

Satellite Executive BRIEFING

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Industry Trends, News Analysis, Market Intelligence and Opportunities

A New Star Over Africa

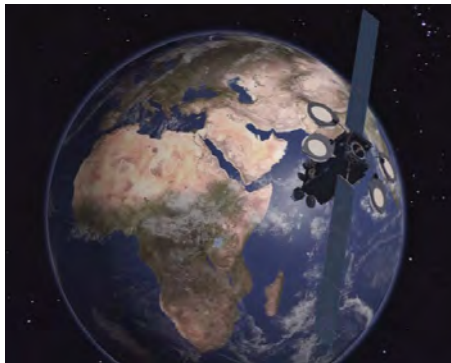
by Virgil Labrador

On August 6, 2019, AMOS-17 was successfully launched by a SpaceX Falcon 9 rocket from Cape Canaveral, Florida. The satellite is located at 17 degrees East where it covers the African continent, along with Europe, the Middle East and Asia. It is positioned right over central Africa, to optimize service in the region.

Scheduled to be operational this month, AMOS-17 is the most advanced high-throughput satellite (HTS) to date, providing satellite communication services to Africa.

Manufactured by Boeing Satellite Systems International, AMOS-17 is 6.5-ton high-power, high throughput satellite designed specifically to meet Africa's fast-growing communication demands. AMOS-17's advanced digital payload will operate in the

C, Ku and Ka bands with a digital channelizer to provide fixed HTS C-band coverage to Africa, steerable HTS Ka-band coverage to anywhere from China to Brazil, and extensive Ku-band coverage throughout Africa with additional coverage in Europe, the Middle East, China, and India.



“AMOS-17 offers a lot of flexibility for customers. It has a digital processor which allows

for the interconnectivity of the various bands, for example, we can uplink in C-Band and downlink in Ku-Band,” said Jacob Keret, Senior Vice-President for Sales of Spacecom, the operator of the AMOS satellites. “The satellite also has 12 HTS C-Band beams, each covering a major country in Africa, so you don't

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Focus on Africa



This month, key events in Africa will be pivotal for the satellite industry as a whole. In Sharm El-Sheikh, Egypt, the World Radiocommunication Conference (WARC), the international treaty-making conference governing the global management of scarce radio-frequency spectrum as well as geostationary-satellite and non-geostationary-satellite orbits will be held this month. At stake would be the vital C-Band frequencies currently allocated

for satellites that the powerful mobile industry is trying very hard to expropriate from the satellite industry. The WARC, held every three to four years, is mandated to review and revise the Radio Regulations, the international treaty governing the use of radio-frequency spectrum and satellite orbits.

Also in the month of November is Africacom in Cape Town, South Africa. This year's edition has many new features such as AfricaTech which shows the important of broadband access and connectivity in the region. Africa is one of the fastest growing regions with the lowest internet penetration rate in the world, so the potential is there but fraught with many challenges. New High Throughput satellites such as the recently launched Amos-17 and the upcoming Low Earth Orbit (LEO) constellation are hoping to bridge the digital divide in the continent. We will be looking at these developments very closely.

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New Star over Africa

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need to go to two or three different beams to cover one country like other HTS satellites,” Keret added. He said the high-powered C-Band beams allows for smaller dishes to downlink the signal—a key consideration for broadband and broadcast solutions for the African market.

The satellite’s digital processing capabilities provide connectivity between all of AMOS-17’s beams in all available bands in any combination. These capabilities also support suppression of interference, flexible capacity allocation, and other digital processing features for improved service. Additionally, all command and control channels, as well as telemetry, are encrypted for maximum security. AMOS-17 is planned to be in operation for a minimum of 20 years, enabling long-lasting and stable service.

“The combination of the inherent flexibility of the digital platform with the mix of fixed and steerable beams ensures fast response to changing customers’ needs,” said Keret.

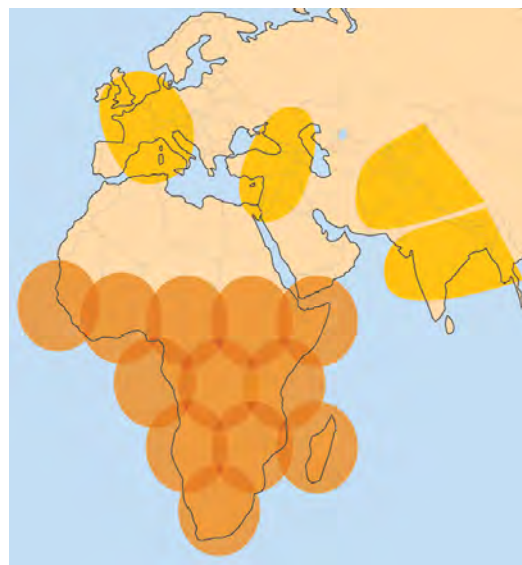
With its extensive capabilities, flexibility, and reliability, AMOS-17 is poised to support growth in a variety of broadcast, broadband, mobility and data services throughout the African continent.

Spacecom CEO David Pollack said, “AMOS-17 places us directly into the exciting growth of Africa’s Sub-Saharan vibrant markets. As a leading multi-regional satellite operator, Spacecom is introducing the most technologically advanced satellite with HTS

beams to service Africa where AMOS-17 will deliver a large selection of services to a variety of broadcast, broadband and telecom clients.”

Spacecom operates the AMOS-3 and AMOS-7 satellites co-located at 4°W, and AMOS-4 at 65°E, provides high-quality broadcast and communication services to Europe, the Middle East, Africa, and Asia via direct-to-home (DTH) and direct broadcast satellite (DBS) operators, Internet service providers (ISPs), telecom operators, network integrators and government agencies.

“The AMOS-17 satellite will provide a great fit for Spacecom’s expansion strategy, offering an innovative design with capabilities that provide flexible service offerings to meet the growing demands of our customers,” said Keret. 🇺🇸



AMOS-17’s advanced digital technology provides a lot of flexibility for customers in Africa. Pictured here are the 12 high throughput C-Band beams each covering a major country in Africa.

View the video of the Amos-17 launch at:

www.satellitemarkets.com/amos-17-launch



Virgil Labrador is the Editor-in-Chief of Los Angeles, California-based Satellite Markets and Research which publishes a web portal on the satellite industry www.satellitemarkets.com, the monthly Satellite Executive Briefing magazine and occasional industry reports called MarketBriefs. Virgil is one of the few trade journalists who has a proven track record working in the commercial satellite industry. He worked as a senior executive for a teleport in Singapore, the Asia Broadcast Center, then-owned by the US broadcasting company CBS. He has co-authored two books on the history of satellite communications and satellite technology. He holds a Master’s in Communications Management from the University of Southern California (USC). He can be reached at virgil@satellitemarkets.com



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Unlocking Africa's Intelligence

by Lou Zacharilla

The boost in non-stop airline traffic between the USA and Africa is on the rise and access to the continent and its cities has as much to do with technology as it has to do with demand. According to travel writer Shannon Sims, developments in plane construction makes it possible to fly longer routes. And ultra long-haul flights, such as next month's launch of a non-stop flight from Newark Liberty Airport to Capetown will provide access to South Africa three times per week. Distances of 9,500 miles (15,300 kilometers) covered in less than 15 hours on a non-stop flight is truly a testament and deserves a genuflection to the wonders of engineering.

