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Industry Trends, News Analysis, Market Intelligence and Opportunities

Maritime Satellite Market Trends

by Bernardo Schneiderman

The maritime satellite market is one of the bright spots in the global satellite industry. NSR's report, Maritime Satcom Markets, 5th Edition, finds that satellite leasing revenues for the maritime VSAT mobility market are projected to exceed US$1 Billion by 2026.

With over US$ 400 million in leasing revenues in 2016 from FSS and HTS offerings, the steady roll-out of the 'connected vessel' over the next decade is being powered by falling capacity pricing. "With broadband connected vessel growth outpacing addressable market growth, there are positive fundamentals within the Maritime satellite connectivity business," said Brad Grady, Senior Analyst and report author. "However, these positives are also attracting additional upstream players, and 'highly defensible' verticals such as Offshore face macro-economic challenges. As Service Providers, Satellite Operators, and Hardware Manufacturers look for their 'next big market', players will increasingly find themselves competing against each other." Dallas Kasaboski, Analyst at NSR and report co-author adds, "While the pool of connected vessels and addressable markets continue to grow, slimming margins, savvy end-users, and a pivot towards "Non-Bandwidth Services" will be the core challenges for incumbents and new market entrants alike over the next ten years."

As satellite connectivity providers acquire new skills to capture additional value-added opportunities or leverage their capacity portfolios to capture new business opportunities, there are clear trends: double-digit per-vessel capacity growth over the next ten years across Merchant, Passenger, Offshore, Fishing and Leisure markets; nearly $3 Billion in additional retail revenue growth for MSS, HTS, and FSS satcom services; and an on-going shift towards emerging regions such as Asia-Pacific and the Indian Ocean, according to NSR.

Among the satellite operators, Inmarsat is the historical satellite service provider in the martime sector bringing now beside L-Band the GX (Ka-band) solution. In addition, Intelsat (EPIC platform of HTS in Ku-Band) and SES (HTS in Ku-Band and O3B in Ka-band MEO satellite) are the new players coming to this market. Another segment of the market are services providers such as SpeedCast, ITC Global (Panasonic Group) and GEE (which acquired EMC), among others. The maritime satellite antenna manufacturers include Cobhan and Intellian are the main players with parabolic stabilized antennas as new players

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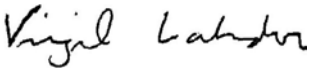
The African Satellite Market

As the year is winding down , one of the last major industry shows is Africacom in Cape Town, South Africa. It's been a very fruitful year which happens to be our 10th anniversary at Satellite Markets and Research. Each year we travel to each continent to cover the developments in the global satellite industry. Africa is a important market for satellite services and Africacom is one of the best shows to attend in the region. What's driving the market is the need for broadband access. Africa's Internet users is still low at only around 30 % penetration. So the potential is definitely there.

With more than half of its 1.2 billion people under 25 years of age, Africa not only has an increasingly technology-aware populace, enthusiasm also burns brightly. Leapfrogging technologies and incubating start-ups are popping up in most of African countries led by Kenya, Morocco and Mauritius. Meanwhile, African economic managers keep pushing broadband penetration, mindful of a World Bank study that a 10 percent increase in broadband penetration could propel a country to gain as much as 1.4 percent increase in GDP.

Africa is definitely a market to watch and as we move on to our next decade of reporting on the global satellite industry, we will continue to strive to cover as much as the industry as we can possibly can on every continent where there is a market for satellite services.



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such as Kymeta and Phasor are coming up with the new flat antennas.

During the last two years since our last article on the maritime sector we had merger and acquisitions and new players are coming to the maritime market from other segments like aeronautical market. In the Service Providers we saw Speedcast acquiring Harris CapRock in 2016 and ITC was acquired by Panasonic Corporation as part of the Panasonic Avionics in 2015. GEE (Global Eagle Entertainment) acquired EMC (Emerging Market Communications) in 2016.

The key growth in the maritime market is the data services and IP. The commercial maritime vertical markets include Cruise Industry, Offshore Oil & Gas, Fishing Industry and Commercial Shipping but application beside the Internet connectivity for leisure and business application the growth of IOT is coming to the maritime market with relevant applications for operations, control and management of assets.

Recent market studies confirming the growth for the next 10 years is exponential because several factors are coming to this segment: More efficient VSAT modems technology, Low cost Satellite Bandwidth, Low Cost Maritime antennas with more powerful Satellite both in Ku (HTS) and Ka-Band.

"...The key growth in the maritime market is the data services and IP. The commercial maritime vertical markets include Cruise Industry, Offshore Oil & Gas, Fishing Industry and Commercial Shipping ..."

We invited the key players in the market for a virtual roundtable and the following is the list of participants that answering our basic questions related with the services and technology that is coming to the maritime satellite market. The participants that answered our request include **Cobham Satcom** (Seatel): **Mathew Galston**, Cobham Satcom's new Senior Director, Maritime Products; **ITC GLOBAL**: **Kevin Franciotti,** Vice President, Channel Partnerships; **Kymeta: Håkan Olsson**, Vice President, Maritime and **Speedcast: Toni Lee Rudnicki** Vice President, Global Marketing.

Excerpts of the roundtable discussion follows:

Satellite Executive Briefing (SEB): *What trends do you see in the next 2-5 years for the maritime satellite market considering the following segments: Cruise, Transportation, Oil & Gas, Leisure, Fishing and Defense?*

COBHAM: A clear trend across the board is the on-going demand for increased bandwidth as users in all maritime industries want access to faster, globally available connectivity in order to meet their operational, passenger and crew needs. The maritime industry is becoming more digital, so the importance of high availability and quality of service has increased. Antennas play a huge part in this, which is why our focus is on delivering solutions that provide high uptime and reliability for global operations on all vessel types.

COBHAM Satcom's Sailor antenna.

For specific segments, cruise is leading the way as the largest bandwidth consumer. With hundreds of simultaneous connections needed to satisfy cruise guest demand for access to the Internet and Social Media on a global basis, the majority of cruise liners have complex, multi-band multiple antenna solutions. As a specialist in this field, we have developed a unique customized approach to these requirements, based on an extensive portfolio of Sea Tel antennas that provide the foundation for diverse customized networks on board. With a combination of Ku, Ka and C-band antennas, we are able to secure operational continuity, regardless of where the vessel is sailing.

There is also a significant trend towards the use of smaller VSAT antennas, which was originally started with the advent of new Ka-band HTS services. Their spot beam configuration means that 60 cm antennas can enable a stable, high throughput link anywhere within the coverage area. But with the introduction of Intelsat's Epic^{NG}, 60 cm antennas can now deliver high performance on Ku-band satellites.

ITC GLOBAL: Overall, our customers across all market segments are looking at VSAT connectivity as much more than just bandwidth. We are working with a number of industries that now recognize this and are actively seeking our counsel. We believe what we offer, in terms of connectivity and value-added services, goes well beyond competitor offerings. As capacity is further commoditized, we are delivering individualized solutions at the end of the pipe. As both operational efficiency and security are drivers across all sectors we serve, it is key for our network to offer superior redundancy. Our global mobility network was designed to maximize reliability,

throughput and resiliency to maintain near 100% uptimes and avoid loss of service during satellite or teleport failures.

On the commercial shipping front, we're seeing an increased interest in automation solutions including fuel management and route optimization. Our customers are trying to do more with less, and they are willing to spend capital to minimize long-term operational costs.

Video delivery is one of the services where we see continued adoption. In the oil and gas sector, demand for remote video streaming to support subsea monitoring continues to become more essential for organizations to track and optimize equipment maintenance before failures occur. Real-time 24/7 visibility can reduce expensive downtime and provides added levels of HSE support for critical offshore operations.

In the cruise market, we see requirements that are equal parts connectivity and programming. Everything goes back to harnessing the bandwidth and the technology to enhance the passenger experience. Our cruise business started with customers approaching us, instead of the other way around, because they realize that entertainment services and passenger connectivity are only as good as the network delivering the service. We're increasing the availability and reliability of the network to improve the overall customer experience. Last year, we set up a custom feed of the Rio Summer Olympics in just six weeks, broadcasting more than 200 hours of coverage in near-HD quality. These services allow customers to differentiate their brand to directly affect consumer loyalty and create potential new sources of revenue

Kymeta: With the digitalization and connectivity needs moving to the next level to support both operational and crew welfare needs, the satellite communications will be key to satisfying that need. The increasing availability of high throughput GEO satellites in the near term, combined with mid/long term availability of MEO and LEO satellites, is key to delivering the capacity to fulfill the ever-increasing requirements.

