manufacturer of L-band SATCOM systems that support cockpit connectivity, Cobham SATCOM has addressed this growing demand from airlines for continuous secure data exchange between the airlines' ground operations and their aircraft and meet the trend for smaller, lighter, less expensive systems that are still feature rich. The answer was the development of a superior next generation solution, designed to resist cyber threats for the next 20 years—the Cobham SATCOM AVIATOR S Series, an ARINC 781 compliant compact and lightweight SATCOM system. The system enables Inmarsat's new SwiftBroadband-Safety (SB-S) IP data service, which includes the encapsulation of ACARS messages (CPDLC and ADS-C) as well as safety voice, a secure and plain IP data.

Development of AVIATOR S

Cobham SATCOM was perfectly placed and established within the industry to develop this next-generation, secure, small system, and to participate in the subsequent evaluation period. As well as being a leading supplier of Inmarsat L-band antennas to the Air Transport community, the company is also active in SOTM and maritime communications with access to significant expertise in broader technologies, such as SOTM radio, which can be tapped for the benefit of the aviation industry.

The Cobham antennas are normally deployed with satellite radios that provide highly reliable and secure communication links to the air traffic control ACARS network for CPDLC and ADS-C messages. Cobham SATCOM has also built and delivered more than 5,000 satellite radio terminals for the aero market, most deployed for the provision of cabin voice and data connectivity.

During the past five-plus years, an industry workgroup of several satellite equipment developers/manufacturers, the major airframe builders and Inmarsat, known as the Air to Ground Communications or SC-222 workgroup, debated and mapped out requirements for future SATCOM systems to provide the above mentioned services, but also provision data services for supporting the use of EFBs in the cockpit. Cobham SATCOM participates in several industry forums, as well as this one, and as a result decided to develop a compliant product to what has become known as the ARINC 781 Small SATCOM Recommendations.

The objective of the ARINC 781 recommendations is the establishment of a new generation of (80 percent) smaller terminals that will use IP data communications to provide cheaper communication, while also reducing the cost of the terminals/SATCOM systems from several hundreds of



thousands of dollars to no more than tens of thousands of dollars. The result is that in 2018 Cobham SATCOM will launch an ARINC 781 compliant small SATCOM system with the most advanced security architecture and domain segregation measures available in a two LRU solution with a two MCU sized Compact Satellite Data Unit (CSDU — the radio) and HELGA (an antenna, high power amplifier and diplexer, all in one enclosure), linked through a standard low cost coaxial cable.

Suitable for all single-aisle and wide-bodied aircraft, AVIATOR S is smaller and lighter and has a lower cost of ownership than any other Inmarsat system, including airtime costs. The total system weight is less than 8kg (17.6 lbs) in the AVIATOR 200S configuration.

Protecting Against Hackers

Cyber security is required to fend off the threat of data or communications corruption by intentional interference, otherwise known as hacking. Hackers pose a threat to lives, even if the original intentions were not malicious. AVIATOR S combines ACARS and IP data with compliance to the latest security architectures, designed to resist cyber threats for decades to come. Cobham SATCOM started an ARINC 781 compliant development in 2013 and, amongst others, won a contract from one of the leading airframe manufacturers for the provision of new generation SATCOM connectivity to their airplanes.

During 2015, industry security analysts concluded studies that indicated a requirement for much more rigorous security architectures to avoid the exposure of flight safety critical communications to hackers. Cobham SATCOM considered these recommendations and decided to embrace them fully, rather than risk the release of a product that may be found wanting on security aspects.

The security provisions in the Cobham SATCOM terminal include segregation of all functions and protection of each functional path with several independent security gates. The ACARS data will be complimented by standard IP data for the support of ancillary services, whatever the airline or user defines that to be. Examples include EFB for weather updates, engine monitoring and flight crew services.

FAA-Supervised Technology Evaluation

The advantages of IP-based data communications have been verified through evaluations of the ACARS over IP over SBB on a fleet of Hawaiian Airlines aircraft during the past 12 months.

Analysis of the test results began in 2015 after Hawaiian Airlines' Boeing 767-300 became the first commercial airline to fly with SwiftBroadband-Safety, enabled by Cobham's AVIATOR 300D system which was certified for FANS 1/A+ and CPDLC communications as well as ATC voice over SBB during the evaluation period.



Cobham SATCOM's AVIATOR S.

The results of these trials were presented at a recent FAA PARC meeting and the results conclusively prove the superiority of this service mechanism over previous generation solutions.

The advantage of this means safe reduced separation in congested airspace, better situational awareness to the pilots and air traffic controllers and, most importantly, safer flying for passengers. As part of these evaluations, it has also recently been announced that the Cobham and Inmarsat solution has enabled in-air connected EFBs for the first time.

With data already being successfully collected during the on-going evaluation using the Cobham CSDU interface, the latest advancement confirmed the AVIATOR/SB-S system can also be used to channel ACARS data via the Aircraft Data Management (ADM) technology, or Aircraft Interface Device (AID), to another interface as well: the pilot's EFB.

Stamp of Approval

In addition to the successful results of the evaluation of SB-S enabled by the Cobham system on Hawaiian Airlines, an agreement with the previously mentioned airframer provides a further stamp of approval for the use of Internet Protocol to provide critical digital communications capabilities for airlines. Cobham is now set to provide its AVIATOR 200S and 700S for Air Transport Single Aisle and Long Range aircraft families from 2018 and has been selected for line-fit certification by another soon to be announced major airframer.

AVIATOR S will enter the qualification phase later this year and be certified for flight through an EASA TSO by mid-2018.

cobham.com/SATCOM

Providing dependable communications and Internet access anywhere under the most demanding conditions. Cobham SATCOM's satellite and radio communication terminals perform in the most challenging and remote environments on land, at sea and in the air. The company designs and manufactures these high performance products under the AVIATOR, EXPLORER, SAILOR and Sea Tel brands, providing customers with outstanding performance, value and support through global sales and service network.

Willem Kasselmann was appointed Vice President Aero at Cobham SATCOM in November 2016. He has global commercial responsibility for the aeronautical business of Cobham SATCOM. He joined Omnipless Manufacturing in 2003 as Business Development and Marketing Director, before taking on the role of Director of Sales and Marketing for the non-Americas Aero Business at Cobham SATCOM from 2014. Before joining Cobham, Willem worked for ARMSCOR, Grinaker Electronics and MIH in South Africa and South Korea.

Smart Devices and Connectivity Are Key To Smart Offshore Fishing

A Globalstar Perspective

By Ron Wright, Regional Sales Representative, Globalstar

Ten years ago, having a flip phone and asking a loved one back home to check email was a sufficient way to stay connected while working offshore. Today that is not the case.

It is no surprise that the importance of technology has made its way to the marine and maritime industry. Captains and their crews rely heavily on smart devices, access to Internet and reliable connectivity to operate seamlessly. Having access to email, social networking accounts and minute-by-minute weather reports are now all vital parts of running a successful business on the water.

Satellite telecommunications' role in accommodating the industry's need for high-quality and reliable data services is now greater than ever before. Phones, tracking, and S.O.S. devices are vital and invaluable equipment. Satellite service providers, such as Globalstar, now have marine hardware below \$1,000 in cost and service plans under \$40 a month to fit the needs and budget of virtually any size commercial vessel. For smaller operators that are budget conscious, Globalstar offers a suite of products that provides the same access and tools as larger satellite companies, at a lower cost sufficiently meeting the needs of this niche market.

Generational fishermen, who have handed down their Globalstar satellite phones which they relied on solely to make phone calls, can now be paired with the Globalstar 9600, a satellite data hotspot.

This allows customers to use their existing smart devices to send and receive email over the Globalstar satellite network via the Sat-Fi App.

Many boaters are also enjoying the convenience of the Globalstar

Sat-Fi® hotspot, which pairs with an existing WiFi enabled device, e.g. smartphone or tablet to make calls, send text or email from beyond cellular.

Data capabilities provided through this satellite technology, paired with various apps, provides ease of access to tools that enable fisherman to focus on what they are really on the water to accomplish: to catch fish.

On a daily basis, captains rely on various apps on their smart devices to ensure they are upholding various regulatory standards. Vessel monitoring and observer programs, customs documents, crew contracts and fishing logs, can all be addressed while at sea. Apps that allow scanning documents and quickly turning them into .PDF files to be sent via email now provide a level of professional communications that used to require additional personnel on shore or a trip to town to locate a fax machine.

Weather, ocean conditions for fishing decisions, email for delivery schedules, market price, fuel and ice delivery, maintenance schedules and HR, all require a level of connectivity which, for a long time, was all handled on shore. Additionally, many crewmembers have projects or second jobs on shore that still require attention while at sea, and connectivity is a key





differential between working for one company over another.

XWeb compression service, part of Global Marine Networks suite of services, allows users to access web pages through their optimized browser and service. This service provides three to five times compression, with settings to reduce images and other media enabling users to navigate many of the common web pages for news, weather, sports and stocks. The software even comes with a preloaded set of bookmarks to the low bandwidth versions of common sites to get you started.

For email, text, weather and news, Ocens (ocens.com) offers solutions à la carte enabling users to combine services or elect single services depending on the customer's specific needs. One of Ocens apps, OneMail, allows access to existing email accounts such as Gmail, Exchange, AOL, Hotmail and most other IMAP accounts over multiple connections. This provides users with the ability to seamlessly switch from cellular to satellite to WiFi by simply telling the app where to look.

Designed for low and high bandwidth satellite connections, the app allows customers to use the same email enjoyed at home or office while located in remote lands or sea areas. Users control the frequency of downloads and can start with simple headers to avoid unnecessary and costly data. This is a must-have for those frequently moving in and out of traditional WiFi or cellular coverage.

Elements that people on land take for granted, such as texting and other messaging apps, are not luxury items for the maritime industry but rather a means to an end. OneMessage (also part of Ocens' suite of services) is a User to User text app that lets one user text another user using WiFi, cellular and satellite. Because each user is identified with individual log-ins within the app, text messages always make it to the intended recipient using as little data as possible. By using various methods of connectivity users, could virtually send and receive text messages non-stop, whether they are in cellular range or not.

Quick messaging and weather monitoring only scratch the surface of how technology is changing the maritime industry. Technology is also changing how commercial fishermen are locating fish and choosing prime areas to cast their nets.

Ocean Imaging (oceani.com and seaviewfishing.com) uses their Seaview software to provide an optimized and premium service for commercial fishing, which includes unique information such as sea height, plankton, microwave and other satellite images. Some are even interpreted for best fishing opportunities. Information may be updated as often as eight times a day.

To help optimize use, Seaview allows for the download of a list of all available information that reveals the time and amount of cloud cover so users can be informed before they take the time and expense to obtain a chart. This avoids users from attempting to access data and find that there is too much cloud cover to get any valid information. The information can be combined, overlaid and animated within the software and even includes coastlines and bathymetry.

GRIB Explorer Plus for the iPad provides a full featured, intuitive yet powerful graphic display of the globally-available GRIB data its built-in compression engine delivers to you. Use the area selection tool to get the data you need without having to download a bloated file. Profiles are built in for Globalstar and other satellite providers to make setup simple. Then the app provides the tools to animate, rotate, and interpret weather and ocean conditions for fishing and navigation.

All of these data powered tools are indispensable and are revolutionizing the industry. The problem lies in how to provide access to the bandwidth needed at an affordable price for hardware and service.

Globalstar provides data speeds up to four-times faster than other fixed antenna satellite providers. Add to that, bundling airtime with every service plan and allowing it to be used for either voice or data. And finally, keeping the solution under \$2,000 delivers impressive capabilities to any mobile business outside of terrestrial coverage.