My goodness it almost reminds you of that ultimate non-stop wonder of global access: satellite communications!

Access has long been the buzzword for the digital age.

And as we know from the satellite industry – at least if you have been paying attention to Mark Dankberg, Greg Wyler and yours truly - once you provide people with access things happen.

Mostly good things.

Airline access to Africa predicated on Boeing's engineering technology relies on satellite technology. Planes don't fly very far or very well without it. <https://www.sspi.org/cpages/how-satellite-brings->

[you-a-better-flight](#) But people living in Africa are entirely dependent in the long-term on the growth of cities and local economies. These will depend on another satellite offering. This is the one that - if the smart money is really that smart - will deliver some new cargo: a promising future. Because the future depends on African nations educating, training and retaining its best and brightest.

Low Earth Orbit satellites and their promise of total connectivity and access to enough broadband to plug people into the global economy are the promised platform for the advent of what I call "Intelligent Africa."

During my panel at the Satellite Innovation conference in Mountain View, California last month, the audience, when polled, agreed that five or fewer of the new constellations would survive. We agreed that broadband would con-

tinue to be the largest driver of volume growth, as Euroconsult reported. After all, it already accounts for 70% of the total capacity in use.

Falling capacity pricing is another matter!

But will falling prices have unintended consequences? Access to broadband in Africa, however it arrives, could result in the transformation of places that follow solid economic development principles. If the public and private sectors work to design policies and plans that lend themselves to using education, knowledge, culture and local autonomy in cit-





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ies and region as the tools for excavating human intelligence, economic output and social stability could appear within a generation or faster.

Nairobi County is one example of a place that has used this idea to advance. It has tried to make access part of its economic development strategy and resurgence. https://www.intelligentcommunity.org/nairobi_county Similar to what we see in Mexico, with ventures like ViaSat’s Community WiFi initiative, Nairobi embraced the beginning of a market economy over 10 years ago, which permitted the private and public sectors to make progress.

Kenya’s leading industrialist, Manilal Chandaria, stepped forward and founded a business school and incubation center at several universities. Microsoft and Intel worked with an association of schools to bundle devices and education apps, which were consistent with the national government’s 20-year plan emphasizing the role of IT in education. It set itself up for a future where IoT and connected devices would assist in the management of its economy and region.

In 2014 Nairobi County embraced the six indicators of the Intelligent Community Method, the first of which is to ensure that it work toward a robust broadband and telecom infrastructure. The other five indicators include more “elite” steps on the path to at minimum smart city status, including digital equality and access for all as well as the creation of a knowledge-based workforce. This is where educational initiative falls and where LEOs may have a more prominent role going forward.

Because the first step is access; access for schools, hospitals, entrepreneurs and, local governments, which provide services. The net result of this will allow people to stay home – and not flee to London or the USA for economic opportunity. Once again, satellites are being called upon to be part of this evolution. Stay tuned as LEOs either make it or break.....

To meet people who are doing work like this I encourage you to attend this year’s Better Satellite World Awards dinner and networking event in London on 2 December. <https://uk.sspi.org/events/the-better-satellite-world-awards-dinner-2019>



The SSPI produce podcasts in two series: Making Leaders and Better Satellite World.



SSPI’s Making Leaders program is dedicated to building the human capital and leadership strength of the space and satellite industry. Podcasts feature interviews with leaders on their own career paths and the essentials of hiring, managing and leading others.



Better Satellite World episodes feature conversations with people whose work in space & satellite make a stronger economy, a better society and a more sustainable planet. They demonstrate why space technology is indispensable to modern life.

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A Teleport With a View to the Future

by Virgil Labrador



I've been to many teleports all over the world and having worked in one for several years, it never ceases to amaze me how teleports which provide essentially similar services can still be unique in their own way. This was the case when I visited the sprawling VIVACOM teleport in Plana, Bulgaria about 30 kilometers south of the capital city of Sofia. This is one of the largest ground station facilities in Eastern Europe with more than 50 antennas ranging in size up to 18.3 meters.

The VIVACOM teleport is the oldest teleport I have ever had the privilege of visiting, having been established in 1977. However, nothing in the teleport today show its age, with the exception of the experience and expertise of their staff, who pride themselves in their over 40 years of continuous operation. The teleport was the first in Bulgaria. It's a state of the art teleport well poised for the innovative services that are required in the competitive new media environment.

VIVACOM is the largest telecommunication company in Bulgaria with a full service portfolio including fixed and mobile networks, digital interactive TV, high speed internet, international fiber optic connectivity and teleport services. The World Tele-

port Association (WTA) has accorded VIVACOM's teleport Tier 3 full certification under WTA's Teleport Certification Program which places it among the most modern telecommunication facilities of its kind worldwide.

The teleport's location in Bulgaria provides a strategic location between Europe and Asia and Middle East and Africa. "The geographical location of our Plana teleport allows us to provide uplink and downlink services to satellites from 40° West to 90° East. We provide access to one of the most popular satellite positions covering Europe, Africa, Asia and Latin America. VIVACOM has pointed antennas to satellite positions and beams which are not accessible from Central and Western Europe and Americas. We can quickly and easily add new uplink or downlink carriers and provide the signal at our major PoP's in Europe like Frankfurt, London, Paris and many others," said Vladimir Rangelov, Senior Sales Manager-VIVACOM.

The teleport itself is located in a very beautiful valley in the mountains south of the vibrant capital city of Bulgaria, less than an hour from Sofia's international airport. It's in a very secure area where the road leading up to the teleport ends in the sparse-



VIVACOM provides End-to-end satellite solutions

PLANA TELEPORT

 VIVACOM

ly populated valley where the teleport lies. The location of the teleport was specifically selected due to minimal rainfall and excellent protection against electromagnetic interference. This is extremely important for



the growing market for Ka-band transmissions, according to Rangelov. This makes the location ideal for earth stations and gateways for the upcoming Low Earth Orbit (LEO) constellations and GEO HTS satellites. The teleport sits on 48,000 square meters of land where it has substantial room for expansion for additional antennas.

Currently, VIVACOM teleport's main business is still broadcast services. The earth station uplinks more than 200 TV and radio channels for Europe, Africa and Latin America and provides play out solutions bundled with the satellite transmission services. It also hosts several Multiple Channels Per Carrier (MCPC) platforms for various satellites including Eutelsat, Intelsat, SES, Gazprom and HellasSat covering Europe, Africa and Latin America. Among its clients include leading international broadcasters such as Disney, FOX Networks, National Geographic, Viacom and Viasat who count on VIVACOM as a reliable and trusted partner, said Rangelov.

The company, however, has a clear view of the future of their business. They have made substantial investments in upgrading its facilities to meet the requirements of the new services including enhancing the power plant of the teleport to 1MW and its terrestrial connectivity with redundant DWDM fiber links to main PoP's in Europe. They also invested in the latest DVB-S2x iDirect hub providing regional Maritime VSAT coverage and land VSAT in Africa,

where they see growing demand.

But they clearly have their sights on the upcoming LEO constellations and the new GEO HTS projects and have made key investments in preparation for that. They have already been selected by Eutelsat to host one of their Ka-Band gateways. VIVACOM also hosts S- and X-band LEO earth station for nano satellites for its partner Endurosat—a Bulgarian company manufacturing cubesats. They provide end-to-end LEO Ground Station Services with Endurosat and are prepared to provide similar hosting and gateway services for the upcoming LEO constellations.