Speedcast: In the next few years, scalability will continue to become a key interest among providers and operators. More and more customers are looking for offerings that enable their solution to grow and expand as the needs of the customer change. Security is also seeing a big push, both in cybersecu-

rity and physical security, especially in the maritime markets. Vessels are even being required to meet regulations set by the Maritime Safety Committee to have stronger and more advanced defenses against cyberthreats.

The human element of offerings is also becoming a key focus for many operators. Service providers are not only looking to please the operator, but also the end-customer as well. In cruise, operators are searching for solutions that can enhance the passenger experience with increased reliable connectivity, wearable tech, video streaming and more without having to pay for more bandwidth. In the energy and defense markets, crew well-being and satisfaction are key elements to an operator's needs. In addition to the capabilities listed above, solutions must be able to incorporate training elements including video streaming and communication.

SEB: *What specific regions do you see a potential growth in any specific market segment?*

COBHAM: While in the last five years especially, VSAT has seen significant growth in the shipping sector, there are still tens of thousands of vessels going to sea with L-band MSS. This is a large section of the maritime industry without access to VSAT-based high-speed/capacity connectivity that could help them to improve operational safety and efficiency significantly. So, migration from L-band to VSAT services is a key potential growth area but some ship owners still need convincing of the benefits. With the advent of smaller, lower-cost antennas for HTS services though, and further education on the cost control benefits of pay monthly as opposed to pay as you go services, we are positive that many of the fleets still operating on L-band will eventually make the move to VSAT

ITC GLOBAL: ITC Global is focusing on many regions as maritime demand continues to grow.

Kymeta: This is a global need, but the utilization will naturally be concentrated along the main shipping routes, cruising areas and regions with natural resources. For the first time, satellite will now be a good option for the polar and far northern and southern regions through LEO constellations that orbit north-to-south as opposed holding in a stationary orbit over the equator.

Kymeta flat panel antenna.

Speedcast: While the cruise market has traditionally been mostly focused in the Caribbean and Mediterranean, the Asia -Pacific region is a growth market for this vertical, specifically Southeast Asia and China.

The energy market is expected to see growth in all regions, but specifically in the Middle East, the Gulf of Mexico, East Africa, Australia and Brazil.

Transportation is mostly focused in Europe and the yachting market is expected to continue to grow in the Caribbean and Mediterranean.

SEB: *Do you have a specific set of antennas or solutions that address the requirements of a specific Market segment (ie. Oil& Gas, Defense, Transportation, etc.)*

COBHAM: End-users have differing requirements, so we have designed our portfolio to meet specific needs. Sea Tel antennas are more commonly used to enable the higher bandwidth consumption of cruise and oil & gas for instance, where complex, customised networks are more common. The SAILOR range of VSAT and MSS antennas meets the need for more standardised solutions in the merchant sector, fishing and to some extent yachting. While there is of course cross-over, it is important to match the technology we provide to the technical, operational and budgetary needs of our end-users. This is where our industry knowledge creates value, from scoping and recommendations, to deployment and support.

ITC GLOBAL: We take the term "technology agnostic" to another level, accommodating different requirements across different remote sites globally. In terms of network design and VSAT technology, we've been deploying and installing future-proof solutions capable of migrating to High Throughput Satellites (HTS) to enable customers to fully harness HTS benefits as soon as those satellites come on line.

Tailored networks ensure that our customers' application requirements are fulfilled and deliver high performance and reliability. This is true across all markets we serve. Earlier this year, we had a quick-turnaround requirement for a Gulf of Mexico customer to provide voice and high-speed data services. When they contacted us with an additional requirement for streaming video to enable wellhead monitoring for their offshore operation, we deployed an experienced field tech team member to activate service within 24 hours. The customer gained immediate access to real-time subsea video streams that were required to com-

plete their project. Rapid, responsive deployment is the hallmark of our customized support.

Next year, ITC Global will begin the process of migrating customers to Newtec Dialog, a new high-bandwidth satellite modem. We believe the new platform, which is also being deployed to Panasonic's aero customers, will deliver significant performance gains over legacy modems that may not fully meet the needs of our mobility customers as the market changes. This new ground system partnership illustrates a continued commitment to investment and innovation for our customers' benefit.

Kymeta: The Kymeta flat panel solutions are uniquely positioned to satisfy the requirements of future communications today. Kymeta™ mTenna™ technology has no moving parts and can be manufactured in high volumes because it uses metamaterials technology that is produced on existing liquid crystal display production lines. The Kymeta flat panel solutions have been proven at sea since March 2017 in the Caribbean, the Mediterranean and across the Atlantic. Thanks to the scalable terminal solutions where one or multiple antennas can be used for scalability of the throughput, the needs can be addressed for any maritime segment. The technology appropriate for any vessel, and is also inherently compatible with MEO and LEO constellations, making it uniquely positioned to avoid obsolescence as new satellite constellations are launched.

ITC Global delivers a high-availability network for an industrial oil platform in the Gulf of Mexico.

SpeedCast: Speedcast is a strategic business partner with a deep understanding of the customer's business. As such, we aim to deliver customized and flexible solutions to each customer based on their individual needs. Speedcast's approach focuses on what the customer needs and how we can best provide it. For example, a commercial shipping vessel might need solutions that incorporate IoT technology to monitor temperatures within the cargo hold. Speedcast provides customized solutions to operators that enable them to react if any temperature changes occur.

Speedcast looks at how to optimize a customer's business, particularly when it comes to disruptive technology and the trend toward cloud-based applications. Big data is a focus in the industry, and Speedcast works to incorporate solutions into their offerings every day.

SEB: *What impact are you expecting with the introduction High Throughput Satellites in Ku-Band and the new generation of Ka-band in your product portfolio?*

COBHAM: We have a range of SAILOR and Sea Tel antenna solutions to meet all requirements of the new generation of satellite services, but perhaps the biggest impact has been the reduced requirement to use only >1 metre antennas for high throughput globally. This has allowed us to reduce the size and weight of our antennas, making them suitable for more vessels. Based on an advanced lightweight carbon fibre composites / aluminium design and weighing in at just 37kg, SAILOR 60 cm VSAT antennas for Ku and Ka-band can be carried on board and installed by hand, negating the cost of hiring a crane and forklift in port. They are less expensive than 1 metre antennas to buy in the first place and transport costs are also lower. These savings can ultimately be passed on to the end-user by service providers in what is a very competitive market place, while still providing the performance for reliable, high speed connectivity on a global basis.

VSAT is now becoming much more viable for maritime sectors that previously only had L-band MSS as an option. There is now real potential for VSAT to become more mainstream in the fishing sector for instance. Considering the length of time that some trawlers stay at sea, to have access to high-speed, pay monthly connectivity is a massive improvement for them in terms of safety, operational needs

Speedcast TV On Demand™

and the wellbeing of crew members. Likewise, smaller antennas can open VSAT use up to more yachts. Of course, a 60-cm antenna is still substantial in this context, so it's only the larger ocean-going yachts that will benefit, but still, HTS has introduced potential for growth in the recreational markets.

An interesting consequence of HTS, especially in the context of Inmarsat's Fleet Xpress service, is that FleetBroadband gets a new lease of life. Available for over ten years now, FleetBroadband has become the de facto industry standard L-band service in many regions and sectors, and SAILOR antennas for the service have outpaced the competition by orders of magnitude. We've sold over 50,000 SAILOR FleetBroadband terminals so far, and many of these will be re-used within new Fleet Xpress installations, helping to make migration to Inmarsat's new service more cost-effective. However, we also see that the new generation of HTS services is driving new sales, as SAILOR FleetBroadband is an integral aspect of Fleet Xpress and a very reliable back-up solution for global connectivity in combination with other HTS services.

ITC GLOBAL: The tremendous benefits of HTS capacity are indisputable. The Panasonic network, which we leverage for ITC Global customers, is planned to be the largest HTS Ku-band network in the world. Today, the high availability network covers 98% of maritime traffic routes and enables near-100% uptime.