While the flip phone's days are numbered, Globalstar, innovative apps and other satellite providers, all are paving the way to make the transition to smart devices a lot easier to secure that big catch.



www.globalstar.com/

Ron Wright has 17 years of experience in the telecom industry and specializes in Marine and Maritime communications' solutions. He owned his own business where he helped to assemble communications systems for emergency vehicles and emergency vessels ranging from 40 to 125 feet. This included tow-vessels, marine transport and commercial fishing boats.

Ron is also an active member of a number of organizations including WFOA and AAFA. Currently, he specializes in working with business and consumer customers in finding suitable communications solutions.



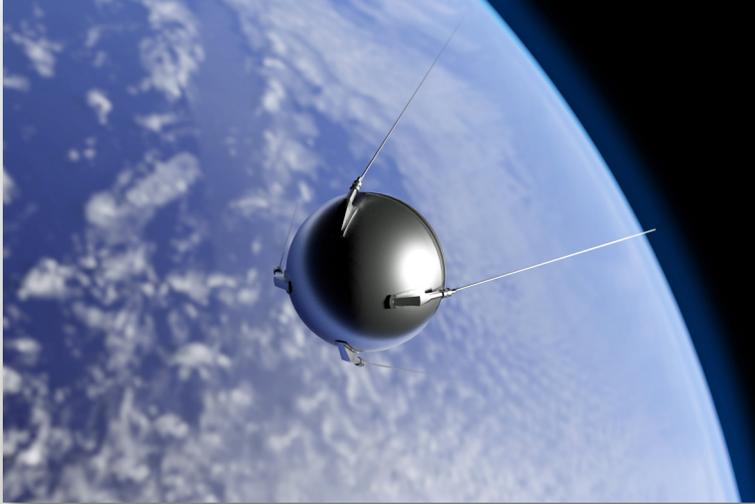
Smallsats: Making The Best Of Space Technologies

By Mufassira Fathima, Writer, Allied Analytics LLP



The growing popularity of the smallsats market is a testimony to the best use of evolving space technologies in today's world.

More than 60 years have passed since the world's first artificial satellite, Sputnik, was launched in 1957. That satellite was about the size of a small beach ball and forever changed the history of space technologies.



Artistic rendition of Russia's Sputnik orbiting Earth.

Fast-forward to today and the scale of the technological advancements, as well as the political, industrial, and economical progress being made all over the world, is resulting in the redesign of satellites and the technologies that drive these smaller and extremely focused spacecraft.

Every industry vertical, including civil, defense, commercial, and government sectors, wants in "on the action," and this demand has spurred the latest trend of designing smallsats for a variety of purposes. Mini-, micro-, and nano-satellites—what are known as smallsats—are being launched on a highly regular basis—when rides are located—to aid in Earth Observation (EO), telecommunication, scientific research and experimentation projects. These activities have afforded a real boost to the smallsats market.

The demand for high-resolution imaging services is certainly one reason for the growth of this industry. An upsurge in the number of industry verticals investing in the satellite market, to gain better data and information through affordable satellites, continues to gain impetus.

The low cost and weight of smallsats makes them a lucrative option for companies who also find these satellites easier to launch through inexpensive and less exorbitantly priced launch vehicles. These and other business-related factors have ensured a robust market for smallsats.

According to the experts at Allied Market Research, the global smallsats market is estimated to earn nearly \$7,179 million by the year 2022. This would be feasible with a projected CAGR of 19.8 percent during the time period of 2016 to 2022.

The small satellite industry offers highly encouraging market scenarios. The potency of this industry can be accounted for by the rush of several emerging economies and governments who wish to become a part of this growth. This desire has also increased investment in the space industry, positively affecting the progress of the smallsat market segments.



The ISRO's PSLV launch vehicle carried aloft 104 smallsats.

Making A Mark With More

The rapid technological progress by several nations to address space missions is a testimony to the phenomenal growth of the market. Whether for commercial imaging, EO, research, or technology demonstration, the launch of smallsats caters to a broad array of applications.

With weights that range up to 110 kilograms, smallsats have become easier and more feasible to launch, thanks to a significant reduction in costs. Smallsats are capable of being propelled into elliptical orbit through already available as well as up-and-coming inexpensive launch vehicles. Also noted is the latest trend of multiple payloads, where several satellites are hurled into space via a single rocket.

ISRO (Indian Space Research Organization) has recently rewritten history and reaffirmed their presence in the space world with a simultaneous launch of 104 satellites. The PSLV vehicle, named C-37, contained satellites from six other countries and included three important passenger smallsats intended for remote sensing.

By successfully deploying all 104 satellites into their assigned orbits, the PSLV has clearly made a stellar mark in the space industry. The multiple satellite launch containing smallsats has inspired other countries and their space organizations to follow in India's footsteps and work to capture and participate in the smallsats market surge.

Create Their Own Impressions

There should be no surprise that nowadays small firms and new businesses want to participate in this movement. The cumulative lower costs of launching smallsats has inspired smaller firms to venture into this space and to launch their own satellites that are designed to be solutions for specific applications.

For instance, Rocket Lab recently announced the delivery of their first test rocket to the company's private launch facility. The rocket, Electron, is built in-house by the company and arrived at the company's launch facility on the Mahia Peninsula, New Zealand. Electron is expected to make a first test launch in the immediate future.

This development is definitely expected to inspire other launch firms and facilitators to develop their own manufacturing and launch programs. Rather than wait for a larger company or organization to position their satellite as one of the passengers on a larger payload, less grandiose launches are expected to revolutionize how the smallsats industry will gain market share in the future.

The global smallsats industry is on the cusp of revolutionizing space technologies. Through the introduction of compact, inexpensive smallsats that are targeted specifically for particular application areas, the market aims to make space technology more accessible to companies at a micro level. Expect an impressive growth spurt of smallsats to further develop this market—and at a global level.

alliedmarketresearch.com/

Mufassira is a content writer at Allied Analytics LLP. She holds a bachelor's degree in business management and has an active interest in the maneuverings of various industry verticals. Mufassira reads, researches and writes on a diverse range of topics that also include current ecological trends and developments.



The Electron launch vehicle. Photo is courtesy of Rocket Labs.

High G Vibration and SRS Shock Testing:

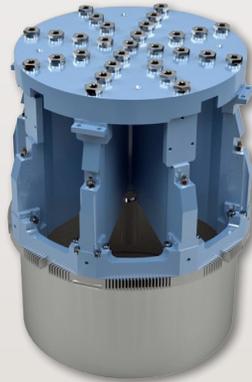
An Exporior Laboratories Perspective

By Phil Rogers and Gerrit Lane, Application and Project Engineers, Exporior Laboratories

Increasingly higher G levels required for vibration and SRS shock testing for aerospace and space customers is being experienced by Exporior Laboratories—presented here are test levels that the company has been able to routinely perform, using high performance Unholtz-Dickie T2000 Shakers and a state-of-the-art Kinetic Impact Pyroshock Simulation (KIPS) System.

Test Type	Max Test Level
Random Vibration (20 Hz - 2,000 Hz)	175 G rms
Sine Sweep Vibration (up to 2,000 Hz)	220 G pk
SRS Shaker Shock (100 Hz – 10 KHz)	5,000 G (SRS)
SRS Pyroshock Simulation (100 Hz – 10 KHz)	30,000 G (SRS)

The key to achieving these extreme vibration and shaker shock G-levels is the Model T2000 vibration system and its solid metal, inductively coupled armature. This unique Induct-A-Ring armature weighs only 110 lbs and can generate up to 25,000 lbs pk sine / 23,000 lbs rms random and 67,000 lbs pk shock force. It uses a solid metal coil with no winding on the moving armature, allowing it to be driven at extreme G values without coil failure.



This means that output current and voltage from the Power Amplifier in this resistive band are “in-phase”—generating high heat loads for the shaker armature cooling system. A conservative shaker cooling system is essential.

Also notice that the *Figure 1* PSD profile has reduced g^2/Hz demand in the 1,200 to – 2,000 Hz band where most electrodynamic shakers exhibit armature resonance. As a result, the full “resonant boost” from the shaker armature Fn that can be taken advantage of with a flat PSD profile is not as effective when running this highly sloped PSD profile.

To make up for the diminished armature Fn boost and to achieve the full 173.4 G rms level, the Vibration System must have a large KVA Power Amplifier to provide extra shaker armature drive.

No Band Splitting Needed

Exporior Laboratories runs this complete profile without band splitting. Most other test labs have to run the above PSD profile as a series of split frequency band tests, due to max g limits of their shaker and/or output current and voltage limits of their power amplifier.

The bottom line is this—for running high g-level, shaped vibration PSD’s without band splitting, you need a large Power Amplifier, rugged shaker armature design and maximum cooling system performance for successful testing. That’s why Exporior uses the T2000 Induct-A-Ring Shaker and companion 240 KVA Power Amplifier to handle high G, shaped PSD profiles.

The test shown in *Figure 2* is a demanding sine sweep at g-levels that exceed the max acceleration levels allowed by most electrodynamic shakers. The T2000 vibration systems at Exporior Laboratories can deliver this high level sine vibration performance based on the following combination of technical factors:

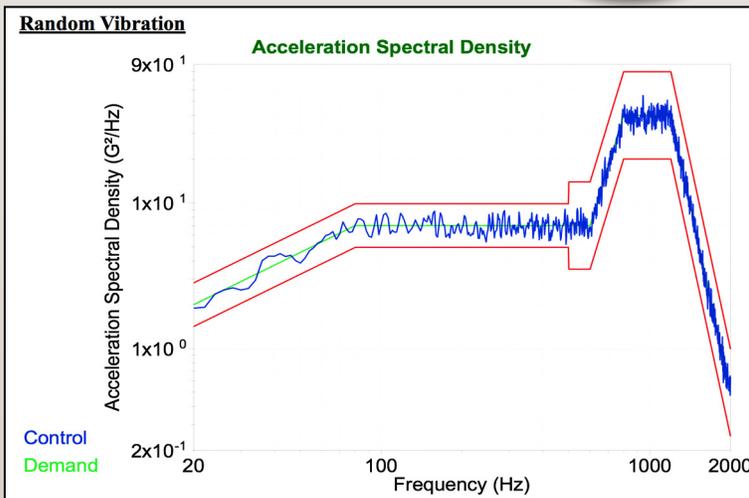


Figure 1. Random PSD @ 173.4 G rms with 40.0 g^2/Hz in mid-band.

The random vibration associated with a rocket launch is a brutal dynamic environment that often calls for highly shaped PSD profiles as seen in *Figure 1* above. The highly shaped PSD profile in *Figure 1* includes substantial g^2/Hz energy in a part of the test spectrum where the electrodynamic shaker armature exhibits “resistive” impedance.



Figure 2. Sine Sweep Vibration @ 167 g pk.

- A. Lightweight Armature: 110 lbs
- B. Sine Force Rating: 25,000 lbs pk
- C. Solid Metal Induct-A-Ring Armature (no driver coil windings)



This same T2000 Induct-A-Ring Shaker also has excellent low frequency performance, delivering up to *3-inch pk-pk displacement*, which allows sine testing in the low frequency range required by specifications such as wind milling vibration.