Apart from its superb infrastructure, VIACOM has a dedicated team of professionals who are very passionate about satellite communications. "But the most important advantage is that we're providing the right service fast and on time. We exceed our customer expectations and we deliver more for our clients with unparalleled service reliability. Customers also optimize their costs using our services. We invest long term in satellite business and we have excellent relationship with our partners and clients," said Rangelov.

With increasing competition and changing customer requirements, these are challenging times in the teleport business. With such a rich history, VIVACOM is able to draw on its vast experience while making key investments for the future. It's a teleport well equipped to face the coming challenges ahead.

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A Truly *Fan-SAST-ic* Week: The 8th CSA-IAA Conference on Advanced Space Technologies, and a Visit to SAST

by **Blaine Curcio**

Space industry conferences come in all shapes and sizes. As someone who has spent most of my career covering the commercial and government satcom industry, most of the conferences I attend are more commercial in nature—discussion tends to focus on business plans that are already in existence, or otherwise, on the horizon. This year, for the first time, I was fortunate enough to be invited to the 8th CSA-IAA Conference on Advanced Space Technologies, a conference held every two years in Shanghai, and hosted by the Chinese Society of Astronautics (CSA), the International Academy of Astronautics (IAA), and the Shanghai Academy of Spaceflight

Technology (SAST). The conference featured a number of academic talks about conventional space industry topics (mine was on LEOs vs. GEOs in HTS, for example), but

also hosted some talks on, as the conference name would suggest, advanced space technologies, and other, more out-there topics. The conference week was wrapped up with a Friday site visit to co-host SAST, which proved to be one of the highlights of the week.

China on the Move

One of the most interesting talks throughout the conference was one given by Zong Wenbo, the Sec-

retary of the Party Committee and Vice President of SAST. Among other things discussed was a layout of a 30-year plan for Mars, which would involve a “small base, livable home” on the red planet by as soon as 2036, as shown at right. The “Mars Environment-Friendly Project”, as described by SAST, will be undertaken by the broader CASC organization, given the project’s size and scope, and has an objective of “focusing on major scientific issues such as artificial intelligence, origin and evolution of life, exploration of extraterrestrial life, and livability of extraterrestrial objects....to build Mars into an environment-friendly and harmonious home for human habitation”.



In addition to Mr. Zong’s speech, Zhou Hui of the China National Space Administration provided an overview of the Belt and Road Spatial Information Corridor, a long-term project by Chi-

na to develop the space infrastructure along the Belt and Road countries (basically all of Eurasia and Africa plus others). The Spatial Information Corridor includes short, medium, and long-term goals, which can effectively be characterized as building China’s space capabilities through export to BRI countries, while also helping the BRI countries develop their own nascent space programs, and eventually, have some exchange of talent between these regions.

Fast SAST Facts	
Name	Shanghai Academy of Spaceflight Technology (SAST)
Established	1961
Employees	~17,000
Budget	RMB 17 billion (US\$2.5 billion)
Major projects	Long March-2, 4, 6 Fengyun satellites

as well as building a space-ground integrated information network. While very different in terms of content (one being interplanetary, the other being multinational), Mr. Rong and Ms. Hui's two speeches provided insight as to China's long-term space ambitions, and were two of the more interesting speeches at the conference.

Other speeches included several by foreign dignitaries, including a speech on property rights in space (we need them), as well as speeches on various industrial materials and their properties. Another highlight of the conference was the translation technology used. For both English and Chinese speakers, the conference had both human interpreters and an AI interpreter. The human interpreters were, as is normally the case, speaking into earpieces, but the AI interpreter was listening, and then typing the translated text on the screen to the left and right of the speaker. As was highlighted by the conference organizers, the AI was rather better at translating Chinese into English (more voice data for Chinese), but even the English into Chinese was, as far as I could tell, quite not bad. On the whole, the conference was somewhat more academic, and a bit more futuristic than most that I have attended, but it was an interesting and enlightening experience.

The Visit to SAST

On the Friday of the conference week, SAST organized a visit to their facilities. Going into the

Ms. Hui visit, my expectations were fairly high—SAST is a massive subsidiary of CASC, with roughly 20,000 employees. Noteworthy among CASC subsidiaries, SAST is the only one that manufactures both rockets (Long March-2, 4, and 6), and satellites (EO and meteorology), in addition to a variety of components such as solar panels. Despite my high expectations, the facilities clearly surpassed them. The only unfortunate element to the visit was that photos were not allowed inside, which means any below photos from inside of SAST were taken from their official website. With that being said, the visit to SAST had a number of highlights.

There are, in fact, several of these rooms throughout the SAST facility, of which a smaller one is pictured here. The photo shows stages for the LongMarch-2D, which, for reference, has a height of around 40m/130 feet, and can carry 3,500kg

visit, my expectations were fairly high—SAST is a massive subsidiary of CASC, with roughly 20,000 employees. Noteworthy among CASC subsidiaries, SAST is the only one that manufactures both rockets (Long March-2, 4, and 6), and satellites (EO and meteorology), in addition to a variety of components such as solar panels. Despite my high expectations, the facilities clearly surpassed them. The only unfortunate element to the visit was that photos were not allowed inside, which means any below photos from inside of SAST were taken from their official website. With that being said, the visit to SAST had a number of highlights.



Long March 2-D Rocket Stages

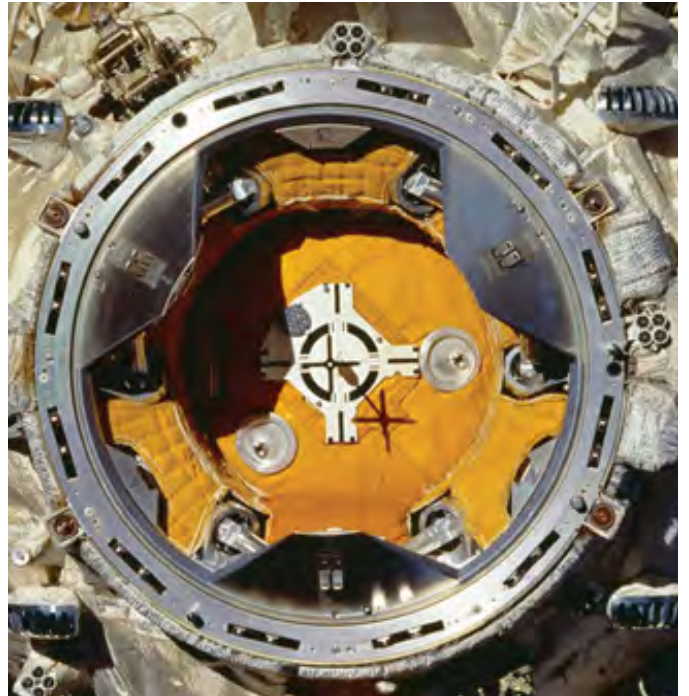
to LEO, or 1,300kg to SSO. SAST also manufactures the slightly larger Long March-4B, and the liquid-powered Long March-6, for which there are also aspirations for reusability. The main takeaways from SAST's rocket assembly room, basic as it sound, was that holy moly, these rockets are huge. To see employees walking around the rockets like Lego men and women, and to then imagine that within China's main space contractor (and SAST parent company), CASC, there are probably 5-10 more such rooms throughout China, was to finally start to realize that, as it turns out, China's record of 38 successful launches in 2018 is no easy feat, it takes a lot of rocket assembly rooms.