The complexity and increased infrastructure costs inherent to HTS technology are creating new partnership opportunities. We are building a strong distribution network by shouldering the otherwise prohibitive capex requirements of building a global HTS fabric. By leveraging our network and channel partner experience, we see long-term growth potential across all of the sectors we currently support.

Kymeta: The Kymeta flat panel solutions are designed for Ku satellites today, but we have already proven that the antennas can also work for Ka band. We are focusing our current efforts on the Ku satellites as this is where the vast majority of maritime market operates, but over time we do see that Ka band satellites will be a viable alternative for high throughput maritime services.

Speedcast: High throughput satellites (HTS) take capacity from megahertz (MHz) to gigabits per second (Gbps) and more, allowing companies to use, transfer and receive data more quickly. The change that is being seen with this new generation of Ka-band is a dramatic business improvement for many providers. However, as a band-agnostic and technology-agnostic company, Speedcast is prepared to take advantage of new and innovative band technology, whether it is Ka-band or Ku -band. Speedcast is also actively testing low earth orbit (LEO) and medium earth orbit (MEO) satellites, so the increase in available bandwidth will allow Speedcast to continue to grow and enable more offerings to its customers.

SEB: *Do you have any new solution that you launched the last 12 months or you are planning to launch during the next 12 months focus in specific segment of the maritime market?*

COBHAM: In addition to the 60cm SAILOR 600 VSAT Ku, which we unveiled earlier in 2017, we are now looking towards the availability of our first antenna for operation on the new Iridium NEXT network for Iridium Certus services. The SAILOR 4300 will be ready and shipping by the end of the year, ensuring that maritime users will have access to a class-leading antenna solution for when Iridium Certus services become available early in 2018.

SAILOR 4300, the first of our planned Iridium Certus^{SM} terminals, will be among the first available for operation on the Iridium NEXT constellation. Like Iridium's current satellite constellation, Iridium NEXT features a cross-linked Low-Earth Orbit (LEO) architecture, providing coverage over 100 percent of the earth's surface. Iridium Certus will guarantee high bandwidth connectivity as a primary channel or as an integral part of multi-band communica-


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tion networks.

While delivering high-speed, global connectivity as a standalone terminal, SAILOR 4300 has also been designed for seamless integration with onboard communication networks, making it an ideal solution for VSAT service providers to provide a cost-effective, high-speed secondary/back-up communications channel. SAILOR 4300 provides this capability using a specially designed, easy to configure VSAT integrator 'smart box'.

Cobham SATCOM is an experienced first-mover in the development of L-band terminals and is already established as a market and technology leading enabler within the sector. SAILOR 4300 for Iridium Certus combines the same reliability, flexibility and ease of installation inherent to Cobham SATCOM's existing L-band terminal portfolio including SAILOR FleetBroadband, ensuring that customers moving to Iridium's next generation network experience the best available service at a very competitive price point.

Kymeta's flat panel antenna deployed on a vessel at sea.

ITC GLOBAL: The demand for connectivity has increased exponentially for both operations and crew, and their intersection has become our sweet spot. Our customers need to provide enhanced crew amenities and keep the network safe and efficient at the same time. These two requirements can easily clash in terms of network security and prioritization. ITC Crew LIVE is our answer, delivering comprehensive crew welfare connectivity where dedicated bandwidth and satellite equipment completely separates staff and corporate activity to provide proactive security for operational data. The uptake by crewmembers has been phenomenal with now more than 25,000 registered user accounts. User consumption levels continue to climb. More importantly, we've taken over 1.8Tb of data per month off corporate networks for our customers. Our clients see considerable savings because crews are no longer making calls on the corporate network and in cases where we provide the crew network but not the corporate service, some customers have reported that Crew LIVE actually delivers a more reliably solution.

Kymeta: The Kymeta flat panel solutions have already been proven in the superyacht segment, and a key result from the early adopters is that one panel solutions have worked even better than we expected. As such, we are now in the process of expanding the reach into smaller leisure vessels as well as regional shipping and cruising markets where a one panel solution will be suitable.

Speedcast: Speedcast has launched multiple solutions over the last 12 months including GO4SPEED™, Speedcast TV On Demand™ and SIGMA Gateway. GO4SPEED™ is a new global near-shore, data-only 4G/Long Term Evolution (LTE) solution for maritime and energy. GO4SPEED provides flexible usage packages, cost control and overage protection, is easy to install and can be configured to compliment other communications services such as VSAT and mobile satellite service (MSS).

Speedcast TV On Demand™ is one of Speedcast's newest value-added services for the cruise, ferry, commercial maritime and energy industries. The solution allows passengers and crew to access a wide range of entertainment and information onboard any commercial vessel, cruise ship, ferry or offshore rig, and promises a simple user interface, installation and programming.

SIGMA Gateway is a new network device capable of managing Speedcast's global VSAT, L-Band, 4G/LTE and Wi-Fi services to deliver secure virtualized server environments to Speedcast's customers.

Speedcast is constantly delivering new and innovative solutions to its customers and is relentless in its pursuit to deliver better, faster and stronger communications services than any other provider in the industry.

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Space Debris

by Peter Galace and Virgil Labrador

Since after the launch of Sputnik in 1957, millions of space debris—old satellites, rocket stages, and fragments of disintegration, erosion and collisions—have been strewn in space.

The US Space Surveillance Network says it is tracking more than 21,000 objects larger than a tennis ball, and about one hundred million objects larger than 1 mm, orbiting above us. And due to their enormous 17,000 mph orbital speed, each one of these objects carries with it the potential to damage or destroy many of the satellites that we now depend on in the conduct of our daily lives.

While most orbital debris is within 2,000 km of the Earth's surface, the International Space Station, orbiting at an altitude between 330 and 435 km, makes travelling at the habitable artificial satellite a little safer. Most of the space debris are found within the 750 – 800 km range, where low earth orbit (LEO) satellites, traveling up to speeds of 28,163 km/h (17,500 mph), congregate.

Examples of LEO satellites orbiting at this altitude are imaging, spy, and weather satellites, vital to the regulation of our daily lives. GPS satellites fly at an altitude of 20,200 km above the Earth, in medium earth orbit (MEO), while communications satellites and some weather satellites are placed in geostationary Earth orbit (GEO) 35,786 km (22,236 mi) above the Earth's equator. But even if the MEO and GEO spacecraft are seemingly away from the 750 – 800 km danger zone, they are not immune from possible collision with the hazardous space wastes.

And with the hundred million space junk littering our space, the danger to satellites will continue to persist for maybe thousands of years. And they are growing in numbers rapidly in all orbits, created mostly by collisions, rather than removed through the natural decay caused by atmospheric drag.

Space Collisions

In February 2009 two relatively small satellites, Kosmos 2251, a Russian military communication satellite, and the solar panel of Iridium 33, a commercial American communications satellite, collided over Siberia. The crash produced more than 2,000 pieces of space debris, according to NASA, with sizes greater than 10 centimeters, and potentially hundreds of thousands of smaller fragments that can no longer be tracked from Earth. Experts say about 10% of all known space debris accumulated over the past 55 years come from the 2009 Kosmos-Iridium collision.

In February 2015, the USAF Defense Meteorological Satellite Program Flight 13 (DMSP-F13) exploded on orbit, creating at least 149 debris objects, which are expected to remain in orbit for decades. Another collision occurred on January 17, 2005 when a part from a U.S. rocket launched in 1974 collided with a piece of a Chinese rocket stage from 2000. New chunks of debris were created by the crash.

Also in 2002, the European Space Agency (ESA) launched Envisat, an eight-ton satellite that carried atmospheric sensors, advanced imaging radars, and spectrometers that monitored Earth's land, oceans, atmosphere and ice caps. But on April 8, 2012, ESA lost contact with the spacecraft, then considered the largest Earth observation satellite ever built. On May 2012, after losing control, ESA formally declared an end to Envisat's mission. Today, Envisat is the largest inoperable satellite in LEO polluting our space. It is also one of the greatest threats for collision.

The rising population of space debris increases the po-

tential danger to all space vehicles, but especially to the International Space Station, space shuttles, and other spacecraft with humans aboard.