SRS Shaker Shock

Far Field SRS: Until recently, electrodynamic shakers have been limited to the category called “far field” SRS shock—with a maximum frequency range of 3,000 Hz. Far Field SRS tests performed with electrodynamic shakers at most test labs rarely exceed 1,000 g, due to Shaker and Power Amplifier limitations. This historically low ceiling for SRS shaker shock has been dramatically expanded by Exterior Laboratories using the company’s high performance T2000 Shakers. This major breakthrough in SRS shaker shock is linked to the following key factors:

- A. T2000 Shaker rated up to 600 g real-time armature acceleration (g vs. time)
- B. Ultra-High peak current and voltage outputs from the 240 KVA Power Amplifier
- C. Addition of a shock impedance mode inside the T2000 Shaker to maximize power transfer between the 240 KVA Amplifier and the T2000 Shaker for SRS profiles that demand high drive voltage at the armature input.

With these technical factors in play, SRS levels as high as 5,000 g have been achieved out to 10,000 Hz—see *Figure 3*—thereby substantially exceeding the Far Field SRS limits.

Mid Field SRS: Exterior Laboratories is now in a strong position to deliver SRS testing with its T2000 Shakers for Mid Field SRS Pyroshock specifications (out to 10 KHz) at previously unreachable g-levels.

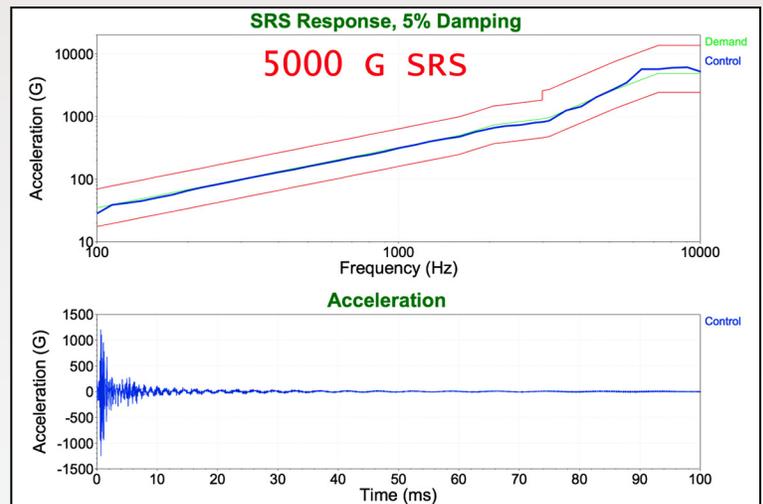
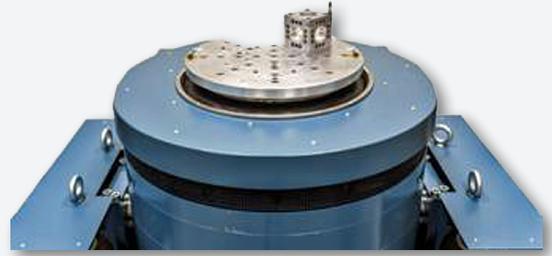


Figure 3. SRS Shaker Shock @ 5,000 g to 10 KHz.

Advantages of SRS Shaker Shock

Shaker shock is performed using a PC Controller with accelerometer feedback to lock in the SRS profile as measured at the control accelerometer location. Once the control equalization is completed at low level (typically at -20 dB), the SRS test is brought to full level without overshoot and within relatively tight tolerance bands over the entire frequency range.

The drive spectrum can then be memorized by the Controller so that all subsequent SRS shocks can be produced with essentially identical profiles.



SRS Pyroshock

Pyroshock testing simulates the high G, high frequency shock environment associated with pyrotechnic events, such as rocket stage separations. These are sometimes called "SRS Shock" tests, as they are specified with a Shock Response Spectrum (SRS) profile. This profile is a representation of the maximum predicted acceleration of a system across a range of assumed natural frequencies.

Exporior Laboratories' Kinetic Impact Pyroshock Simulation (KIPS) test system is able to simulate near- and mid-field Pyroshock, experienced by the parts closest to a pyrotechnic event, by using high speed impact to excite a tunable resonant beam. By adjusting the impact force, location, and damping, this platform allows for highly customizable shock generation. Pneumatic actuation of the system allows for quick setup and resets.

Adjustable resonance allows for an acceleration boost in only the desired frequency range. For shocks with a specified T_e (event duration), adjustable muzzle velocity, impact mass, and custom damping materials allow us to customize shock duration while meeting acceleration requirements.

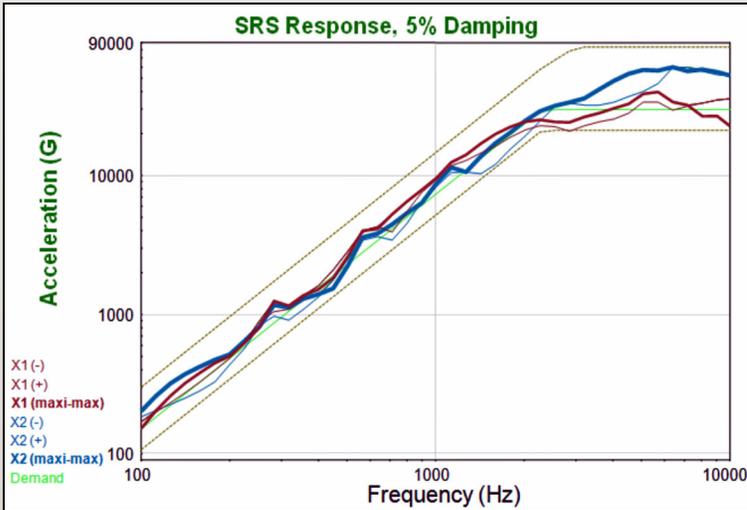


Figure 4. 30,000G Shock measured at two diametrically opposed accelerometer locations

The KIPS system offers short transients and a uniform shock input that can provide near-equal measurements at multiple fixture mounting points. The design, which has a net-zero displacement, ensures narrow differences between the positive and negative SRS Acceleration traces.

With the use of 3D simulation and frequency analysis software, Exporior Laboratories has designed a suite of custom shock platforms and fixtures tailored to each individual unit. Frequency analysis allows identification of mode shapes and resonant frequencies, which lets us prevent cross-axis acceleration and ensure that units are not over-tested.

exporiorlabs.com/

Phil Rogers joined Exporior Laboratories in 2014 as a Vibration and Shock Specialist after retiring from Unholtz-Dickie, where he worked as an Applications Engineer and Western Regional Sales Manager for more than 35 years. Phil's detailed knowledge of electrodynamic vibration systems and special testing techniques for achieving maximum vibration and shock performance from these systems is an asset that's now available to all of Exporior Labs' customers. He may be contacted at progers@exporiorlabs.com

Gerrit Lane joined the Exporior Laboratories dynamics test team in 2015 and has worked on development and implementation of the KIPS Pyroshock simulation system for use in high G SRS. He serves as a Project Engineer overseeing vibration and shock test programs and pursuing expansion of dynamic testing methods and capabilities. He may be contacted at glane@exporiorlabs.com.

OTT Watch: Are CDNs The New Satellite Platform?

A Vimond Media Perspective

By Miguel Silva, Chief Commercial Officer, Vimond Media



The influence of over-the-top (OTT) video has been so widespread that one wonders: What has it not changed

OTT has driven competition, consumer choice and new economic models across the media and entertainment landscape. For broadcasters, OTT has impacted operations, in particular, by supporting an alternative means of content distribution.

However, have content distribution networks (CDNs), on which OTT services depend, become the new satellite communications platforms? Industry analysts have been comparing broadcast and CDNs for several years. The variables, which include viewership, video format and costs, indicate that the two approaches bring their own efficiencies to bear in separate use cases.

The Rise of OTT

Before spelling out the differences, let's briefly review the rise of OTT. About a decade ago, Google acquired YouTube for \$1.65 billion. Soon thereafter, Netflix began giving its mail-order DVD subscribers the option of viewing video online.

Over time, this market matured. Netflix is now approaching an astonishing 100 million global subscribers and YouTube generates billions of views and dollars. Dozens of others, from Hulu to iFlix, also entered the fray.

Meanwhile, incumbent video providers began launching multi-screen and direct-to-consumer (DTC) offerings of their own. In some cases, they have even integrated OTT apps within their menus. Despite subscriber losses, many now view OTT as a core service.

From VOD to Linear

The first wave of OTT was almost entirely video-on-demand (VOD). But as operators and broadcasters launched their own services, live video services reappeared.

In some cases, these were just streamed events; in others, smaller versions of an existing lineup. Hulu, for instance, is finalizing deals for their own "skinny" live TV bundle. BSKyB's recently announced plan for a "dish-free" payTV service also falls into that category.



CDN vs.
Satellite





Key Factors

When assessing whether to deliver video via broadcast or CDN, content providers will want to keep several variables in mind, including:

Viewership.

Well-established channels or widely viewed events may never leave the transponder. New services and niche programming are better candidates for OTT delivery. This year, the CBS All Access service will feature a Good Wife spinoff and new Star Trek series. But distribution could change. The BBC's "Car Share" was shown online in 2013 before going to a channel; it was the broadcaster's first such series to follow that pattern.

Video format.

Whether video is in SD, HD, and UHD or 4k format impacts the business equation. Indeed, large amounts of UHD content today is cost-prohibitive. Compression reduces the impact, but mostly influences the ongoing deployment of HD. Just to be clear, however, media processing (one of our roles at Vimond) takes place prior to file distribution.

Multicast vs. Unicast.

Technology continues to evolve, and one innovation in recent years has been to leverage the advantages of multicast (one-to-many) communication within a standard unicast (one-to-one) IP transmission. Doing so can improve the efficiency of CDNs, making them more "broadcast-like" and responsive to the variabilities of linear video.

Cost structure.

CDN costs have plummeted over the past two decades, from many hundreds of dollars to fractions of pennies. In 2016, Streaming Media reported that commodity CDN pricing as low as \$0.0025 per GB delivered. Transponder costs have declined as well, with more efficiencies promised with high throughput satellites (HTS). But the primary cost factor is simply the fixed and variable distinction, as discussed above.

Reality Check

As a provider of technology for online TV brands, Vimond Media has an interest in the CDN side of this equation. However, the company's concern is that broadcasters and other service providers select the correct solutions.

In one internal study, Vimond Media found that Dutch broadcasters are collectively spending more than 219 million euros annually in CDN expenses for an average of three hours of OTT viewing per day. Our analysis indicates that viewership has grown to such an extent that many of these channels should "graduate" to lower-cost satellite broadcasting.

For satellite vs. CDN distribution, the bottom line is that larger channels with high viewership are less likely to be profitable on OTT; whereas niche channels are much more so.

Profitability matters. Selecting the correct distribution strategy can align a broadcaster more closely to that critical goal.

vimond.com/

Linear and on-demand, however, are two different creatures. This is where CDNs have made their mark.

When Netflix deploys new content, such as season two of Marvel's Daredevil which the service simultaneously released to 190 countries last year, they use their own CDN to pre-populate the files on appliances at Internet interconnection locations around the world.

Only the largest Internet companies — Apple, Amazon, Facebook, Google, etc. — have built out their own infrastructure. However, whether third-party or in-house, CDNs are how OTT on-demand video is distributed — linear is a somewhat different matter.

CDN vs. Satellite

Rightly configured, CDNs can deliver live linear. Major sporting events have been streamed for many years. This is where CDNs can compete with satellites.

Broadcasters pay a fixed price to lease satellite transponders. But they pay a variable price for CDN transport, based upon traffic measured in either Mbps or gigabytes (GB) delivered.

Thus, on the one hand, is a flat, horizontal cost; on the other, an upward-sloping cost curve that varies according to the number of viewers and amount of video.