The Docking Mechanism Rooms

One of SAST's most interesting projects is the creation and refinement of the docking mechanisms that are used for China's Space Station and its associated spacecraft, the Shenzhou and Tianzhou. As the manufacturer of a docking mechanism allegedly based on the Soviet APAS-89 (pictured at left in absence of a photo of the Chinese equivalent), SAST had two large rooms for testing the docking mechanisms. The two rooms included a horizontal test room and a vertical test room. The horizontal test room has a huge and perfectly flat surface, on either side of which were half of the docking mechanism. When performing a test, a layer of highly pressurized air lifts the two docking mechanisms, and they are able to float into one another, testing their ability to dock. The vertical test room, as the name would imply, involved a similar test, albeit with a huge, balloon-like structure protruding from the ceiling, in which one side of the docking mechanism was stored.

Elsewhere in SAST

Other than the rocket assembly room and the docking mechanism room, there were a variety of sights to see inside of SAST's massive facility. This included SAST's facilities for manufacturing solar cells and other batteries, an area that the company is using to try to diversify its business. One example that we saw was a motorbike that was powered by a hydrogen fuel cell that had been developed by SAST. Elsewhere in the facilities were photographs and models of arguably the most famous satellites produced by SAST, the Fengyun series of meteorological satellites. Finally, we were able to see examples of SAST's involvement in China's various lunar missions, including the power supply,



Soviet APAS-89 Docking Mechanism

deep space measurement and control devices, and digital transmission technology on the Chang'e-3/Chang'e-4 missions. The very last stop of our trip was the entry hallway, which showed a mural of the China Space Dream, including a Long March-6 and other SAST Easter Eggs. As it was the only area in the entire tour in which we were allowed to take a photo, it seemed impolite to not take the opportunity!

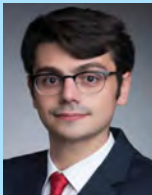


The author at the "China Space Dream" mural.

Conclusion

The 8th CSA-IAA Conference and the ensuing visit to SAST was a great experience. Having done much study of SAST as part of projects for my own company, and for Euroconsult, to have the chance to finally go and see the company was both educational and inspirational. The conference and visit were well-attended, with an impressive number of foreign delegates. While I will certainly not be attending next year (it is every two years), I very much hope to attend the 9th conference in 2021—perhaps by then, SAST will have relaxed its photography policy, and we can get some real photos of the docking rooms! 🇨🇳

“...The conference highlighted several major tasks for China’s aerospace industry in the next five years, including developing three major satellite systems for remote sensing, communication, and broadcast, as well as building a space-ground integrated information network...”



Blaine Curcio is the Founder of Orbital Gateway Consulting. He’s an expert on the commercial space and satellite industries with a focus on the Asia-Pacific region. He can be reached at: blaine@orbitalgatewayconsulting.com



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November 12-14, CITIC,

Cape Town, South Africa

Amos Spacecom

Booth E.46

www.amos-spacecom.com



Spacecom is a leading operator which offers a variety of services to television broadcasters, direct broadcast operators, government organizations, enterprise networks. The AMOS fleet of advanced satellites consists of the AMOS-3 & AMOS-7 satellites co-located at 4°W, AMOS-4 located at 65°E, and AMOS-17 located at 17°E. AMOS-17 was specifically designed for the African continent with unique high throughput C-band as well as Ku and Ka beams.

ARABSAT

Booth C.67

www.arabsat.com



Founded in 1976 by the 21 member-states of the Arab League, **Arabsat** has been serving the growing needs of the Arab world for over 40 years, operating from its headquarters in Riyadh-KSA and two Satellite control stations in Riyadh and Tunis. Now one of the world's top satellite operators and by far the leading satellite services provider in the Arab world, it carries over 500 TV channels, 200 radio stations, pay-tv networks and wide variety of HD channels reaching tens of millions of homes in more than 80 countries across the Middle East, Africa and Europe—including an audience of over 170 million viewers in the Middle East and North Africa (MENA) region alone tuned into Arabsat's video "hotspot" at 26°E.

Comtech EF Data Corp.

Booth D70

www.comtechefdata.com



Comtech EF Data Corp. is a leading supplier of communications equipment with a focus on satellite bandwidth efficiency and link optimization. Our high-performance satellite communications ground equipment is deployed globally to support mission-critical and demanding applications for government, mobile backhaul, premium enterprise and mobility. Service providers, satellite operators, governments and commercial users wanting to optimize communications, in-

crease throughput and delight customers leverage the performance and flexibility of the Comtech brand. The solutions are facilitating fixed and mobile networks in 160+ countries and across every ocean.

Es'hailsat Qatar Satellite Company

Booth E50

www.eshailsat.qa



Es'hailSat, the Qatar Satellite Company, is a communications satellite operator headquartered in Doha, Qatar. Es'hailSat was established in 2010 with the goal of managing and developing Qatar's presence in space. The company provides independent, high-quality, advanced satellite services to broadcasters, businesses and governments in the MENA region and beyond.

With the aim to be a truly global satellite operator and services provider, Es'hailSat started the operation of its first satellite Es'hail-1 at 25.5° East in 2013 supporting key broadcasters in the region, beIN SPORTS and Al Jazeera Media Network. Es'hail-2, the company's second satellite was launched on November 15, 2018 and entered in commercial service early 2019 at the 26° East orbital position.

Gazprom Space Systems

Meeting Room Village #5

www.gazprom-spacesystems.ru



Gazprom Space Systems (GSS) is a Russian satellite operator providing high quality Yamal capacity all over the world. Yamal satellite fleet consists of four satellites, namely Yamal-202 (49°E), Yamal-300K (183°E), Yamal-401 (90°E) and Yamal-402 (55°E). Due to high performance and wide coverage areas, Yamal satellite capacity is in high demand over Asia-Pacific, Middle East, Europe, Russia and CIS. It is perfect for Backhaul, Trunking, Broadband, mobility and SNG services.

Integrasy S.A.

Booth F8

www.integrasy-space.com

Integrasy is a privately owned company specialized on engineering and manufacturing Satellite Spectrum Monitoring



systems, broadcasting and VSAT telecommunications markets.

Integrasys was founded in 1990 by Hewlett-Packard engineers' experts on Automated RF & Microwaves Test Systems and Software and the Marquess of Antella. Since then, Integrasys has evolved towards today's company, offering a wide range of Carrier Monitoring Systems and VSAT Commissioning Tools.

Our mission is to provide the industry the best quality and fastest satcoms technology available in CMS & VSATs, with the customer service and care that our customers deserve.

ND SatCom

Booth A47

www.ndsatcom.com

At Africom 2019, **ND SatCom** will be highlighting its **SKY-WAN 5G** product which features: One compact device for all applications and network roles; Smallest hub on the market; and supports all kinds of topology.



The SKYWAN 5G satellite router is a reliable, flexible and versatile satellite communication platform for customer centric networks. It is a bi-directional MF-TDMA plus DVB-S2X system that supports voice, video and data applications in the most bandwidth efficient manner combined with unrivalled real-time performance.

Newtec (ST Engineering iDirect)

Booth F9

www.newtec.eu



Newtec (now ST Engineering iDirect) is specialized in designing, developing and manufacturing equipment and technologies for satellite communications.