In 1978, a NASA scientist, Donald J. Kessler, warned that the density of wayward objects in LEO could be enough to cause collisions between objects and cause a cascade—each collision generating space debris that increases the likelihood of further collisions. The Kessler syndrome, now also called the Kessler effect, could potentially render space activities and the use of satellites in specific orbital ranges unfeasible for many generations.

In fact, he predicted that as early as 2000, the density of space debris would be so great that random collisions could be inevitable, and that the outcome of these random collisions would be more debris, and subsequently more collisions. The Kessler effect could potentially mean a few years without cell phone reception, Internet, and a five-day weather forecast.

Considering that there are an estimated 8,500 tons of space waste in LEO alone, the Kessler effect might just ignite any time.

Graveyard Orbit

In addition to the fragments of space debris are whole retired or discarded satellites positioned in graveyard orbit, also called the junk orbit or disposal orbit, where spacecraft are placed at the end of their operational life. Satellites in graveyard orbit are located 235 – 300 km above GEO, meaning over 36,021 km above the equator or higher than GEO.

The International Telecoms Union (ITU) requires geostationary satellites to move to the graveyard orbit at the end of their lives to reduce the probability of colliding with operational spacecraft or generating space debris. For satellites in LEO, controllers could use a spacecraft's last ounce of fuel to slow it down. That will force the satellite to fall out of orbit and burn up in the atmosphere.

But satellite engineers have the second choice of sending the satellite farther away from Earth, such as those in GEO. The second option is usually preferred because satellites waste a lot of fuel to slow them down and allow them to fall back into the Earth's atmosphere. It takes less fuel, NASA explains, to blast satellites farther into space than to send them back to Earth.

According to Kyle Hill of www.nautilus.us, it requires 140 times the velocity to shove a satellite into the atmosphere than it does to relegate it to a graveyard orbit. Naturally, more fuel means more money.

There is no exact number of dead satellites "buried" in the graveyard orbit but the number continues to grow because some 20 GEO birds expire each year, and some of these will be sent to the graveyard. Thus, it is inevitable the total number of graveyard residents will increase indefinitely.

At the moment over a hundred satellites are believed to be in the graveyard orbit. Hill, quoting a 2005 study published in Advances in Space Research, says 103 spacecraft in geostationary orbit reached the end of their life between 1997 and 2003. Though all of them were required to be disposed of in the graveyard, only one third actually did so, while the other two-thirds either didn't make it out far enough or were abandoned with no maneuvers whatsoever.

Citing another study published in Space Debris in 2000, www.nautilus.us concludes that merely another six to seven collisions in geostationary orbit would double the risk of additional collisions within that band. Even if ITU's rules on graveyard orbits were always implemented, the study concluded that the distance of the graveyard would have to be pushed back nearly 10 times the recommended distance to adequately reduce future collisions.

Eventually, with more satellites retiring upwards, sooner or later, we will get crashes in the graveyard orbit. A high-orbit collision would produce space junk with a long residency time, endangering active satellites. As the number of dead satellites in GEO increases, the probability of even more collisions increases.

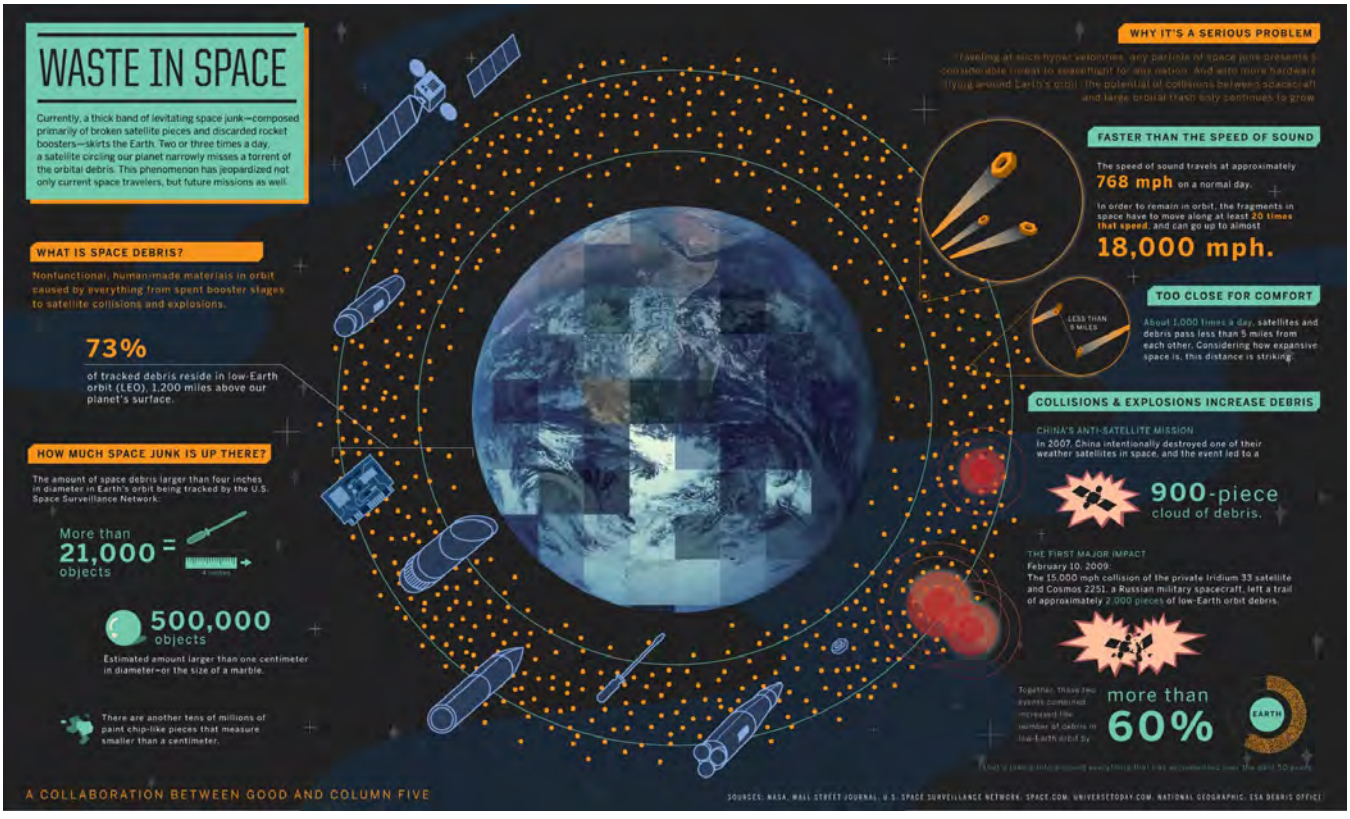
Proposed Space Clean-up Jobs

To stave off chances of space collisions, the obvious solution is to reduce debris population in key orbits. Fortunately, several worldwide agencies and companies are already working to get rid of derelict satellites and other space junk.

ESA has initiated its own Clean Space initiative and is working on a debris removal mission called e.deorbit. The program will target ESA-owned derelict satellites in low orbit, capture them, then safely burn them up in a controlled atmospheric reentry.

ESA is considering several kinds of "capture mechanisms" to pick up the debris, such as nets, harpoons, robotic arms and tentacles. But take note, no automated capture and deorbit of an uncooperative object has ever been performed before.

Another idea proposed by the Swiss Federal Institute of Technology in Lausanne is to push debris out of space. CleanSpace One, a technology demonstration spacecraft, is expected to launch in 2018 from the back of a modified Airbus A300 jumbo jet. The Swiss Space Systems satellite would then meet up with a decommissioned SwissCube nanosatellite to move it out of orbit. The idea is to use a collapsible net that aligns and then collapses onto satellites that have expended their useful lifespan.



Swiss Space Systems said it is investing £10 million (US$12.96 million) for the development of the spacecraft, the entire projected cost. CleanSpace One is targeted to weigh about 30 kilograms.

In 2014, the Japanese Aerospace Exploration Agency (JAXA) proposed the use of an electrodynamic tether that generates electricity, which could slow down the speed of satellites or space debris. A tether made from thin wires of stainless steel and aluminum could be attached to one of the thousands of dead satellites or bits of rocket that are jamming up space. The electricity generated by the tether as it swings through the Earth's magnetic field is expected to slow down the satellite's speed, forcing it to gradually fall closer to Earth, where it will burn up.