Analysts have come up with several points at which CDN costs cross-over those for satellite delivery. In 2013, IHS published research indicating that CDN costs were greater than broadcast of SD at 5,000 simultaneous viewers, and greater than broadcast of HD at 3,000 viewers.

Last year, Ampere Analysis reported that OTT is always less expensive than satellite for a daily viewer base below 20,000 — their report held even if average viewing was five hours and all content was ultra-high definition (UHD). On the other hand, regardless of format or the amount of video watched, satellite feeds for a single channel or service were always cheaper for a viewership of 10 million.

That's a quite wide range — between 20,000 and 10 million viewers. How best to manage services within those parameters is the question.

Satellite Transponders Overview

An Insight Partners Executive Summary

Satellite transponders are the space-based sophisticated cluster of radio repeaters, integrated into telecommunication satellite.

Being a critical fragment of antenna system and microwave repeater, these transponders amplify single or multiple carriers received from the uplink (terrestrial transmitters to satellite receivers) on the downlink (satellite transmitter to terrestrial receiver) of a geostationary communication satellite.

These, satellites along with their cohorts in the same orbit, embrace bent-pipe repeaters or conventional type transponders that use Ku- and C-bands. These repeaters receive and transmit carrier waves frequencies as well as distribute them into separate transponders of a fixed bandwidth.

The market for satellite transponders is anticipated to grow in terms of coverage and capability as Ka- and Ku-band frequencies pertain to fuel the market growth; moreover, the rising number of subscriber updates and new subscribers are also expected to drive the global satellite transponders market. Furthermore, owing to the present technological advancements in satellite communications (SATCOM), several new applications of satellite transponders are expected to emerge. These satellites are accounted to be potent enough to compete against their rival — Digital Subscriber Line (DSL) broadband — in terms their performance.

The market for satellite transponders is highly influenced by the rising demand for high throughput satellites (HTS) and Fixed Satellite Services (FSS).

Satellite transponders are the critical constituent of fixed satellite services (FSS). These services coherently offer transponder leasing agreement, which is also the key service offered in terms of satellite transponders.

Going forward, FSS is predicted to remain relevant in the coming years and the expectation is they will remain a prime enabler for upcoming, advanced television services. As the market for FSS increases, the demand for satellite transponders is also anticipated to rise. As FSS operates primarily on the Ku- and Ka-bands, expansion in the bandwidth of these particular frequency bands would result in a significant rise in payload capacity of the satellites, which is further expected to generate more demand for communication satellite transponders.

Furthermore, escalating need for data communication and numerous launches of the latest HTS systems are anticipated to drive the satellite transponders market and to also escalate the consolidations in the value chain. HTS have signified growth over the past two years — approximately 20 new systems were ordered that included eight satellite expansions that were ordered by O3b. This is subsequently leading to a remarkable rise in the volume of leased HTS capacity, which is anticipated to cause a the growth surge within the satellite transponders market, thereby generating growth pockets for ecosystem vendors.

Expansion in the Ku-band applications to generate new opportunities for the communication satellite transponders market.

Live broadcasting and video distribution are seen as some of the major applications of Ku-band satellites, as they are also used for several data services that include: VSAT services, broadband connectivity, mobile backhaul, aeronautical, and maritime services. In this highly connected world, all of these applications are considered crucial for the success of a business concern.

In fact, Ku-band is the main spectrum used by mobility networks to deliver broadband connectivity in areas where terrestrial networks cannot reach, such as over the ocean and in the troposphere. The Ku-band currently captures approximately 40 percent of the market in terms of bandwidth.

The demand for Ku-band transponders is anticipated to rise, owing to the increasing demand for satellite TV, especially in developing economies. That is further supported by High Definition TV (HDTV) and demand for other, similar, bandwidth applications.

The evolution of 3DTV channels that consume higher bandwidth and require 50 percent more capacity is expected to offer additional thrust to the Ku-band satellite transponders market. Followed by Ku-band are the C-band transponders that presently hold the largest market share — the expectation is that a steady decrease in demand will occur for C-band during the forecast period as prominence is lost to the Ku- and other bandwidths.

North America will lead the global market by capturing more than 60 percent of the share of the market.

The US has experienced several developments over the past few years in terms of satellite launches. The US government is a major contributor to the growth of satellite transponders leasing revenue. Due to country's reducing dependency upon internally operated and owned satellites along with the nation's requirement to maintain network for information gathering and communication worldwide, the US is expected to continue to dominate the market.

The US military had purchased commercial satellite communication services for their own purposes; however, military officials are now in talks with the commercial industry as well as lawmakers to design and develop more new and more flexible agreements that would permit the military to purchase satellite services based on their situational demand.

These moves will also save the military money, all the while offering extended bandwidth whenever such is needed. These acquisitions may not continue to remain the noteworthy source of growth, because of the decline in SATCOM activities as related to the government & military over the past few years. Furthermore, one of the leading companies in the satellite industry is expected to launch a service that will provide redundancy to US Air Force Global Positioning System (GPS) satellites along with a private organization that will deliver location and timing signals via the Iridium 66 satellite rather than through the use of terrestrial terminals. This would make transfer of information far more secure.

Owing to the near approach of saturation in the North American market, South America and Middle East are expected to be the fastest growing markets for satellite transponders in the not-too-distant future.

Transponder leasing services to dominate the global service market

Over the past one to two years, the global satellite transponders market has witnessed approximately a 4.3 to 4.5 percent of rise in the demand for leased transponders. The project is that this will increase further due to the snowballing cost of transponders throughout the globe. Examining the leased transponders market, Europe is noted to be the costliest region in the world, followed by Australia and New Zealand. South Asia offers the lowest leasing rates, which is why Asia Pacific (APAC) is considered to be the most promising market for satellite transponders in the coming years.

The rise in the leasing of communication satellite transponders is highly dependent upon the adoption of HD video broadcasting as well as the widespread use of High Dynamic Range (HDR) Applications. Leasing services are expected to dynamically increase their market share; however, the fluctuations in transponder leasing costs will be highly dependent upon the future capital costs of satellite launches and maintenance.

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An Insightful IRG Event @ Intelsat

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



Once again, as the D.C. Satellite Show ended, our Satellite Interference Reduction Group (IRG) “gang” headed for Tyson’s Corner; however, instead of hitting the shops (much to Helen Weedon’s initial disappointment), we headed to Intelsat for our IRG workshop.

The D.C. show had been quite interesting and offered several amazing and interesting announcements. It is clear that satellite is changing and satellite operators are having to embrace other networks and business models.

This was acutely apparent with announcements from the likes of Blue Origin and Eutelsat. So, I kicked off our IRG workshop at Intelsat with the reflections of an old man, my take on the show, the industry and what we are doing incorrectly.



I attended a number of panel sessions throughout the week and even those where interference should have taken center stage, it didn’t. Inmarsat’s Mark Steel put it well when he commented that the industry just thinks it is being solved by the engineers, so there is nothing more to be done. Of course, we know that is simply not the case.

Trevor Willoughby of Intelsat posed the question as to whether some in the industry have been doing the same old thing, the same old way, for far too long. Although innovation is now happening on a larger scale, he commented that the industry has only just woken up. He backed his comment up with the fact that the new Epic series of satellites have interference mitigation technology already on board.

That said, we then moved onto hear about companies who are innovating within the interference reduction realm, including Andy Lucas of Comtech EF Data who discussed emerging ecosystems. Roger Franklin at Crystal told us why we need to automate to effectively reduce satellite interference and Alvaro Sanchez of Integrasys further backed that story up, talking about the implications of not maintaining and automating VSAT systems.

Clever flat panel technology was discussed by David Garood of Phasor. With Communications-On-The-Move (COTM), my concern is always that people not trained in satellite equipment can all-too-easily cause interference. David commented that Phasor antennas won’t transmit until the unit locates a satellite, which is then verified when demodulated. The antenna does use what I like to call a “proper” tracking system (who remembers monopulse?), which I find reassuring; however, we shouldn’t forget that things can and will go wrong, so we need to ensure things are in place to resolve issues as soon as they occur.

I wrapped up day one by reminding everyone that it is clear that the dynamic within this industry is changing and we need to be proactive if we want to resolve interference. That means better tools and solutions, along with automation.

Day 2 kicked off with good old Carrier ID as the cause célèbre and with a plea to the manufacturers to ship equipment with CID turned on by default.

Moving on, we asked what is today’s interference technology puzzle and there are actually numerous pieces that need to fit together to make a real difference. That includes Carrier ID as well as VSAT tools, and “Just Data.” I used that term, as I think “Big Data” is somewhat misunderstood and overused, but in reality, it is just data, followed by the means to process that information.

As with day 1, the next important part was to launch into the actual tools that are making a difference. That was kicked off by Bob Potter of Kratos who told us about SatGuard, which has quite frankly revolutionized VSAT interference identification and resolution.

From there, we moved on to a different type of geolocation with Erwin Greilinger of Siemens Convergence Creators who presented SIECAMS. He discussed some of the constraints of traditional geolocation systems and how the SIECAMS single satellite solution overcomes those constraints.

Thierry Balanche of Zodiac Aerospace gave us a highly visual presentation of the different cogs that connect together to help us solve interference, similar to the puzzle analogy. We need the engineers and manufacturers to build the various cogs that can work together for the greater good of the industry.

This was followed by an update from Mark Rawlins of the Space Data Association and Dan Oltrogge of Analytical Graphics Inc. about the upgrades to the Space Data Center (SDC). Earlier that week, SDA and AGI announced a longterm agreement to launch an upgraded SDC Space Traffic Management service. As well as a highly accurate, independently generated catalog of space objects, it also features a number of features to combat interference. This includes the construction of geolocation scenarios and a Carrier ID database.

Having introduced the topic of data, we dove deeper into data, machine learning and cognitive computing. Buzz Merrill started with the very, seemingly, simple question: "Do cats drink milk?"

Of course, you and I know the answer to that, but the computer needs to understand what cats are, what milk is... even what "drink" means. Once the computer can put together all of that information and use existing material to evaluate and learn, it can come back with the answer.

Buzz noted that big data by itself is not intelligent and doesn't learn. However, the more information we put in, the more the systems can be trained and learn deliver resolutions. In the interference world, that is all about putting in information around real life cases and scenarios so that similar cases can be resolved much more quickly by learning from past cases. The key thing here is not to replace the humans, but to help the humans.

Following a lengthy discussion about data, SES' Steve Smith highlighted a number of current industry trends:

- *ASI is a large contributor to the RFI environment, accounting for around 50 percent of interference cases.*
- *Mobility services are increasingly contributing to RFI*
- *VSAT networks are continuing to grow*
- *There is an expanding range of communication service types and products*
- *With a range of LEO, MEO, and GEO orbits using shared bands, it is becoming increasingly difficult to identify short term disruptions.*
- *HTS multi-spot beams may reduce, or may contribute to RFI – we will have to wait and see.*

- *Operational teams need a range of skills due to the variety of services.*

These are naturally all leading to further complicating the life of a satellite operator engineering teams, and especially those at the front end of dealing with interference events.

On a technology front, traditional monitoring will be the solution for most of these issues. At the same time, working with other operators will be key to solving these.

This is where organizations such as the SDA come in, enabling RFI data sharing. Steve also posed an important question as to where the IRG and SDA fit in. In his mind, and I agree, IRG is the forum for raising the issues, identifying the problems, and discussing with the different stakeholders. Once the problem is identified, there is a role for organizations such as the SDA to handle the operational services. He closed his presentation by commenting that we need to promote the benefits of both the IRG and SDA globally to encourage more participation. Also, all operators should be talking to one another.