As a pioneer in the industry, we are dedicated to creating new possibilities for the broadcast, consumer and enterprise VSAT, government and defense, cellular backhaul and trunking and mobility, offshore and maritime markets.

Our products and technologies can be applied in a wide range of single and multiservice applications from DTH broadcasting, video contribution and distribution and disaster recovery and backbones for cellular backhauling, to small and medium enterprises, SCADA and oil and gas networks, aircraft and vessels.

In October 2019, Newtec was acquired by ST Engineering as part of its satellite communications (satcom) business

within ST Engineering Electronics, leading to the integration of its business with that of ST Engineering iDirect.

RSCC

Booth C34

www.rsc.ru



Russian Satellite Communication Company (RSCC)

is the Russian GEO satellite operator with global coverage. RSCC provides a full range

of communications and broadcasting services via its own terrestrial telecom facilities and satellite constellation; e.g. video distribution and contribution, DTH, DSNG, broadband Internet access, IP trunking and cellular backhaul, maritime mobility, SCADA, enterprise networks connectivity and other. The company operates various regional satellite TV distribution networks and corporate VSAT networks for fixed and mobile customers.

Spacebridge

Booth D40A

www.spacebridge.com



SpaceBridge Inc. is an established supplier and global market leader

in broadband satellite communications technology. The company

develops and provides satellite network equipment and services, VSAT HUBs, Terminals for Point-to-Point, Point-to-Multi-Point, and Mesh typologies, as well as SCPC broadcast modems for GEO & NGSO satellite constellations and Cloud-Based managed services.

UHP Networks

Booth F5

www.uhp.net



UHP Networks is a leading global manufacturer of advanced VSAT networks

and systems. Headquartered in Montreal, Canada, the company has over 380 networks and over 45,000 remote

terminals installed in 50 countries. Among its customers are Fortune 500 corporations, major broadcast networks, top-tier US Mobile Network Operators and government agencies. UHP has the industry's first software-defined VSAT router, offering unparalleled processing capability (packets per second, Mbps, TCP sessions) per W of consumed power and superior bandwidth efficiency owing to the industry's most sophisticated TDMA protocol and DVB-S2X signaling. The company won the 2018 VSAT Stellar Award for Best Ground Segment Technology.

Linking Budgets, Linking Networks, Linking Capacities

by **Alvaro Sanchez**

Link budgets are living a new era. Not only capacity engineers are capable to make this calculation for the quotes. This way of calculating all the gains and losses between transmitters and receivers in satellite communications have significantly changed.

The first step in designing a satellite network is to perform a satellite link budget analysis. The calculation of the received power is a set of complicated processes that not everyone could find the right answer, therefore, a specialist is called to manage this complex task involving a complex excel sheet. Now, everybody in the satellite industry can calculate the link budget margin with just using Beam Budget.

Then, you would ask, what is Beam Budget? It is a web-based easy to use; the simplest for quick and accurate link budget calculations. This software solves thousands of link budget calculations in a few seconds.

In terms of user experience, this tool has a user-friendly interface with the ability to generate incredible graphics and charts along with the most relevant conclusions. This data is easy to understand for the entire network, including all profits and losses. In this way, sales representatives have

the possibility to provide a correct offer in a very short period time, doing the link budget themselves.

One of the biggest issues with a link budget calculation is the volume of parameters that need to be input in order to obtain an accurate calculation. With the link budget tool, the only requirement is to fill a few inputs, after that, you will be getting more than 200 results instead of taking 1 or 2 weeks. Op-

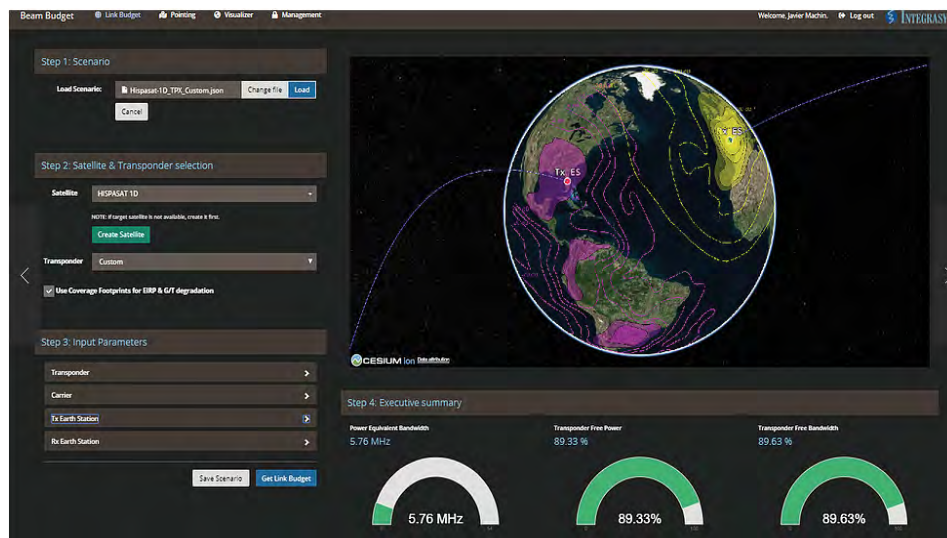
timizing time ensuring accurate calculations is relevant to everybody.

On the one hand, signal degradation is not allowed in this industry, no selecting the wrong satellite or transponder. On the other

hand, completing link budgets correctly and accurately with the correct tool, maximizes revenue and available user capacity. As a result, customer experience will increase exponentially and service reliability will increase much more, allowing a major number of business.

Beam Budget provides users with charts and maps that help them quickly and easily visualize the relevant results of the link transmission speed and margins, as well as bandwidth and power to use for the desired availability.

In most cases, this work requires at least 70 parameters that include: Uplink power amplifier gain





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and noise factors; Transmit and receive antenna gain; slant angles and corresponding atmospheric loss over distance; climactic attenuation factors; satellite transponder noise levels and power gains; receive antenna and amplifier gains and noise factors; cable losses; adjacent satellite interference levels; and intermodulation interferences. However, Beam Budget requires less than half of them for the same accuracy.

The goal of Integrasys was to ensure that all possible frequency bands and types of satellites were covered in a single tool, rather than having to further complicate matters using multiple tools, and it does with great results when the functionalities of different tools can be brought together in a single web-based app.

Each input needs its own elaboration separately, for both the uplink and downlink frequencies. With the tool, the company wanted to introduce a tool that could provide highly accurate results with fewer inputs. This tool can provide more than 2500 link budget calculations with 200 results from just 45 inputs. Moreover, Integrasys has developed a new full-duplex function in which performs calculations from the HUB to the VSAT and the VSAT to the HUB, and a latest option to a regional network link budget.

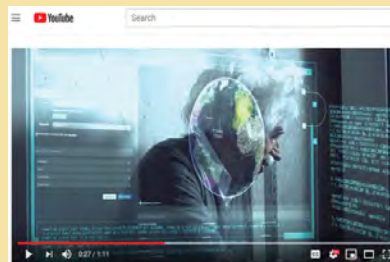
The software is available for every frequency band and enables users to upload different types of satellite data. Every modulation is also supported. The result is the most accurate link budget calculation product possible for a perpetual use.