This concept was tested on February 27, 2014, when JAXA successfully launched the Space Tethered Autonomous Robotic Satellite II, a nanosatellite built by Japan's Kagawa University, in low Earth orbit.

M. Nohmi of Shizuoka University, however, observed that the two-month experimental mission was only partially successful. In a paper, he concluded that not all of STARS-II mission were achieved. He noted that the electrical power and communication subsystem were normal during the experiment and the solar paddles and antennas were fully deployed. But while the tether was deployed, it got tangled, and thus was unable to perform its function.

Another proposed space clearing mission comes from Texas A&M University. Theirs is a fuel-saving concept that captures an object, swings it towards Earth's atmosphere, and then uses the momentum to sail on to the next piece of space debris for removal. Called Space Sweeper mission, it will make use of the Sling-Sat, a spinning satellite with adjustable arms control at the end of the spacecraft, that will capture space debris. It is conceived to harness the momentum imparted by capturing and ejecting one object to slingshot on to the next chunk of space junk.

Another cleanup proposal is the use of CubeSail, an educational satellite project at the Surrey Space Centre (SSC), and supported by world leading industrial partners, Astrium and Surrey Satellite Technology Ltd.

A key feature is the deployment of a 25 square meter sail structure or plastic sheet that will pull space debris out of the sky. SSC says the concept could be fitted to larger satellites and even rocket stages and a mature system could even be sent to rendezvous and dock with redundant spacecraft and then drag it out of orbit.

Surrey Space hopes to launch CubeSail into a 680 km Sun Synchronous Orbit (SSO) from India hopefully within the next 12 months.

Other Novel Ways of Reducing Space Junk

There are also other novel projects on the horizon. The Defense Advanced Research Projects Agency's (DARPA) Phoenix spacecraft project plans to reuse old, but function

Continued on page 18 ...

Products and Services MarketPlace

A guide to key products and services to be showcased at Africacom in Cape Town, South Africa from November 7-9, 2017.

ABS
Booth # F14 www.absatellite.com

ABS operates a global fleet of satellites including ABS-2A at 75 °East the latest addition to the satellite fleet. ABS provides capacity to support video and television distribution, cellular backhaul, broadband trunking and maritime connectivity. Its extensive teleport network provides comprehensive coverage to 93% of the world's population including Africa, Middle East, Asia Pacific, Russia/CIS and the Americas. ABS has strategic alliances and partnerships with state-of-the-art communication hubs to deliver the best possible satellite solutions.

Advantech Wireless
Booth # C132 www.advantechwireless.com

Advantech Wireless SMARTER SOLUTIONS, GLOBAL REACH.

Advantech Wireless supports the critical need for High Throughput Satellite communications in a rapidly expanding digital environment. Our proven low-cost and highly reliable system solutions are meeting the ever-increasing need for high-bandwidth communications essential to broadcasters.

Amos Spacecom
Booth # F82 www.amos-spacecom.com

AMOS by Spacecom

More Coverage. More Throughput. More Services. Across the Middle East, Europe, Africa and Asia. **Spacecom's** AMOS satellite constellation, consisting of AMOS-3 & AMOS-7 co-located at 4°W and AMOS-4 at 65°E, provides high-quality broadcast and communications services across Europe, Africa, Asia and the Middle East. With AMOS-17 planned for launch to 17°E in 2019, Spacecom will further expand its reach, reinforcing its position as a leading satellite operator.

Arabsat
Booth # C67 www.arabsat.com

عرب سات ARABSAT

Operating a growing fleet of owned satellites at the 20° East, 26° East, 30.5° East and 34.5° East, **ARABSAT** is the only satellite operator in the MENA region offering the full spectrum of Broadcast, Telecommunications and Broadband services. This capacity will continue to expand with the launching of new satellites, making ARABSAT satellites' fleet the youngest in the region.

COMTECH EF Data
Booth # B94 www.comtechefdata.com

COMTECH EF DATA

Comtech EF Data Corp. is the global leader in satellite bandwidth efficiency and link optimization. Our integrated SatCom infrastructure solutions encompass Advanced VSAT Solutions, Satellite Modems, RAN & WAN Optimization, Network & Bandwidth Management and RF Products.

Newtec
Booth # F9 www.newtec.eu

Newtec

Newtec, a specialist in designing, developing and manufacturing equipment and technologies for satellite communications, will be showcasing at the NAB its most advanced VSAT modem to date – the first on the market to support wideband DVB-S2X , the Newtec MDM5000 Satellite Modem. The MDM5000 is capable of receiving forward carriers of up to 140 MHz, and processing over 200 Mbps of throughput. On the return channel, it supports SCPC, TDMA and Newtec's unique Mx-DMA™, up to 75 Mbps.

ND Satcom
Booth # B42 www.ndsatcom.com

ND SATCOM

With over three decades of experience, **ND SatCom** is the premier supplier of and integrator for innovative satellite communication equipment systems and solutions to support customers with critical operations anywhere in the world. Customers in more than 130 countries have chosen ND SatCom as a trusted and reliable source of high-quality and secure turnkey and custom system-engineered communication solutions. ND SatCom's flagship product, the SKYWAN platform, enables international users to communicate securely, effectively and quickly over satellite.

RSCC
Booth # C34 www.rscc.ru

RSCC

The **Russian Satellite Communications Company** (RSCC) is Russia's satellite communications operator, whose spacecraft ensure global coverage. In 2017 RSCC is celebrating its 50th anniversary, The RSCC satellites are positioned along the geostationary orbital arc from 14 ° W up to 145 ° E, covering the entire territory of Russia, CIS, Europe, Middle East, Africa, Asian-Pacific region, North and South America, and Australia.

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-ing pieces of defunct satellites to create new space-based systems — instead of adding completely new ones.

The idea is to launch a "tender" vehicle that would make use of small "satlets" without an expensive antenna needed to make satellites function. Once in space, the tender would move a relatively inexpensive satlet to a defunct geosynchronous satellite. There, the old satellite's antenna would be recycled and incorporated into the tiny satellite, effectively creating a new communications system without necessarily producing more space junk.

Other scientists are also proposing the use of lasers to zap space debris. This involves the use of photon power and letting light waves slow down scrap space materials until they re-enter the Earth's atmosphere, where they are expected to burn up.

But there is danger to using lasers. Space junk-targeting lasers could be used as a powerful war tool, which could proliferate in space, further endangering our already fragile world.

On January 11, 2007, China conducted an anti-satellite missile test by destroying a Chinese weather satellite—the FY-1C polar orbit satellite of the Fengyun series, at an altitude of 865 km (537 mi), with a mass of 750 kg. The satellite was destroyed by a kinetic kill vehicle traveling with a speed of 8 km/s on the opposite direction. It was launched with a multistage solid-fuel missile from Xichang Satellite Launch Center or nearby.

Keeping Space Clean and Safe

In 2008, the UN General Assembly adopted resolution 62/217, endorsing the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space. The resolution limits the long-term presence of spacecraft in LEO, up to some 1,600 kilometers (1,000 miles) above Earth's surface, after the end of their mission. It also calls for the removal of such spacecraft from orbit or for their disposal in other orbits that avoid their long-term presence in the LEO region, where the majority of satellites are placed and where they are in greatest danger of collision.

"The prompt implementation of appropriate space debris mitigation measures is in humanity's common interest, particularly if we are to preserve the outer space environment for future generations," says, Mazlan Othman, Director of the UN Office for Outer Space Affairs (UNOOSA).

However, the space debris rules still depend on the "willingness" of countries to implement the guidelines. But the fact that political consensus was reached is a critical starting point acknowledging that space debris cannot be left to just scientists and astronauts.

Supporting the space debris rule is an even more important treaty, the Outer Space Treaty, or the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", which forms the basis of the international space law. The treaty was signed by the U.S., the United Kingdom, and the Soviet Union (Russia) on January 27, 1967, and entered into force on October 10, 1967. As of September 2015, 104 countries are parties to the treaty, while another 24 have signed the treaty, although have not ratified it. The Republic of China (Taiwan), which is currently only recognized by 21 UN member states, ratified the treaty prior to the United Nations General Assembly's vote to transfer China's seat to the People's Republic of China (PRC) in 1971.