As you can tell, this event was yet again a packed couple of days with some great discussion points. Toward the end of October, the IRG will have the annual workshop in Brighton, UK. Please book the dates in your diary — October 25 and 26 — and get in touch with IRG if you have an interesting topic to share at press@satirg.org.

satirg.org/

intelsat.com/

Martin Coleman is the Executive Director of the Satellite Interference Reduction Group (IRG). Martin is responsible for spearheading a number of significant initiatives and is committed to introducing new technology and processes to mitigate all types of satellite interference: VSAT TDMA Systems, BIG Data; a reference guide to Interference; sorting out those Difficult Cases including new standards and processes within the Geolocation industry; assisting the ITU in dealing with Harmful Interference; and implementing Carrier ID (CID). Martin regularly addresses the industry on the subject of satellite interference, at global industry events, on an individual basis, and at IRG-led conferences and webinars.

The Benefits Of An Open-Source Google Earth

A Thermopylae Sciences and Technology Perspective

By Joseph Vetere, GIS Engineer, Thermopylae Sciences and Technology (TST)

You may well ask, “What does an open sourced Google Earth Enterprise product mean for me and how can I benefit from it?”

Anyone in the satellite imagery and remote sensing community should have a finger on the pulse of Google Earth and be aware of the vast capabilities offered by Google’s Earth Enterprise suite of software. Google Earth Enterprise (GEE) is a classic, well-rooted product offering from Google and has been strongly supported for the past decade.

GEE allows users of geospatial data, including imagery, terrain and vector data, to bring the awesome capabilities of Google Earth to bear on their unique business needs, and for hosting custom globes within private or offline networks. The GEE suite includes software for creating and hosting fit-for-purpose Google Earth globes on powerful hardware platforms.

Far beyond the small, niche population of geospatial users and hobbyists, Google Earth is widely used by all types of people who are curious about exploring the world. From majestic mountain peaks, to the ocean deep, across sweeping plains and urban landscapes, Google Earth is a powerful platform for quickly and easily exploring the world around us.

We can all regale in the moment we first zoomed-in to our home address and exclaiming, “Look! I was rafting in my swimming pool when the satellite flew over!” It doesn’t take a lover of GIS and remote sensing to delight in the wonders of Google Earth.

The awesome power of Google Earth Enterprise, however, opens up new ways to utilize this capability. GEE lets users create their own globes, loaded with specific data of unique relevance, for hosting within their own network environments. (Or even beyond the confines of a network entirely; see “GEE Portable”)

“What? You’re telling me I can create my own Google Earth globe?!” Yes. And this technology has been widely used by non-profits, Fortune 500 firms, and federal governments for nearly ten years. GEE is not an undertaking for the faint of heart. Formerly, a GEE Globe covering any geographic area larger than a small city required an investment in time, processing power, and data storage space, in addition to software licensing costs. However, such an investment yields the speed and quickness experienced by the end-users of Google Earth that has made it so wildly popular and fun to

use. How can a user sweep the mouse across an entire continent—rather, PC monitor—and see thousands of square miles of imagery and data race across their screen?

Everything rendered in Google Earth are tiles, tiny square images that have been created (“fused”) by GEE Fusion ahead of time, then stored and hosted on the GEE Server platform, and finally streamed to the end-user. Embedded tools like the Google Maps JavaScript API V3 are the efficient methods Google utilizes to serve their geospatial data to millions of users every day. GEE users are harnessing the same technology that Google utilizes to deliver their public-facing Globe and Map products.

The power of GEE Fusion is incredible. Fusion, the Linux-based tool that features both a GUI and command-line utility to create globes, is the mighty engine behind Google Earth and Maps in the GEE suite. Users can import raw GIS data into Fusion in familiar vector, imagery (raster), and terrain formats. And this is where the magic begins.

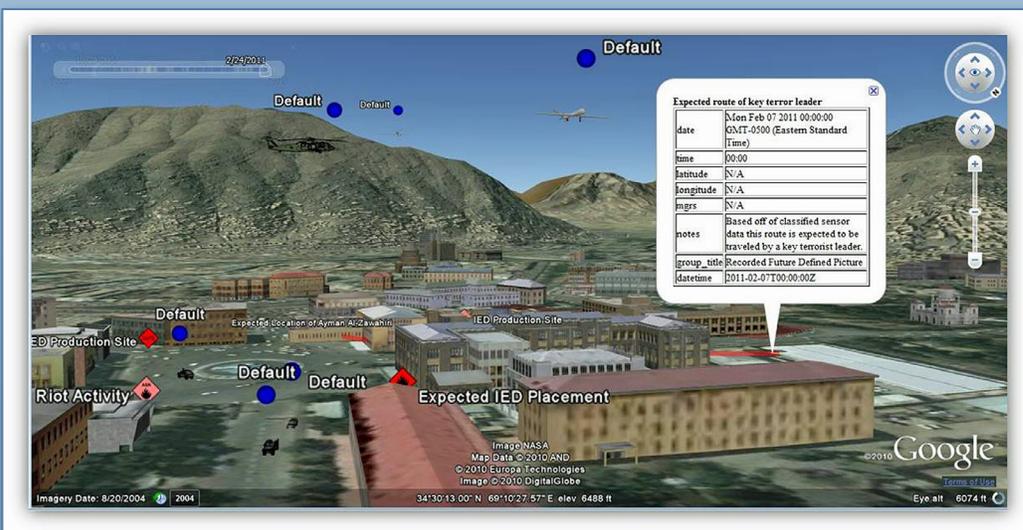
People relatively familiar with Google Earth know that the software renders imagery based on zoom level—the altitude relative to Earth’s surface from which the user is viewing the geospatial data. During Fusion processing, the software will first combine imagery, terrain, and vector resources together, and continue to perform this operation for 22 different zoom levels supported by GEE. Fusion will rasterize vector resources and “draw” its features onto the imagery, which may be “draped” over terrain data. Finally, Fusion interpolates the data, pixel by pixel, to create the various resolutions of imagery for all the zoom levels, yielding very high-resolution image tiles at higher zoom levels (nearer to ground level), and more generalized, lower-resolution image tiles at lower zoom levels (higher altitude).

The storage space required to store this data increases exponentially depending on the resolution of the data and the size of the geographic area. At lower zoom levels, the globe may be represented with just a few dozen image tiles. At the higher zoom levels, when the user is looking at higher-resolution data, Fusion may have created millions of image tiles to provide coverage for the area. Once all the geospatial data is fused together, the completed globe (“database”) is pushed to the GEE Server to be accessed by end-users. Globes are accessed by commercial-off-the-

shelf (COTS) web browsers running the Google Earth Plug-in or via the installed Google Earth Enterprise Client (EC) desktop application.

Historically, there were high barriers-of-entry for industries and firms that realized the value of Google Earth Enterprise. Investing in the software suite to display broad areas of the world required a great deal of computer processing power, storage space, licensing costs and support fees, as well as the high-skilled human capital to administer the hardware and operate the software.

However, thousands of users world-wide took the plunge and invested in GEE and the results were astounding. Firms were able to create and host their own Google Earth globes, outfitted with their own data, serving their own customers and end-users. Organizations filled the globes with super high-resolution imagery



A customized instance of GEE shows 3D models, data feeds/metadata, and temporal capabilities to produce a 4-dimensional view over satellite imagery.

and served it to users who were already familiar with the Google Earth desktop application.

Companies loaded their globes with demographic data and retail points of interest (POIs) to study customers, then point them directly to their nearest store. And first responders, early on the scene after natural disasters like the 2010 earthquake in Haiti, fed life-saving data to their GEE servers back home and created globes that enabled the easy sharing of critical, time-sensitive information.

One could only imagine the panic that ensued when the Google Maps product team announced that the GEE software would be deprecated in 2017. Users were left in a lurch. There are still minimal alternative options in the GIS marketplace for a technology offering that delivers the power of the GEE suite with full feature parity and the intuitive look and feel of the Google Earth experience.

While these alternatives are on the market, the speed, flexibility, and familiarity of Google Earth still holds a special place in many people's minds—not to mention companies like ours at Thermopylae Sciences & Technology (TST) that extended the Google Earth platform to power our own software application iSpatial.

The announcement that came out of a long-quiet Google in the beginning of 2017 couldn't have been better: GEE was to be open-sourced.

Finally, with the open source announcement, millions of end-users who depended on its power would not be left in the dark or empty-handed. Power players in the GEE community can now get their hands on the source code that powers it all and develop beyond what Google has created.

The GEE suite can now be customized even further. New features based on evolving user-requirements (and new users) can be developed, and engineers with ties to GEE can provide support for bug fixes, and keep up with the ever-evolving cyber security risks by closing vulnerabilities. The code will be widely accessible on the popular open-source GitHub platform, leveraging the creativity (and generosity) of the global community of open-source developers. TST engineers are focused on readying the current codebase for GitHub, and subsequently shifting support to work with partners on the future of the stack.

The fun doesn't stop there. Naturally, Google found a way to give GEE a fresh "coat of paint" and a new track on the way out the door.

Enter Google Cloud Platform (GCP)—a highly-scalable cloud computing environment. Gone are the days of standing up massive GEE Fusion grids; racks and racks of processors and hard drives (and associated manpower)

are no longer necessary. GCP provides virtualized cloud computing, where customers can create virtual machines running a Linux-based operating system (Ubuntu, in the case of GCP and GEE) with hardware configurations to match their processing power and storage needs.

While GEE Fusion's hardware system requirements for basic installations are relatively minimal, creating a Google Earth globe covering any reasonably-sized geographic area requires significant processing power and hard drive space. Taking advantage of GCP allows users to stand-up Fusion environments with substantial hardware specs while working to create a new globe (or modifying an existing one), and can subsequently shut the system down when Fusion processing is complete.

Google's library of high resolution imagery is also available on the GCP cloud, so now the rich content and processing power are sitting right next to each other. Engineers who have built petabytes worth of globes in the past universally recognize this cloud Fusion process will dramatically decrease build times, and more easily allow for on-demand globes wherever and whenever they are needed. Moreover, GCP bills daily based on hardware utilization, so customers aren't charged when the virtual machines are not running.

While cloud computing is not new on the scene, another offering by the Google Maps Team is in the mix that adds value for users who choose to leverage GCP to power their GEE environment: Google Earth Engine (GE Engine). GE Engine combines the power of GEE with petabytes of geographic data spanning the globe. Everything from historic NOAA weather data, SRTM terrain data, and data as simple as international political boundaries are offered by GE Engine. Leveraging the power of GE Engine, GCP, and GEE reduces the amount of required storage space, bandwidth, and processing power, as users are taking advantage of Google hardware, software, and information that are already connected via the same fiber network.

For customers looking to save time and money, Google remains a one-stop shop for efficient and powerful geographic data management, analysis, and dissemination. Couple these enterprise-level solutions from Google with an open sourced GEE, and users have flexibility like never before.