For a commercial visit to any customer, the link budget is really important for the purchase and sale satellite capacity. These calculations allow satellite operators to confidently establish new satellite networks to ensure the best performance for a client network. Established networks use link budgets to calculate and demonstrate the capabilities of potential customers, as well as satellite users need these tools to ensure the service, selecting is the right choice.

If link budgets cannot be completed quickly enough, this could result in lost opportunities and costly expenses. Similarly, if a customer comes on board without an accurate calculation, they may quickly take their business elsewhere if the result

View a video on Link Budgets at:

<https://www.youtube.com/watch?v=KnD-42wlf6ko>



does not match the expectations.

Quick and accurate link budget calculations are essential, making this tool accessible to anyone within an organization, as well as facilitating stakeholder understanding with the executive summary report.

As conclusion, Integrasys delivers disruptive technologies to simplify the satcom industry, bringing satellite to the people, facilitating operations, increasing revenues, saving up operational expenses and ensuring the maximum performance of the networks. Beam Budget is the finest solution for calculating link budgets easily, accurately and obtaining a considerable return on investment. Now, link budgets are more accurate and easier than ever.

Founded in 1990 by the Marquess of Antella and Hewlett Packard (HP) engineers, Integrasys specialises in providing satellite spectrum monitoring systems for the satellite, telecommunication, and broadcast markets. Its solutions enable fast and efficient installation and monitoring, helping reduce both errors and cost.

For more information, please visit <http://www.integrasys-space.com/>



Alvaro Sanchez is the CEO of Integrasys, which specialises in providing satellite spectrum monitoring systems for the satellite, telecommunication, and broadcast markets VSAT Tools for VSAT deployment and maintenance. He can be reached at:

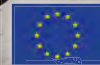
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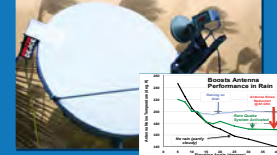
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Satellite, 5G, Cyber Security for a ‘Global Digital Ecosystem’

by **Martin Jarrold**

Last month I spoke at an event for information technology security professionals in Riga, Latvia. The theme of my presentation was a little off the mainstream of topics addressed during the several tracks of the program – unsurprisingly heavily focused on cyber security, but also covering the continuing evolution of 5G, the upcoming generation of terrestrial mobile broadband communications. However, the organizer’s annual invitation to GVF to contribute to the program has, at least in recent years, had a contextual parallel as the role of satellite as an essential and integral part of the future 5G “network of networks” has increasingly been defined and been recognized beyond the standards-setting environment of the 3GPP and, also, more widely than in the satellite industry itself.

My choice of title? A “Network of Networks” for Digitally Driven Sustainability: A Cyber Secure Satellite-5G World. An alternative title might have been “Triangles”. What follows will explain the rather cryptic nature of this alternative.

The train of thought which led to my choice of the actual title was initially influenced by the inter-relationships between the vertices of a number of conceptual “triangles”, the first of which features – satellite, 5G, and cyber security.

Issues pertaining to the sat-



ellite-cyber security relationship have been well-addressed by the satellite industry through GVF (jointly with two of its sister industry associations), with the initial promulgation in 2017 (updated in 2018) of the Joint Statement on the Satellite Industry’s Commitment to Cyber Security and a Secure Supply Chain which set-out a series of core principles to which industry organizations should adhere on a voluntary and collaborative basis, without mandating regulation being externally imposed. The essence of these principles is as follows:

- Security and risk manage-

ment should be part of an organization’s overall corporate culture;

- Organizations should, implement and maintain best practices to protect against evolving threats, including by leveraging industry-driven resources to inform their own development of voluntary, proactive, risk-based approaches to risk mitigation;

- Collaboration, not regulation, is the best way for organizations to manage cyber risks;

- Voluntary information-sharing among the private sector, between the private sector and government, and between the private sector and end users is vital.

European Space Agency (ESA) engagement in the satellite-cyber security environment is most recently evidenced by their call for proposed solutions to determine the viability of satellite-based services in support of cyber security and to assess technical feasibility and commercial viability for diverse, current and future, vertical sector users of satellite, the most vulnerable having been identified as being maritime, aeronautical, smart vehicles, financial services, energy infrastructure and emergency services. Potential solutions, which should include

Following the Signal

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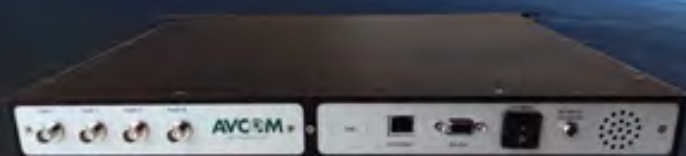
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contributions from innovative technologies – Artificial Intelligence, Machine Learning, Big Data analytics – will be enabled by space as a means to mitigate the cyber security risks and to enhance cyber resistance and the resilience of existing infrastructures, services and operations, and contribute to enhancing the end-to-end cyber security of space-based applications.

As for the satellite-5G inter-relationship in my conceptual “triangle”, the 3GPP – the 3rd Generation Partnership Project uniting seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), providing their members with an environment to produce the Reports and Specifications that define 3GPP technologies, including 5G – has said the incorporation of satellite networks will help enable 5G service rollouts in unserved and under-served areas, enhance reliability and increase service availability everywhere to the benefit of critical communications and transportation applications.

A wide range of 5G Satellite Use Cases have been identified and the NetWorld 2020 Satellite Working Group European Technology Platform has noted that “Satellites will integrate with other networks rather than be a standalone network to provide 5G and this integration forms the core of the vision.” Release 17 of the series of 5G standards enhancements releases from the 3GPP, which is due to be published in 2021, will further reinforce the satellite element of the “network of networks” and will reflect the focus of GVF Mem-

“...Security and risk management should be part of an organization’s overall corporate culture...”

bers, from across the industry value-chain, that are directly engaged in the development of solutions that are geared to be fully 5G ready.

Due to limitations to the word count of this column I will not address in detail the third side of my conceptual “triangle”, the 5G-cyber security inter-relationship, here, with the exception of noting that governments, telecoms network companies and technology groups are working on heightened security standards for 5G and the Internet of Things. Whilst there are apparent flaws in 5G security – such as the use of fake mobile base stations to steal information – 5G data encryption and network user verification mechanisms have improved on 4G, but the 5G weak link is in communication of IoT devices connected to 5G networks, particularly when manufacturing default passwords on such devices are not upgraded.

My second conceptual “triangle” is that of the characterization of 5G itself, divided between the three major use cases (the vertices?) of: [1] enhanced Mobile Broadband (eMBB); [2] massive M2M Communications (mMTC); and, [3] Ultra Reliable Low Latency Communications (URLLC). In combination, the major use cases encompass:

[1] Web browsing, video streaming and virtual reality, together generating 10,000 times more traffic than over 4G networks, with greater than 10 Gbps peak data rates and provid-

ing 100 Mbps whenever needed. New applications will include fixed wireless internet access for homes, outdoor broadcast applications without the need for broadcast vans, and greater connectivity for people on the move;

[2] Narrowband Internet access for sensing, metering, and monitoring devices. The Internet of Things (IoT) connecting billions of devices without human intervention at a scale not seen before. Has the potential to revolutionize modern industrial processes and applications including agriculture, manufacturing and business communications;

[3] Services for latency sensitive devices requiring sub-millisecond latency with error rates that are lower than 1 packet loss in 10⁹ packets. Mission critical including real-time control of devices, industrial robotics, vehicle to vehicle communications and safety systems, together with remote medical care, procedures, and treatment.