The space law bars countries from placing weapons of mass destruction in orbit of Earth, installing them on the Moon or any other celestial body, or otherwise stationing them in outer space. It exclusively limits the use of the Moon and other celestial bodies to peaceful purposes and expressly prohibits their use for testing any kinds of weapons, conducting military maneuvers, or establishing military bases, installations, and fortifications. The space law, however, does not prohibit the placement of conventional weapons in orbit. The treaty also emphasizes that the exploration of outer space shall be done to benefit all countries and shall be free for exploration and use by all countries.

In the end, it is man that has the responsibility to see to it that space has to be cleared of space junks and all activities are devoted only to peaceful purposes. Let us heed author E.A. Bucchianeri who once said: "There are so many problems to solve on this planet first before we begin to trash other worlds."

Peter I. Galace is contributing editor for of *Satellite Markets and Research based in Asia*. He writes extensively on telecommunications and satellite developments in Asia for numerous publications and research firms. He can be reached at:
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Virgil Labrador is the Editor-in-Chief of ***Satellite Market and Research*** based in Los Angeles, California. He is the author of two books on the satellite industry and has been covering the industry for various publications since 1998. Before that he worked in various capacities in the industry, including a stint as marketing director for the Asia Broadcast Center, a full-service teleport based in Singapore. He can be reached at: virgil@satellitemarkets.com

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The 'Vision' Thing

by Lou Zacharilla

I have a confession to make: I have often led a chorus of those who bitched incessantly about the satellite and space industries being "visionless." I said that what was lacking was not a long-range view so much as the creativity to make the *present* narrative sexier and more imaginative. I argued that we urgently needed more sex appeal to seduce the markets, future talent and ourselves into believing in our own value. After all, we can do anything for anyone who moves any kind of content around the world (or the known Universe!) Let's own it, I said. My knock was that we are a global collection of wonderful, collegial people whose manners and civil temperament are cloaked in practical suits and outfits. We were this way because we are an industry where the prospect of failure, and the technical tight-rope required of us, is so high and so taut that we could be no other way. Our priesthood of engineers and technicians was (and remains), by the nature of the demands of engineering and technical excellence placed on us, a congregation of the left-brained. The necessarily cautious. But that we had to loosen our ties to attract the things we need to survive, and to become more financially attractive.

This became clearer when we were challenged at WRC-15 for our spectrum, and challenged elsewhere for talent and the attention of investors. We needed to break from our cloister and put our dukes up. It was time to stake our claim. To many we seemed unfit for duty. But deep down, we knew better. After all, people like me had staked a claim and my career on two trade associations (SSPI and World Teleport Association) which exist to better an industry which has proven itself resilient and even great.

Then something happened. And when "something happens," it always happens in two places: inside us and outside of us. It is the nature of things. It also happens before we even know it is in motion.

The gong went off for me when I realized that our narrative as an industry was as spent as the treasury of most states. My sense of inner rhythm – based on hundreds of conversations around the industry - told me that we were better than we showed. I was frustrated when I noticed that the poetry of communications was being written in places like Singapore and Silicon Valley, where a new "magic, to borrow from our Chairman Emeritus Arthur C. Clarke, was becoming indistinguishable from the imagination of humankind, and the promise of capitalism and political freedom.

So with the support of the industry and SSPI's board of directors, we went to work. The first step was to again stake our claim to our heritage, since it was ours to claim. We gathered with our colleagues and I and the SSPI team reached into our advertising background and asked the industry for help in telling us stories. The result was the *Better Satellite World* campaign. It remains a wonderful booster shot to us all, and it has propelled us to think about ourselves differently. Finally, we are using our imagination in a way that inspires and sells.

That was the "inside" part.

"Out there," much was happening. In fact, it had been happening probably since the day ViaSat-1 was launched.

Three of the world's richest humans put their money down on our industry. A fourth claimed the virtue of satellites in his and his wife's foundation's endeavor to rid the world of a dreaded disease. Suddenly, we were cool and we were relevant. We had the vision thing. Bezos, Branson and Musk thought enough of OUR congregation to join it, and to keep putting crisp new bills into the collection basket. Hot damn! The world's entrepreneurial A-List were part of our quest to create a "better satellite world." This was followed by the new gold rush in Silicon Valley and in the UK, where new fleets were being financed and planned that will transform space and beyond.

Each endeavor now shares our vision of world where satellites are a critical link to something which will outlive us all and perhaps redeem us: human destiny in space.

SpaceX sees Mars as a destination for humanity, with reusable launch vehicles critical to the task. In the meantime, while its T-shirts read "Occupy Mars," it must pay its bills on Earth. For the sake of paying them, it enables a robust market for launches, and provides functional applications for the new age of satellites.

As former SSPI chairman Clay Mowry so elegantly states, his boss Jeff Bezos of Blue Origin has a vision to put a giant workforce numbering in the millions into space, while using space to make life on earth better. It's not just talk.

"...Each endeavor now shares our vision of world where satellites are a critical link to something which will outlive us all and perhaps redeem us: human destiny in space..."

Bet on it. We will not only explore the outer reaches, as we have been doing for a long time, now we will make places like Youngstown and Capetown better. We will create new wealth, new industries and ensure that systems here on this planet improve. The Gates Foundation has already credited GPS satellites from Boeing with helping to eradicate Polio in India. Think of that.

Of all the visions promulgated by the billionaires who have come to play the space game, our traditional practicality is best revealed in a vision from the United Launch Alliance (ULA). Its CisLunar-1000 concept, admittedly put together quickly, is one I buy into. It is the conservatives vision of the practical outcome of putting 1,000 people to work in cislunar space over the next three decades.

The "sizzle" may not be worthy of the high-end thrills of a joyride that will deliver to you 11 minutes in space (four of them weighless.) But think about the $900 billion per year in "Gross Space Product" that may occur through a combination of products, services and events which will take place over the next 15 years. That is ULA's vision and its math. These include things as technical as ACES refueling and propellant storage. It includes exciting things like LEO tourism and propellant mining on the Moon.

I believe that our industry will enable the global economy to take a stride that will help rebuild the global middle class. How do you like that for a vision?

In the near-term, as someone said at a recent conference at law firm Reed Smith (where "Chatham House Rules" applied), we will need to show our creativity at WRC-19. This will be very important when it comes time - in two short years - to again battle the telecommunication industry for spectrum. We'd better get started. The Better Satellite World campaign stands ready and we hope our new congregants will help.

Satellite is the indispensable technology. Space is dispensable only if you discount the fact that our own star is hovering within its vast dark uncertainties. We may once have lacked vision, but the pull of something vast and thrilling changed all that. Time to stop bitching and continue "visioning."

Lou Zacharilla is the Director of Development of the Society of Satellite Professionals International (SSPI). He can be reached at: LZacharilla@sspi.org

The Value of Independent Teleports

by David Andres

The satellite communications market is undergoing a radical transformation. Long gone are the days of stability, long term contracts and high margins. While our sector is trying to adapt to the new paradigm of a mobile broadband world connecting everyone and everything, a few aspects define the moving forces of the aforementioned transformation. On the one side, we have technical innovation as we have never seen in the satellite sector before: reusable launchers, electric propulsion, in-orbit refueling on spacecrafts, new waves of LEO and MEO constellations, micro and nano satellites, HTS and vHTS payloads, flat panel antennas, beam-hopping, beam-forming, frequency reuse, new frequency bands, NFV/SDN integration…

On the other side, we have commercial aspects and market forces changing the landscape: demands for much bigger amounts of bandwidth, the emergence of new small-size satellite operators, competition from terrestrial players, spectrum threats, capacity saturation in certain regions, pricing pressures, … all leading to a few industry hiccups, consolidations and verticalization of the satellite operators, who are now openly competing with their traditional customers (namely the teleport operators and service providers).

How do small and medium size independent teleport operators remain relevant now and in the future?

More than ever there is a need for a vision and strategy for companies like us. Whereas it is increasing the value of the offering, diversification of products and services, company transformation, seeking strategic alliances… But outside the future strategy the SME teleport operators must always remain loyal to its values.