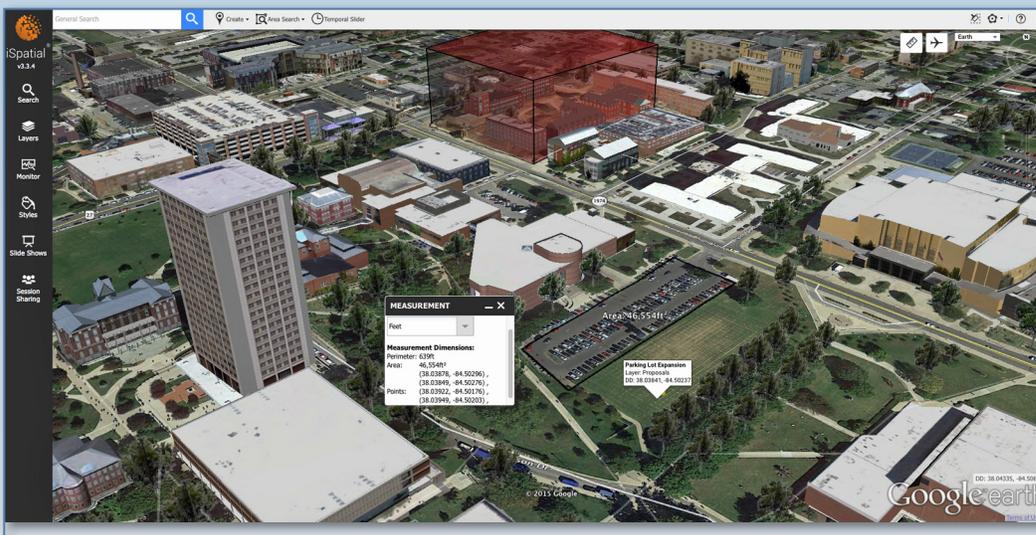
There might be a perception that it is difficult for some users of GEE, even those who have successfully used the software for years, to put these various and complex puzzle pieces together — especially considering that the software has evolved from before.

Again, this is yet another case of the opposite holding true... diverse

and innovative teams of engineers are available to address all aspects of the GEE software and how it can be implemented in nearly any environment. These engineers are available to be called upon to answer the tough questions, pair up users with a custom solution that fits their exact needs - in terms of hardware, software, and support - and leverage their years of experience and expertise to deliver exact solutions - while reducing costs, overhead burden and time spent.

t-sciences.com/

Mr. Joseph Vetere, GIS Engineer with Thermopylae Sciences & Technology (TST). Mr. Vetere has more than seven years of experience supporting Google Earth and GIS-based initiatives with TST, primarily serving US Government and Military customers. Mr. Vetere is helping customers in these sectors transition to the new, open-sourced Google Earth Enterprise platform.



GEE enhancements like TST's iSpatial framework offer advanced capabilities over GEE including drawing tools, data integration, sharing, and other often-requested features.

By SatCom Frontier Editors, courtesy of Intelsat General

The commercial space industry is on the cusp of a new era in satellite performance. In the past two years, multiple commercial satellite operators have begun launching high-throughput satellite (HTS) constellations.

These next-generation satellites will be able to provide far more throughput than existing wideband satellites, with increases in throughput of up to 400 percent.

HTS will enhance the end user experience much like the terrestrial move from dial-up to broadband access. The United States government could greatly benefit from HTS, but not all HTS is created equal. Different satellite operators are taking different approaches to HTS. That's why it's important to look at the differences and what they mean for the end user experience.

On the following page is a comparison of four announced HTS providers based on publicly available information. As you can readily see, providers are making different decisions regarding HTS coverage areas, and the band over which to supply connectivity. There are also substantial differences in performance.

Intelsat Epic^{NG} leads in many areas by a wide margin because it incorporates multiple smaller spot-beams with high frequency re-use. This design delivers performance, coverage footprints, and connectivity efficiency unmatched on any other HTS platform.

Performance on an Epic^{NG} satellite is improved in bits per second per Hertz as well as in the aggregate MHz available and the geographic area covered. Epic^{NG} complements Intelsat's existing global widebeam coverage areas, providing satellite bandwidth anywhere on the globe.

Space News published a lengthy interview with IGC President Skot Butler late last year. He spoke about the DoD's appetite for the increased performance Intelsat Epic^{NG} can deliver:

"Given the escalating bandwidth demands of governments around the world, we designed Intelsat Epic^{NG} with our customers' needs front and center," said Butler. *"Our design goal, focusing on efficiency and thus optimizing the throughput to the individual network users, has delivered immediate performance upgrades. Intelsat customers in the enterprise,*



HTS Capacity Comparison

	Viasat	Inmarsat	SES	Intelsat
Launch Timing	Viasat-1: 2011 Viasat-2: 2Q2017 Viasat-3: 2019 – 2021	Inmarsat-5: 3Q2013 – 4Q2017 (global HTS coverage since 4Q2015) Inmarsat-6: 2020 – 2021	SES-12, SES-14, SES-15: 2Q2017 – 4Q2017	IS-29E, IS-32e, IS-33e, IS-35e, IS-37e, Horizons 3e 1Q2016 – 3Q2018
Global Coverage by:	2021	4Q 2015	4Q2017	2018
HTS Coverage Gaps once “global”	TBD	None	Africa Australia Parts of Russia/Europe Transpacific	Southern Atlantic Ocean Indian Ocean Southeast Pacific Ocean
HTS Coverage as of Today	CONUS	Global	None	North- and South America North Atlantic Europe; Africa; Asia
Frequency	Ka-Band	Ka-Band L-Band S-Band	Ku-Band	Ku-Band C-Band
Target Markets	Consumer Broadband, Aero, Enterprise, Government	Aero, Maritime, Enterprise, Milsatcom	Aero, Maritime, Enterprise, Government	Aero, Maritime, Enterprise, Government

mobility and wireless infrastructure sectors are using Intelsat EpicNG, in most cases with existing hardware, transitioning seamlessly onto our high performance network. In the same way, EpicNG will support IGC customers as they leverage HTS to deliver high-bandwidth applications to smaller antennas and achieve greater overall network resiliency.”

Intelsat Epic^{NG} offers the government customer more benefits than simply faster throughput. Currently, more than 80 percent of military satellite communications is delivered via Ku-band.

Intelsat Epic^{NG} offers Ku-band and uses an open architecture design for HTS. This means that Intelsat Epic^{NG} can be used immediately by existing customers without any additional investments in their existing antennas or infrastructure.

By contrast, some upcoming HTS platforms are closed architectures, which means they dictate to the end user which terminals and teleport locations must be used. As Intelsat Epic^{NG} is an open system, it allows the military to purchase dedicated capacity for a specific terminal or group of terminals.

In addition, the throughput of that capacity is dedicated and available to only that user’s terminals. As such, maximum throughput capabilities can be guaranteed.

The ability to leverage current ground equipment, provision targeted bandwidth and have enforceable SLAs means that Intelsat Epic^{NG} delivers substantial cost savings for the government while maintaining an enormous amount of flexibility.

Delivering HTS performance to smaller and smaller antennas opens up a whole range of non-military uses as well. Small UAS could be used by federal, state and local government officials across a range of applications, including search and rescue, infrastructure monitoring, anti-poaching operations, forest fire suppression and agricultural monitoring. HTS can power a range of new capabilities for government agencies in need of real-time, actionable intelligence.

HTS systems offer quantum leaps forward from the satellite communications of today, but users need to look underneath the hood. Intelsat Epic^{NG} was designed to take full advantage of this next-generation in space-based communications while maximizing Users’ continued use of existing investments

Intelsat Epic^{NG} provides the most compelling value proposition for government customers, and will play a large role in keeping the United States ahead of potential adversaries in space.

The preceding article is courtesy of Intelsat General’s SatCom Frontier infosite and their editorial team.

intelsatgeneral.com/

Antennas for Systems and Devices: Technologies and Global Markets

A BCC Research Executive Summary

By Shalini Ramamurthy, Analyst, BCC Research

The motif behind antenna market evolution in the next five years is likely to be the Internet of Things (IoT).

IoT is not a new construct. IoT is a smart encapsulation of a series of technological developments associated with machine-to-machine (M2M) communications. IoT spawns cellular and non-cellular waveforms. Consequently, stakeholders have been speculating that the next billion cellular subscribers are more likely to be machines with sensors and antennas. Contribution of non-cellular waveforms is likely to be in order of several multiples to that of cellular waveforms.

The BCC Research report adequately captures the smart re-branding practiced by antenna vendors to associate themselves with IoT.

Smart antennas continue to provide the bulk of the technological impetus that will leave a lasting impact on the antenna industry. As the industry waits for 5G, antenna vendors are busy perfecting the adoption of smart antenna constructs across power values, operating distances and frequency ranges.

At the heart of all these exciting developments is the uncomplicated antenna — an integral component of the radio. The operating principle of antennas is quite simple: conversion between electrical energy and radiation.

The simplicity of this principle has relegated antennas to the periphery of the active and innovative telecommunications research domain. For close to a century after antennas were invented, antenna technology was in the slow lane of evolution while other components, such as basebands, modems, codecs and processors, among others, witnessed frantic development that led to superior performance.

The evolution of cellular telephony with quantum increases in data transfer carrying abilities with every progressive generation has injected acceleration in antenna innovation, as evidenced by the cresting of patent activity around

2014. Cellular mobile devices forced the industry to concentrate on form factor and power management apart from performance.

These considerations amplified the research thrust on antennas as they had to conform to the limitations regarding form factor and power management. Wireless sensors are a progression of this approach wherein power management and form factor attain greater criticality.

Market dynamic of antennas does not depend on technology underpinnings alone. Antennas are staggering in the diversity of frequencies served, material employed, forms assumed, power managed and range covered.

End applications play a defining role in finalizing antenna specifications and pricing. The vast device-base that employs antennas has resulted in an extremely fragmented market with literally thousands of vendors.

Purposeful innovation requires capital and those with deep pockets are often in the custody of the end-device makers themselves. It is not surprising to witness original equipment manufacturers (OEMs) engaged actively in antenna research and development. The health of the antenna market is the closest to being a microcosm for the global economic health.

It is noteworthy that smart antennas are imparting independence to the antenna market dynamic and loosening the grip of end application dynamic on the prospects of the antenna market. The multiplicity of influencing factors and the disorganized nature of players involved make it challenging to render a snapshot of the antenna market. This BCC Research report attempts to capture the essence of this simple, but diversely employed, component.

This study's goals and objectives include the following activities regarding antennas:



- Forecast the market size in terms of dollars and unit sales
- Classify the market size by key classification criteria in terms of dollars and unit sales
- Classify the market size by antenna technology in terms of dollars and unit sales
- Classify the market size by material in terms of dollars and unit sales
- Classify the market size by end application in terms of dollars and unit sales
- Classify the market size by geographical regions in terms of dollars and unit sales
- Classify the market size in individual end applications by antenna technology in terms of dollars and unit sales
- Classify the market size in individual end applications by material in terms of dollars and unit sales
- Classify the market size in individual end applications by geographical regions in terms of dollars and unit sales
- Highlight the roles played by major stakeholders and players
- Provide an overview of the activities of influential companies
- Examine crucial, innovative breakthroughs by means of a detailed patent analysis

This BCC Research report is the fourth offering in its series. Its predecessor, IFT073C, was released in September of 2014. The reasons for covering this market remain largely the same — the simplicity of antennas makes them adaptable. Their adaptability has spawned a multitude of use-cases across verticals and applications. Subsequently, antennas have had to attain a formidable diversity in terms of operating technology.

Antennas are available in different shapes and sizes, and support a large range of power operations. This diversity is unmatched among other radio components. The diversity in technologies, end applications, and materials also make antennas a challenging market to cover and forecast.

While most market studies cover specific aspects of the antenna market based on technology employed or end application catered, it is important to present a unified, comprehensive picture covering all mainstream antenna technologies and markets.

This report achieves this objective and also highlights the role played by innovation through a comprehensive patent analysis and uncovers the close correlation between OEMs employing antennas and antenna research and technology.