The third conceptual “triangle” I have employed was prompted by a United Nations paper – a product of the Development and Environment programs, UNDP and UNEP, authored by Jillian Campbell and David E. Jensen – which discussed the building of a “Global Digital Ecosystem”. The three vertices of this, the third of my conceptual “triangles”, are Socio-Economy, Development, and Environment, elements of the United Nations Sustainable Development Goals.

In 2015, the UN adopted 17 SDGs as part of the Agenda 2030

MARKET INTELLIGENCE

to achieve a better future for all humanity. Radio communications, including satellites – and, therefore the related areas of the forthcoming “network of networks” with integrated satellite and 5G, and of cyber security – have a key supporting role in achieving the 17 SDGs.

This is all the more evident when noting, as does the UNDP, that 68 per cent of the 93 environmental SDG indicators cannot currently be measured due to lack of data. This other “digital (gap) divide” must be bridged, enabling us to acquire and deploy data sets to build a digital ecosystem for the entire planet which will allow data flows to be eventually trans-

formed into insights for sustainable decision-making. This will require various “frontier technologies” – cloud & edge computing; AI & machine learning; IoT; social media platforms; blockchain & distributed databases; software; mobile apps; ACR & VR; and, with reference to the recent news from Google, quantum computing – but also satellite and related communications technologies.

All this must happen with a much elevated and broader understanding of the long-term models and incentives that will sustain these efforts. What is needed is to determine how such efforts can protect data security, achieve interoperability, and maintain high standards, whilst answering the question “Will governance be voluntary and collaborative or regulated and mandated?”



Martin Jarrold is Vice-President of International Program Development of GVF. He can be reached at:

martin.jarrold@gvf.org

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Arqiva Sells its Telecom Division to Cellnex

London, UK, October 8, 2019--Arqiva Group Limited, the leading UK communications infrastructure company, announced that it has reached an agreement with Cellnex for the sale of its telecoms infrastructure and related assets at an enterprise value of £2.0bn.

The transaction comprises c.7,400 of Arqiva's cellular sites, including masts and towers as well as urban rooftop sites, and the right to market a further c.900 sites across the UK.

Cellnex is a significant pan-European tower operator

with sites in the UK, Ireland, Spain, Italy, France, Switzerland and the Netherlands. The acquisition continues Cellnex's investment in the UK and follows their previously announced long-term strategic agreement with BT in June 2019, whereby Cellnex obtained the rights to operate and market 220 high towers located throughout the UK.

The Arqiva telecoms division serves all four UK mobile network operators individually, as well as holding contracts with the two joint ventures they operate between them (Cornerstone (CTIL) and MBNL). Arqiva's towers operate on a neutral host basis.



EchoStar Acquires Helios Wire

Englewood, Colo., October 25, 2019 - EchoStar Corporation announced that its subsidiary, EchoStar Global, has acquired Helios Wire, a satellite-enabled IoT connectivity company headquartered in Vancouver, Canada. The acquisition includes Helios' Australian subsidiaries Sirion Holdings and Sirion Global.

Sirion Global holds global spectrum rights for S-band Mobile Satellite Service (MSS), administered by Australia, and has been working to develop solutions for high volume asset tracking and monitoring applications by satellite.

"This acquisition advances our strategy and further lays the foundation for a global S-band solution for the future," said Anders Johnson, Chief Strategy Officer, EchoStar. "Our aim is to develop S-band technologies that will dramatically reduce the cost of satellite IoT, including machine-to-machine (M2M)

communications, public protection and disaster relief (PPDR) and other end-to-end services worldwide."

Johnson continued: "Over time, EchoStar products and services will be integrated into the new global, hybrid networks that leverage multiple satellites and terrestrial technologies. This acquisition of Helios and Sirion Global positions us closer to realizing that vision."

"Helios' shareholders are pleased to have concluded the sale of Helios and the Sirion subsidiaries to EchoStar," said Raghu Das, co-founder and Chief Operating Officer, Helios.

"EchoStar has a wealth of S-band experience in the United States and Europe and is the perfect operator to take this project forward and accelerate the build-out of the Sirion constellation and deployment of global IoT services."

"We are confident that the transaction will provide economic and communications benefits to Australia, Sirion's home jurisdiction, and around the world," said Peter Ruderman, co-founder of Helios. "We thank the Australia Communications and Media Authority and other Australian authorities for the support they have given Sirion over many years."

The acquisition occurred by way of a court approved plan of arrangement under the Business Corporations Act (British Columbia).





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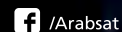


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Dave Kaufman Named CEO of Ball Aerospace

Broomfield, Colo., October 29, 2019—Ball Aerospace announced that Dr. Dave Kaufman has been named chief operating officer, effective January 1, 2020. Kaufman joined Ball Aerospace in 2000 as Senior Program and Capture Manager, National Security Space. Since 2013, he has served as vice president and general manager of the National Defense Strategic Business Unit, where he has made a significant impact.



Dave Kaufman

Mark Healy, currently vice president of the National Intelligence Systems Mission Area within National Defense, will succeed Kaufman as vice president and general manager of the National Defense Strategic Business Unit. Healy has more than 30 years of experience in the U.S. Army and aerospace and commercial industry sectors.

Viaccess-Orca Appoints Forbin as CSO

Paris, France, Oct. 30, 2019—Viaccess-Orca (VO), a provider of OTT and TV platforms, content protection, and advanced data solutions, announced the appointment of Guillaume Forbin as Chief Security Officer (CSO). Forbin will ensure that VO's content protection solutions — including CAS, DRM, and secure video player — and associated services address current and future TV piracy threats.



Guillaume Forbin

Forbin was previously Director, Platform and Content Security at OSN, a leading pay-TV network in the MENA region, headquartered in Dubai. He was responsible for securing OSN's pay-TV distribution platform and protecting premium exclusive content against a wide variety of piracy threats. Under Forbin's leadership, his team won an industry innovation award for OSN's in-house-developed anti-piracy solution.

Prior to OSN, he led The Walt Disney Company's content security efforts throughout EMEA by formulating and executing a regional content protection policy for distribution deals, defining content protection standards aligned with piracy challenges and business constraints. He also participated in the development of multiple Sagemcom devices as well as Sony Bravia TV sets throughout the course of his career.

Forbin holds a Ph.D. in computer vision from the University of Surrey as well as a Master of Science in computer science from the University of La Rochelle.

In addition, VO has announced two new promotions within the ranks to further strengthen VO's leadership team. Philippe Lasry is now Executive Vice President of Solutions Marketing and Arnaud Alvarez is the Executive Vice President of Global Sales.

Ivers Appointed CPI COO

Palo Alto, Calif., October 15, 2019 - Communications & Power Industries (CPI) has announced that Andrew C. Ivers will join the company as its new chief operating officer, effective November 4, 2019.

Ivers will report directly to Bob Fickett, president and chief executive officer of CPI, and will be responsible for implementing the company's growth strategies and helping lead operational excellence initiatives.

Ivers is an experienced manager

and engineer in the electronic components and subsystems industry, and a seasoned veteran of defense and communications companies. Prior

to joining CPI, Mr. Ivers served as an executive for 18 years at L3 Technologies,



Andrew Ivers

most recently as

corporate senior vice president and the president of its Communications Systems business segment. Ivers also held previous management roles at Harris Corporation and Raytheon Co. He has an MBA from the University of Rochester's Simon School of Business and a bachelor of science in electrical engineering and mathematics from the University of California, Irvine.