We atSantander Teleport, as a medium size teleport operator understand our strengths and weaknesses and work to maximize the former and control the latter. Our company size, our company values and our position as an independent teleport operator offers us huge advantages. To name a few…

Independent–An adjective that is sometimes obviated in the industry but that is more relevant than ever considering the current scenery. As an independent operator, we work with any satellite operator, technology supplier, customer or industry partner. Service providers that seek flexibility and want to have their options open must think carefully between partnering with satellite operators for the provision of teleport services – risking flexibility and choice of options – or partnering with independent teleports who can give complete flexibility and as much choice as there is in the market.

Dedication – We have one business unit and no internal divisions. We can dedicate our time and resources to a common goal without internal obstructing interests. Our team understands how their work contributes to the success of our customers and our company. We are proud and celebrate our achievements individually and as a group, and feel motivated to go the extra mile.

Focus and Responsiveness–We work a lot closer with customers at all levels. From pre sales, to delivery, to post-sales operations and support. Our closeness to our customers does not dim after a contract is signed, but we keep close contact with them and ensure that we match and exceed their expectations. We do our best to adapt to individual needs, never the same amongst the different variety of customers. This is an area that larger organizations regularly struggle with.

Technical Competence – As of today, 85% of our company have an engineering degree. New colleagues undergo comprehensive training and shadowing for at least 6 months. By then they became self-sufficient at their jobs whilst they are encouraged to participate in new projects and areas of development. Our existing customers feel the results of working closely with highly capable staff and value this enormously as they see the end results in better planning, less service outages, and happier end users.

Flexibility and Accountability – Our organization is nothing from hierarchical. We all have extended responsibilities, work as a close team, can make fast decisions, and support each other towards the same goal.

And if you think that being an SME limits our capabilities think twice. Some of our achievements from last summer include: Accessing 6 new satellites from 6 different satellite operators, on 3 frequency bands; Anchoring a second HTS satellite; Activating 10 new networks and over 40 carriers; Enabling a new VSAT network for a service provider using our hub; Revamping and extending a customer-dedicated NOC as well as our Operations control room; Increasing our staff with 5 new members of the team, among others.

Next time you think about partnering with a satellite operator, think about the pros and cons and what you really need now and in the future, before deciding between the big companies or the independent satellite operators that can deliver a lot more.

David Andres is Business Development Manager for Santander Teleport. He can be reached at: david.andres@santanderteleport.com

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SatComRus 2017 Highlight the Russian Broadcasting Market

On November 1, 2017 the SatComRus international conference of operators and users of Russia's satellite communications network was held in Moscow. This year's conference was the 22nd edition of the event attended by 360 participants from 92 organizations. This year the number of private companies and international representatives has increased.

The main theme of the conference was the anniversary of RSCC and the domestic satellite communications and broadcasting industry. Warm congratulations were received from the President of the Russian Federation, the Presidential Administration, the Ministry of Communications of Russia and Rossvyaz, from the leaders of the largest domestic and international companies of the industry, as well as from public organizations and the media. RSCC boasts 12 state-of-the-art spacecraft, 6 teleports, new services and applications, and a two-fold increase in annual revenues in the recent three years. Over the five decades, the RSCC has traveled a long and difficult path from a satellite communications station to a successful multi-purpose satellite operator that provides services to customers in 52 countries.

SatComRus 2017 devoted considerable time to discussing the prospects for the development of the satellite constellation and the services based on it. Undoubtedly, the main driver of business growth, according to the participants in the discussions, is access to the Internet and data transmission, including on moving objects.

Of particular interest to the conference participants was a discussion about the future of television services in the context of the changing competitive environment, and the need to transit to a multi-environment. Speakers shared their visions about the future of television, and about the media in the era of artificial intelligence.

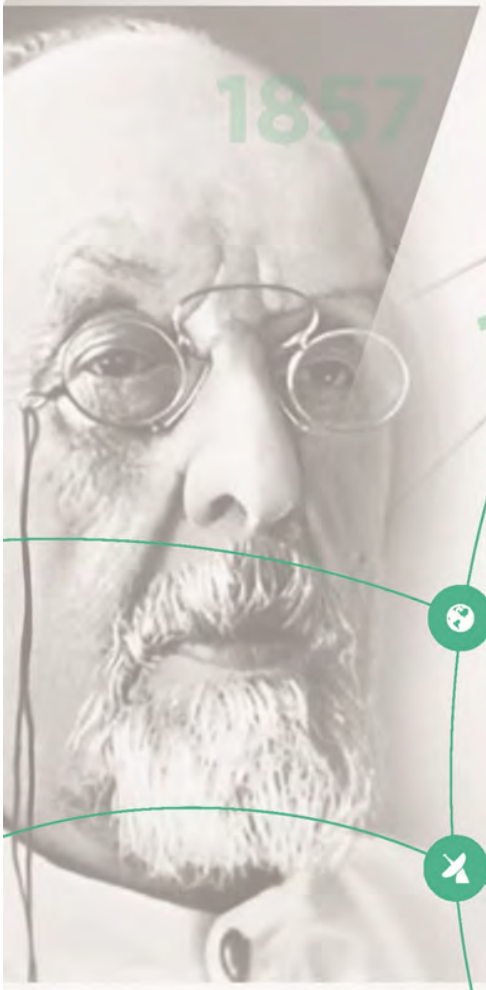
The conference ended with a traditional ceremony of awarding SATCOMRUS AWARDS.

One agenda item of the conference included announcing the results of the "In Focus: Satellite Internet" contest. The contest was organized by Ka-band.info, the portal about satellite Internet in Russia, whose partners are the RSCC and Russian operators of satellite broadband services. The winner of the contest, chosen by the jury by voting in the social networks, was awarded the main prize - a satellite communications terminal operating via the RSCC's Express-AM5 and Express-AM6 satellites. He was also given a "Satcomrus AWARDS" prize. Special prize SATCOMRUS AWARDS in the nomination "Legendary Person" went to Mark I. Krivosheev for his personal contribution to the development of TV and radio broadcasting in Russia and in the world.

The participants of the conference witnessed the ceremony of stamp cancellation. The stamp issue was timed to the 50th anniversary of the RSCC.

The 22nd edition of SatCom Rus conference was held in Moscow, Russia with over 360 participats from 92 organizations attending. This year's event coincided with the 50th anniversary of satellite operator RSCC.

Russian Satellite
Communications Company



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ABS Announce Leadership Transition

Hong Kong, October 30, 2017-ABS announced that co-founder and Chief Executive Officer, **Thomas (Tom) Choi,** is transitioning his role as CEO to that of Director on the Board so that he can pursue other interests and opportunities. Choi will continue to support the company as a Director on the Board and he remains a significant investor in the business.

Tom Choi

ABS' current chairman, and industry veteran of more than 30 years, Jim Frownfelter, will become interim CEO. Jim and majority owners, Permira, have commenced a search for a new CEO and intend to make an announcement in the near future.

Commenting on the announcement, Jim Frownfelter, said, "I would like to thank Tom for his immense hard work in getting ABS to where it is today. Tom co-founded the company in 2005, successfully built it to become a major global player and has been widely acknowledged in the industry for his pioneering achievements. ABS executive committee supports Tom's decision and values the continued access to his expert counsel and insights that will continue to support the firm into the future."

Choi said, "It was an incredible experience and a wonderful time. ABS is one of the very few privately owned companies that became a global satellite operator with customers and operations on every continent. Our start buying existing in-orbit satellites, raising over US$200 million in condosat financing to build ABS-2 and then building the all-electric satellites which were dual-stacked (ABS-2A and ABS-3A) on a Faclon-9, highlights just some of the our achievements over the years. I wish to thank our customers, partners, vendors, employees and investors as I move on to other interesting projects and I look forward to serving the ABS team in my directorship role."

Newtec Appoints Steve Mills as Global VP-Sales

Sint-Niklaas, Belgium, November 2, 2017--Newtec, a specialist in designing, developing and manufacturing equipment and technologies for satellite communications, announced it has appointed St**eve Mills** to the position of Global VP Sales, as it continues to record year-on-year growth of 10 to 20%.

Prior to joining Newtec, Mills was Head of Global Sales and Marketing, Secure Communications, at Airbus Defence and Space where he gained extensive experience in the government and defense market, among others. This role followed four years at Inmarsat as the Senior Director in Global Government.