The market for smart antennas is quantified in this report—considered as the single most important innovation of the decade. It also places in context the role played by wireless sensors in shaping the antenna market

Examined is the antenna market under the following key parameters:

- Antenna technologies
- Materials
- End applications
- Regional dynamics
- Key markets within countries
- Changes in average selling prices (ASPs)

SCOPE of the Report

This report presents the forecasts for antennas for 2016 through 2021 on a volume and value basis. Sales values are presented in US dollars, while shipment volumes are presented in million units. These forecasts are further broken down by antenna technology, antenna material, end application and geographical region.

The following antenna technologies are covered:

- Flat panel/short-range antenna.
- Patch, miniature, embedded and other low power antenna.
- Fractal antenna.
- Medium gain antenna.
- High gain reflector antenna.
- Smart antenna.

Breakdown of materials includes:

- Metallic
- Others

Breakdown by end applications includes:

- Aviation
- Telematics
- Television (TV)/radio infrastructure and user equipment
- Satellite communication infrastructure (barring terrestrial and marine components)
- Mobile phones
- Wireless telecommunications infrastructure
- Computing applications
- Medical applications
- Defense and Surveillance applications
- Residential/industrial/commercial premises and user devices

The regional breakdown focuses on the following geographical areas:

- The Americas
- Europe, the Middle East and Africa (EMEA)
- Asia-Pacific (APAC)

The Global Markets for Antennas

Breakdown by Technologies, Material, and End applications chapter introduces the antenna with key concepts central to understanding its functioning. It also introduces IoT and explains its impact on the prospects of antennas.

The report then analyzes the different classification criteria: technologies, materials, geographical regions and verticals. In conclusion, it provides a snapshot of the end-user application sector classification.

The End Application

Specific Analysis chapter breaks down the antenna market for each of the end applications along antenna technologies, antenna materials, and geographical regions. The chapter will thus provide the reader with an in-depth view of the dynamics of individual end applications vis-à-vis antenna prospects.

The Major Participants

The main actors in the antenna industry chapter identifies the major categories of stakeholders involved in the development and commercialization of antenna technology.

The US Patent Analysis

This chapter covers innovations that impact antenna systems. Patents are categorized by applications and technology as well as on the basis of allocation by year, assignee countries and assignee organizations.

The report should be of value to the following industry players:

- Original equipment manufacturers (OEMs) and contract manufacturers of antenna systems and components in identifying the size and regional distribution of the antenna market.
- OEMs of products that embed antennas in understanding the technology and material pricing trends for antennas in their sector.
- Service providers and network designers in knowing the prospects of specific antennas in their domain.
- Semiconductor device makers.
- Wireless chipset makers.
- End users and distributors.
- Academic and research institutions.
- Financial institutions.

Both primary and secondary research methodologies were used in preparing this report. BCC Research presents an analysis across the global market for antennas based on reported revenue dollars and units shipped, at the manufacturer level. Also analyzed was the data gathered from various research sources via the Internet. Interviews were conducted with well-placed industry sources.

SUMMARY TABLE

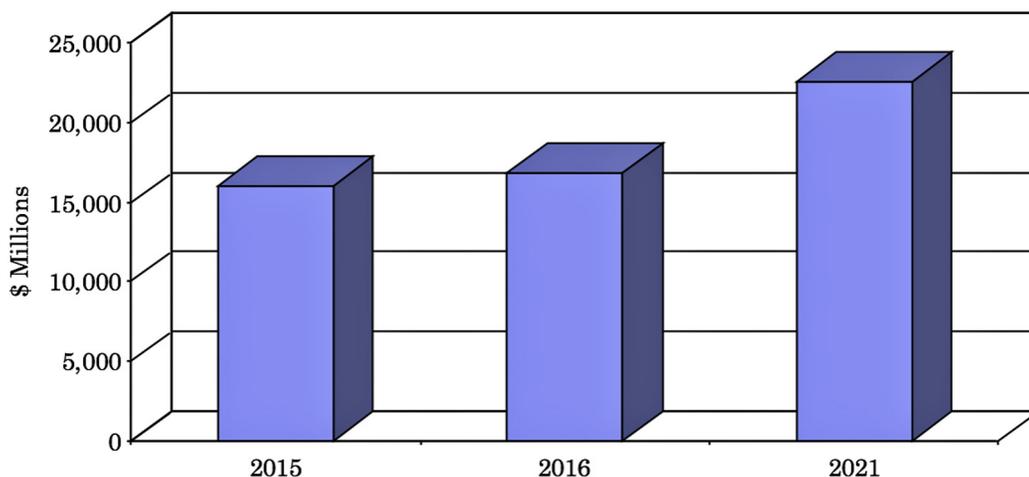
**GLOBAL ANTENNA MARKET, THROUGH 2021
(\$ MILLIONS/MILLION UNITS)**

Antenna Market	2015	2016	2021	CAGR% 2016–2021
Global market (\$ millions)	15,990.0	16,834.0	22,502.0	6.0
Global shipments (million units)	15,845.8	17,795.6	32,296.9	12.7

Source: BCC Research

SUMMARY FIGURE

**GLOBAL ANTENNA MARKET, 2015–2021
(\$ MILLIONS)**



Source: BCC Research

Report Update

The report is an updated edition of IFT073C that was published in September of 2014.

BCC Research forecasts that the CAGR for 2016 to 2021 will be slightly more than 2014 to 2019 (6.0 percent versus 5.7 percent) on the dollar sales front; and slightly less on the shipment sales front (12.7 percent versus 12.9 percent). The contradictory movements on dollar and shipment sales point towards a firming of prices triggered by maturing of the markets.

The firming of prices will be facilitated by the industry’s increasing awareness to the impact of the Internet of Things (IoT), and smart antennas. Indeed, the industry is witnessing a rush of sorts among antenna vendors to brand themselves as IoT-enablers wherever feasible.

While IoT cannot be ascribed to a single path breaking development and is, in reality, a series of progressive improvements in inter-machine communications; the phrase has caught the industry imagination. One

cannot blame antenna vendors to highlight their rightful role in enabling communication among low power sensors. Smart antennas have matured and are increasingly acquiring mainstream status.

On the macroeconomic front, there is not much to cheer as compared to 2014, apart from the fact that the Indian economy has registered impressive GDP growth. China is poised to stabilize at a marginally lower growth rate (between 6 percent and 7 percent) than what was witnessed over the last decade.

The state of the antenna market depends largely on the health of its respective end application markets. Antennas are relatively consistent in their functioning with simple operating principles. Consequently, the dynamics of the end application markets are the deciding factors in the growth of antenna sales. As always, predictably, shipments will grow faster than dollar sales. The faster growth can be attributed largely to sizable erosion in average selling prices across the board, in part due to the IoT.

www.bccresearch.com/

The following sources have been referenced:

- *Primary research, including interviews with experts from companies operating in the handset and waveform domains*
- *Published industry data*
- *Shipment reports of unlisted companies.*
- *10-K reports*

Related BCC research reports

IFT062A Mobile Telematics: Global Markets and Technologies

SAS011C Global Mobile Positioning Technology: Commercial, Military, Homeland Defense

IFT068A Global Markets for Smartphones and PDAs

TRN001F 2012 Intelligent Highway Review

DISCLAIMER

The information developed in this report is intended to be as reliable as possible at the time of publication and is of a professional nature. This information does not constitute managerial, legal or accounting advice, nor should it be considered as a corporate policy guide, laboratory manual or an endorsement of any product, as much of the information is speculative in nature. BCC Research and the author assume no responsibility for any loss or damage that might result from reliance on the reported information or from its use.

Shalini Ramamurthy has an extensive experience in analyzing and evaluating advanced information technology including telecommunications and optical networks. She holds a Bachelor of Engineering degree in Electronics and Telecommunications from Kumaraguru College of Technology in Coimbatore, India, as well as a Master of Science degree in Telecommunications and Software Engineering from the Illinois Institute of Technology in Chicago.

BCC Research is a publisher of technology market research reports and is based in Wellesley, Massachusetts.

Rugged Tablet, Meet Satellite Radio

By Bob Ashenbreener, President, Durable Mobility Technologies, LLC

How often have you heard a rugged computer manufacturer talk about how “far” their technologies will go to keep your field-based workers connected and productive – often showcasing the PC’s ability to reach the ends of the Earth and beyond? And how many times have you been skeptical of such claims? Probably more often than anyone would like to admit, right? I get it.

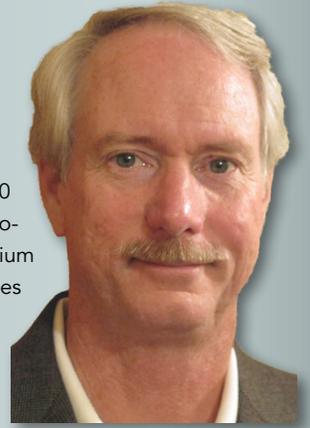
Even the most rugged laptop — built to withstand arctic temperatures or the pressures of high-altitude travel — has limitations. Off-the-grid communications limitations specifically, in that they’ll never capture a signal if they can’t find a 3G/4G network.

Oftentimes, even though you still bring these environmentally hardened rugged computers with you into the field for emergency response calls, pipeline inspections, and other specialized data collection tasks, you just accept that it’s a “file now, transmit later” tool, right? That is until you’re back in network range and you don’t have access to data, for dispatch or reporting. Maybe in the most extreme cases, you’ll rely on a satellite phone to maintain real-time, voice communications.

Well, here’s some great — no, Earth-encompassing — news for you! CLS America has introduced a legitimate “off-grid” PC working in partnership with Xplore.

Working closely with field-based professionals, such as maritime and wildlife authorities, the military, law enforcement leaders, and even expeditionary researchers, they’ve partnered to build a mobile computer that will literally stay connected anywhere you need it to go, the entire time. North Pole? Check. South Pole? Check. At sea? Check. Anywhere in between? Check.

Thorium X, the field industry’s first-in-class satellite communications rugged tablet, is a convergence of the best-in-class technologies covering the entirety of the extreme communications spectrum.



The Thorium X merges the Xplore D10 rugged Android tablet (as the core, no-compromise computing platform) with the Iridium satellite network (comprised of 66 satellites orbiting Earth) to offer real-time mapping data and weather reports, enable real-time email communications, and facilitate the completion and sharing of personalized electronic forms relevant to your workflows.

Even when there’s no 3G/4G, Wi-Fi or Bluetooth signal in site.

That’s real-life proof that technology can go to extremes to support workers who are out there all of the time. That was the take by many of the utility industry leaders at DistribuTECH 2017. Specifically, there was a great deal of interest around the notion of an always-connected mobile computer, and a lot of curiosity about the viability of SATCOM in a device with full computing capabilities...

Tech decision-makers wanted to know whether or not constant, non-coded data communication, anywhere on the face of the Earth, can be guaranteed. Let’s just say that they became convinced this wasn’t an empty promise once they saw the Thorium X in action.

Then there were questions about throughput of the data connection. In short, we demonstrated how Thorium Software manages the data connection in order to efficiently manage email, mapping, weather and custom forms.

Lastly, many asked about the cost of the satellite data connection. While the answer depends on use, it’s fair to say that the average monthly cost is in the same ballpark as cellular data contracts.

However, you don’t have to fret over roaming fees or the need for country-specific network reliability and customer support. Instead, with



CLS' satellite-connected tablet, you get standard, around-the-clock communications connectivity in regions of the world where no other wireless coverage is available or even possible.

Now, will this first-in-class satellite-connected Android tablet be the correct PC platform for every mobile workforce? Maybe, or maybe not. It sure won't cost you anything to consider the potential advantages of this unprecedented level of communications connectivity, especially if you're responsible for a highly mobile workforce.