Newtec CEO Thomas Van den Driessche said: "The designation of Steve comes at a great time for Newtec, with almost 80% revenue growth over the past four years showing clear market share gains in the satellite ground segment. Steve's background and experience will help us build further on both our commercial and government markets, as well as support our continued growth in VSAT mobility, cellular backhaul for 4G and 5G, and solutions to monetize HTS."

Steve Mills

Mills, who will be based in Europe, will oversee the sales and sales support teams in his new role and will be responsible for growing both direct and in-direct business, along with a strong Newtec value proposition in all markets worldwide.

Rignet Appoints SVP and General Counsel

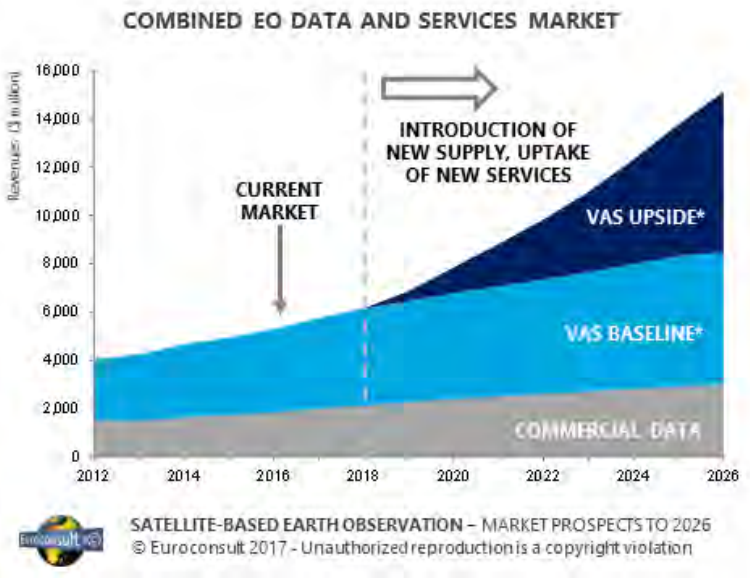
Houston, Tex., November 1, 2017--RigNet, Inc. announced that **Brad Eastman** will join the executive management team as Senior Vice President and General Counsel, effective immediately and will report to RigNet's CEO and President, Steven Pickett. Eastman succeeds William D. Sutton, who, as previously announced, retired June 23, 2017, after more than nine years of service with RigNet.

Eastman brings more than 25 years of legal experience focused on providing corporate, securities and general legal advice to public companies with operations across the globe. Most recently, Eastman served as General Counsel of the Cameron Group of Schlumberger Limited following Schlumberger's acquisition of Cameron International in 2016. Prior to the acquisition, Eastman acted as Vice President and Deputy General Counsel of Cameron International.

Eastman received his J.D. from Harvard University, *cum laude* and B.A. from University of Texas, Liberal Arts Honors Program .

Earth Observation Market to Reach US$ 8.5 Bil.

Paris, France, November 1, 2017 - According to the 10th edition of Euroconsult's report, Satellite-Based Earth Observation, Market Prospects to 2026, the Earth Observation (EO) data and services market should reach US $ 8.5 billion by 2026 based on current growth trajectories. An alternative value-added services (VAS) model also presented has a combined market potential of US $15 billion. This upside model considers the implications of new supply solutions being able to open further markets. As well, advances in artificial intelligence and deep learning are expected to benefit the sector, acting as enablers for new solutions based on change-detection analytics.



The growth drivers for data and services are distinctly different. Defense still dominates the market for commercial data, with the sector alone responsible for over $1 billion in data sales with a focus on very high resolution and high accuracy data sets. Data prices to support defense applications are expected to remain high, a drawback for services development in the civil government and private sector. VAS' largest markets remain infrastructure and natural resources monitoring, however in order to build these solutions often lower-cost or free data solutions are utilized. This creates a disparity in the value-chain in which high-cost, precision data sets make up most of the defense-driven commercial data market, whereas more services are being built from less expensive, more competitively-priced solutions.

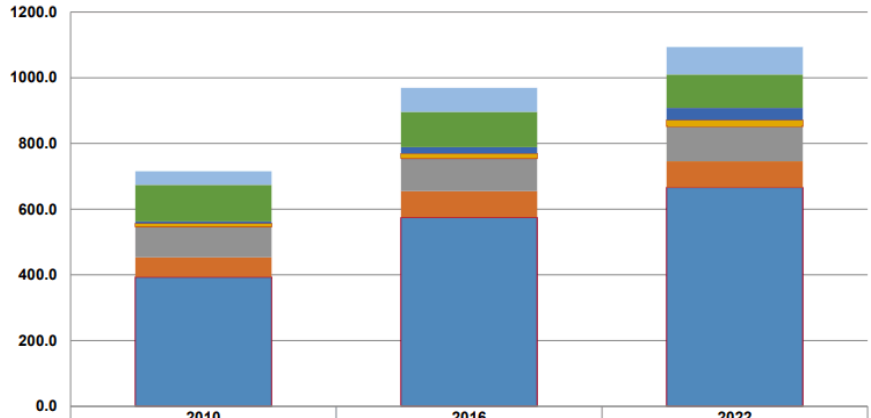
"Companies (both operators and new service providers, such as Orbital Insights, AllSource Analysis, etc.) are building algorithms to detect changes in multisourced data to detect patterns and build predictive analytics," said Pacome Revillon, CEO of Euroconsult. "Bringing higher-frequency collected data into these models, the so-called 'Big Data' environment will further aid developments, with the potential to open new services areas based around location-based systems such as financial intelligence and site monitoring, among others."

Euroconsult has identified approximately 20 companies that have announced intentions to develop lower-cost constellations to collect data at a high rate of revisit based on smallsat and cubesat technologies. As of 2017, these new operators have attracted more than $600 million in venture capital to fund their initiatives. None of the newly announced initiatives have yet reached full capacity; for these constellations to come to fruition, additional investments will be required.

Competition is expected to be fierce on the supply side, as companies must differentiate themselves in the marketplace and bring innovative solutions to maintain market share. Consolidation (such as MDA and DigitalGlobe, OmniEarth and EagleView, Terra Bella and Planet) could linger as companies refine business models and continue to seek investments. DigitalGlobe, for example, is aiming to add a lower-cost satellite constellation (Legion) to its portfolio to counter the probable impact of low-priced solutions entering the market. Airbus will also develop its own very high resolution (VHR) optical system, given that the next generation French defense system will not be commercialized.

From 2007 to 2016, 181 EO/non-meteorology satellites were launched; the cost to develop these satellites generated $17.4 billion in manufacturing market revenues. Over the next decade more than 600 EO satellites (50kg+, non-meteorology) should be launched to support EO applications. Nearly fifty countries are expected to launch satellite capacity, and over half should be from the private sector; this is expected to generate over $33 billion in manufacturing market revenues. Cumulatively, developing programs could represent $4 billion in market value (12% of the total). This figure remains significant, as the majority of export opportunities are to be found with emerging programs, as opposed to more established government EO programs, which remain captive.

Global pay TV subscribers by region (million)



	2010	2016	2022
Latin America	41.5	73.0	83.5
North America	111.6	107.0	102.0
Sub-Saharan Africa	5.6	19.5	36.7
MENA	10.7	15.0	19.5
Western Europe	92.4	99.1	105.8
Eastern Europe	60.2	81.0	80.0
Asia Pacific	393.4	574.4	666.0

There are nearly one Billion Pay TV subscribers globally in 2016 with the Asia Pacific region leading the way with 574 million subscribers. By 2022, Digital TV Research estimates that Global Pay TV subscribers will reach nearly 1.2 Billion.

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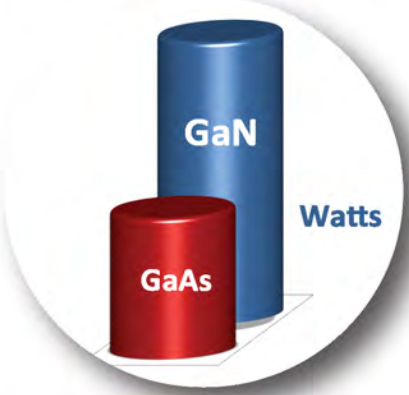

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