Consider this: Even if your field service technicians are off-the-grid one day a month for an ultra-remote pipeline inspection, how much time does it take them to drive back within range of a network to submit their findings and recommend maintenance or repair actions? How much lost time, and lost productivity, could be recovered if they had been able to transmit their findings in real-time via a satellite connection?

If you're looking for an Android-based mobility solution anyways, this is certainly an option to explore today. After all, you never know how much this joint CLS America-Xplore innovation can advance your corporate mission until you understand how fully it can support the needs of your remote field teams.

xploretech.com/

Ashenbrenner has more than 25 years of computer engineering and engineering management experience, with 18 of those specific to mobility and the field requirements that enable real work to happen. He was previously a Solutions Architect with Xplore Technologies (and Motion Computing) for 13 years. In that role, Ashenbrenner led the development of a suite of rugged mobile tablet PCs, services and software, with an emphasis on supporting the whole mobile work environment.

Durable Mobility Technologies, LLC, under the direction of Bob Ashenbrenner, works exclusively with Xplore Technologies to develop future-proof mobility solutions for customers across multiple field service and industrial sectors. As an industry consultant, Durable Mobility Technologies, LLC, is focused on optimizing rugged tablet-based solutions for mobile workers of all kinds, including utility and public safety professionals. Ashenbrenner is particularly committed to helping customers identify mobile devices that survive a tough work day, run all the needed software and tools today, and will remain flexible and scalable to adapt to evolving technology applications as business needs dictate.

In January of this year, Xplore Technologies Corp. (NASDAQ: XPLR) announced the firm had partnered with CLS America to launch the Thorium X, a first-in-class satellite communications tablet system built on the Xplore XSLATE D10 Android™ rugged tablet PC.

Xplore received an initial order from OEM customer CLS for 1,000 XSLATE D10 units and is prepared to fulfill follow-on orders as needed over the next three years to support rising production and sales of the CLS-branded system as end-user demand dictates. The Xplore XSLATE D10 rugged tablet was exclusively chosen to serve as the underlying platform for the Thorium X rugged satellite tablet and software solution.

The Intel®-powered Thorium X features an integrated Iridium Short Burst Data (SBD) modem and flexible satellite antenna that significantly expands the reliability, speed, and cost-effectiveness of mobile communications. As a result, users will be able to maintain continuity in their professional activities from any remote location around the globe – and most likely at a lower cost than most cellular data plans.

In fact, Thorium X users will have the unprecedented ability to access email, view statistical reports of missions, engage in M2M communication and monitoring, and send electronic forms — among other critical tasks — via satellite in real time.

A bright, 10.1" outdoor viewable screen and Glove Touch capabilities make it easy to conduct secure, TPM 1.2-protected transactions day or not, even in inclement weather. Thorium X software solutions are also available as a tablet app and desktop platform to securely facilitate mapping functions, deliver weather reports, and perform data compilation and transmissions in real-time via the rugged satellite tablet.



Mark Holleran, president and COO of Xplore: noted that one of Xplore's strengths is the ability to engineer flexible rugged tablet technologies that allow OEMs, such as CLS, to customize and implement future-proof mobility solutions based on our industry leading platforms. "By adding satellite data communications capabilities to the best Android rugged tablet on the market – the Xplore XSLATE D10 — CLS both expands the addressable market and enables increased ROI for customers with "off the grid mobile workforces.

"We believe that the successful launch and rapid customer acceptance of Thorium X is a significant win for Xplore and our OEM business. As a leading global rugged tablet manufacturer, we remain very agile in responding to evolving market demands for highly specialized mobility solutions. This co-engineering effort with CLS is demonstrative of our ability to help customers solve complex problems for their end users very quickly," Holleran concluded.

"We know that communications challenges in places or during times when no cellular or WiFi is available costs global industries and governments millions of dollars," said Michael Kelly, vice president of CLS America. "Thorium X now allows people to stay connected via satellite 100 percent of the time, and at a fraction of the cost of satellite phones.

"The launch of Thorium X means that users no longer have to rely solely on WiFi or cellular network connections. This is a huge win for people and teams who work in remote areas, or during times that other communications have been compromised, especially those supporting global operations related to Emergency Management, Military, Environmental Monitoring, Government, Fisheries, and other field-centric industries," he added.

For more information regarding the new Thorium X fully rugged satellite tablet, visit thoriumxamerica.com. Live demos will also be available at Xplore's booth #3231 at DistribuTECH 2017 in San Diego, CA, January 31-February 2, 2017. Additional information about Xplore's XSLATE D10 rugged tablet can be found at xploretech.com/D10.

With a range of products and services tailored to customer requirements, and its long-standing commitment to innovation, the CLS Group is a leading provider of location and data collection services and value-added products in the global marketplace. CLS America, in particular, has been providing satellite data intelligence to different end users for the past 30 years throughout the world.

Xplore is The Rugged Tablet Authority™, exclusively manufacturing powerful, long-lasting, and customer-defined rugged tablet PCs since 1996. Today, Xplore offers the broadest portfolio of genuinely rugged tablets – and the most complete lineup of rugged tablet accessories — on Earth. Its mobility solutions are purpose-built for the energy, utilities, telecommunications, military and defense, manufacturing, distribution, public safety, healthcare, government, and field service sectors. The company's award-winning military-grade computers are also among the most powerful and longest lasting in their class, built to withstand nearly any hazardous condition or environmental extreme for years without fail.

Launching Multinet's First Venture Into VSAT SATCOM:

A SpeedCast Perspective

Multinet Pakistan Private Limited (Multinet) is one of the premier infrastructure and communication solution providers for leading carriers and enterprises in the Middle East region and has been providing their services to their customer for more than a decade.

Multinet excels in providing leading edge connectivity solutions to B2B segments over their own digital optic fiber infrastructure that spans more than 107 cities across Pakistan.

Multinet established itself as the connectivity and managed services partner of choice covering all market verticals, including finance, oil and gas, and small and medium-enterprises (SMEs) in the region.

Further, the company has one of the densest customer bases in Pakistan, catering to the communication needs of enterprises of all sizes by providing them with robust and cost effective communication solutions.

Multinet was looking to launch the first satellite arm of its business in early 2015 in order to service customers who could not be reached by its optic fiber infrastructure due to their geographic location.

Multinet needed to provide reliable, cost effective and secure communication services for their rurally located end users, especially businesses in the financial sector, such as rural bank branches, which required secure data centers to host its servers.

Further, Multinet required a partner who would not only provide the satellite communication services required but who would also train its staff on how to successfully operate and run the networks and satellite hubs.

Providing Solutions

SpeedCast has provided VSAT solutions based on new generation satellite communications technologies. To support the required connectivity and service level for the end users based in the most rural areas of Pakistan, SpeedCast deployed two iDirect® Hubs in Pakistan, the first in Karachi and the second in Islamabad.

SpeedCast also developed a training program for Multinet staff to educate them on how to physically operate the hubs and the network as well as providing them with theoretical training surrounding the satellite communication network.



The Impact

As the relationship has developed, SpeedCast is continuing to develop and assist Multinet's strategy, developing a long-term plan to expand the satellite network from an initial 300 remote sites to 2,000 rural sites in Pakistan within three years.

This will be facilitated through the addition of additional geo-redundant hubs. SpeedCast will continue to support Multinet's network with future upgrades and training for their staff as the technology and network advances.

The Results

Through the provisioning of the company's VSAT satellite solutions and industry expertise, SpeedCast has successfully helped to launch Multinet's first venture into the SATCOM services sector.

This is the first time SpeedCast has helped to launch an operator's VSAT operation. The two iDirect hubs that SpeedCast deployed are geo-redundant and will protect Multinet's end users in rural areas of Pakistan, such as bank branches, from network invasion and natural disasters.



The new SATCOM network has enabled key verticals in Pakistan, such as the financial sector, small and medium enterprises (SMEs) and the oil and gas industry, in more than 300 rural Pakistani locations, to have access to reliable, cost effective and secure communication services.

SpeedCast's training and education has provided Multinet with the expertise necessary to provide best-of-class services for its end users. This deployment demonstrates SpeedCast's commitment to enable its partners to provide

high-quality VSAT services anywhere in the world.

speedcast.com

SpeedCast International Limited (ASX: SDA) is a leading global satellite communications and network service provider, offering high-quality managed network services in over 90 countries and a global maritime network serving customers worldwide. With a worldwide network of 33 sales and support offices and 31 teleport operations, SpeedCast has a unique infrastructure to serve the requirements of customers globally. With more than 5,000 links on land and at sea supporting mission critical applications, SpeedCast has distinguished itself with a strong operational expertise and a highly efficient support organization.

Startups At The Final Frontier:

Space 2.0 Event Aims to Skyrocket NewSpace Companies to Success

By Thomas Nowakowski, Editor-in-Chief, Astrowatch.net



NewSpace companies seeking their place in a rapidly growing and demanding commercial space market will have an unmissable opportunity in late April to reach new heights.

A business event known as Space 2.0 is coming to Silicon Valley with the aim of boosting the development and growth of NewSpace start-ups.

This event, organized by Infocast, will occur from April 25 to 27, 2017 at the Crowne Plaza San Jose-Silicon Valley in Milpitas, California. It will be accompanied by the Earth Pixels meeting on April 25 that is dedicated to Earth-imaging issues, during which NewSpace companies will network with satellite operators, GIS developers, data aggregators and end users of geospatial data.

The upcoming Space 2.0 meeting will be the third edition of the event. The first one transpired in 2015 and was dedicated to introducing the space industry to NewSpace start-ups. One year later, the event's main purpose was to facilitate funding opportunities for such start-ups. This year, Infocast has even more ambitious goals.

"In 2017, we hope to accelerate actionable business plans for the NewSpace companies, who, hopefully, have received the funding they need and are now looking to

partner-up and collaborate with the incumbent space industry," Matthew Masongsong, Event Designer at Infocast told Astrowatch.net.

At this year's Space 2.0 conference, NewSpace companies and newer start-ups with actionable business models will have the opportunity to network with investors, aerospace primes, government agencies and incumbent players from the satellite operator and manufacturing worlds.

Space 2.0 meetings are becoming the go-to meeting for networking, with a strong emphasis on funding and investments. Masongsong notes that their events allow start-ups to benefit from two dedicated investment panels (early-stage and later-stage funding), as well as a panel dedicated to the government's role in fostering capabilities coming from start-ups.

The long list of Space 2.0 2017 participants includes key players in the space industry such as DigitalGlobe, Made In Space, United Launch Alliance, SSL/MDA or Virgin Galactic, among many others.

Additionally, several governmental entities have confirmed their participation as speaker: NASA, USAF, NGA, CASIS, In-Q-Tel, and the California Department of Food and Agriculture.

"Their participation is specifically for the purposes of connecting them with commercial space companies," Masongsong noted.

Renowned commercial and governmental participants, together with crucial experience from past events, could make Space 2.0 a trend-setter when it comes to NewSpace business. The organizers hope that their annual event is becoming more and more recognizable in the space industry.

"Although the terms NewSpace, alt.space, or commercial space are the most common terms used within the industry, when you hear the term Space 2.0 industry experts know you are talking about Infocast's inaugural NewSpace event," Masongsong said.

Satnews Publishers (www.satnews.com/) is the official media partner of the Space 2.0 event.

Sign up for the conference at: infocastinc.com/event/space-2-0.

Register today with the code **1720MEDIA15** and receive a 15 percent discount on the registration fee.