Orbion Appoints Orndorff VP of Biz Dev

Houghton, Mich., October 16, 2019 - Orbion Space Technology, developer of next-generation small-sat propulsion systems, announced the appointment of Greg Orndorff, Vice President of Business Development.

Most recently, Greg was Vice President, Government Systems at Vector Launch—responsible for developing a New Space commercial launch initiative for the United States Government. Prior to Vector Launch, Greg held executive and senior management roles at SGT, Inc., the Johns Hopkins University Applied Physics Laboratory (Space department), Northrop Grumman, and Orbital Sciences Corporation. Greg is a former United States Air Force Officer where he performed tours in operations and acquisition of space systems.

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Earth Observation Data and Services Market to Grow by 9% in the Next Decade

Paris, France, November 1, 2019 – In its new survey titled, “Satellite-Based Earth Observation Market Prospects to 2028”, Euroconsult forecasts that the market for data and services derived from Earth observation (EO) satellites is expected to grow by 9.4 percent each year for the next ten years for a total upside market value of US\$ 12.1 billion by 2028.

“We expect that growth in demand for Earth imagery will be driven by a mix of defense and new commercial organizations,” said Alexis Conte, report editor and Senior Consultant at Euroconsult. “This will be supported by the arrival of new constellation operators with lower-cost solutions, attracting new customers to the one-meter resolution market. At the same time, some revenue from this segment is expected to move to the 50-centimeter and below resolution market, dominated by traditional satellites.”

Governments are expected to continue to be key in driving growth over the next decade. The research shows that the total civil government investment in EO programs, including meteorology, in 2018, was \$9.8 billion, reflecting 5% growth over 2017. This is the 12th year of continuous investment growth from governments and the trajectory is likely to continue with more than US\$ 10 billion of investment in 2019. According to the forecast, 52 countries will have launched at least one EO satellite by 2028.

A growing focus on multi-satellite constellations

is significantly changing the market landscape. Constellations increase the frequency of data collection for better global coverage and faster change detection. Euroconsult identified more than 20 companies that intend to develop low cost smallsat constellations for Earth observation, including satellites designed to collect optical, radar and hyperspectral imaging. The report provides detail on each of these

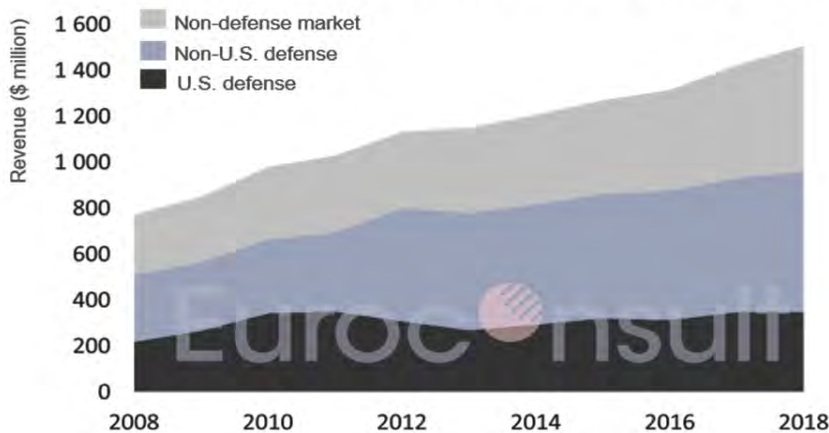
proposed constellations and the applications they are pursuing.

Analytics derived from vast quantities of multi-sourced data are driving the shift in revenue generation from imagery to services. “According to our findings, business to business opportunities for

value-added services that rely on EO data are growing,” said Pacôme Révillon, Chief Executive Officer at Euroconsult. “If changes can be detected over a given area and relayed with low latency at a competitive price, demand for EO-based solutions will grow. Location-based services and financial services are likely to be the first industries to benefit from faster access to this low-cost data in a market previously dominated by government customers.”

The report is now available for download from the Euroconsult online shop.

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Highlights from Satellite Innovation 2019

by **Bernardo Schneiderman**

The Satellite Innovation conference and exhibition held at the Computer History Museum in Mountain View, California from October 8-10 highlighted the latest industry trends and technological innovations. The conference featured over 120 speakers in 17 in-depth sessions and three keynote presentations. There was also an exhibition hall with 55 companies showcasing their products and services. The event organized by Satnews Publishers is now on its third year and is evolving into one of the must-attend industry events in the West Coast of the US.

The conference was organized in key segments such as Tech Briefs and Market Briefs and roundtable discussions. Keynote addresses were given by Stephen Spengler, CEO of Intelsat, Mark Dankberg, Chairman and CEO of Viasat, and Dr. Fred Kennedy, former Director of the U.S. Space Development Agency. Chris Baugh, President of NSR gave a Market Briefing on the High Throughput Satellite (HTS) and new Low Earth Orbit (LEO) constellations.

One of the Tech Briefs presentations was delivered by Yoel Gat, CEO of SatixFy who compared the technology of True Time Delay (TTD) antennas against the more popular Phase Digital Array (PDA) an-



tennas. Gat listed the limitations of PDA antennas and said that TTD antennas will surmount all these limitations with superior performance.

Among the companies exhibiting at the show is ACORDE. The company is showcasing its new

Satnews Publishers Founder and CEO Silvano Payne addressing the conference.

40W BUC in Ka band. It is an extremely compact version with a weight lower than 11 lbs. Another compact unit is the 100 W BUC in X band, weighting 13 lbs. On the receiver side, the wide-band LNBs in Ka covering 17.7 – 22.2 GHz, both in simultaneous outputs or switchable configurations

Space Bridge, represented by its CEO David Gelerman highlighted a high throughput modem SC1 able to handle 2 million packets per second and 1.5Gbps bandwidth.

The conference concluded with a visit to earth imaging company, Planet Labs headquarters in San Francisco.

Overall, it was a very fruitful event with in-depth discussions of industry trends and issues, key technologies on display and ample opportunities for networking.



Manuel Lobreira, CEO of ACORDE showcasing their new compact BUCs in Ka- and X-Band.

The Satellite Markets 20 Index™

Company Name	Symbol	Price		
		November 7	52-wk Range	
Satellite Operators				
Asia Satellite Telecommunications Holdings Li	1135.HK	10.34	5.00	10.36
Eutelsat Communications S.A.	ETL.PA	16.70	14.80	19.24
APT Satellite Holdings Limited	1045.HK	2.96	2.62	3.80
Inmarsat Plc	ISAT.L	555.60	355.00	617.20
SES S.A.	SES.F	17.00	12.52	19.16
Satellite Manufacturers				
The Boeing Company	BA	354.05	292.47	440.01
Maxar Technologies	MAXR	11.27	3.83	19.46
Lockheed Martin Corporation	LMT	379.77	241.18	399.96
OHB SE	OHB.DE	37	28.50	38.40
Honeywell International Inc.	HON	180.79	123.48	181.83
Equipment Manufacturers				
C-Com Satellite Systems Inc.	CMLV	1.78	1.04	1.98
Comtech Telecommunications Corp.	CMTL	34.64	20.95	36.61
Cobham Plc	CBHMY	3.98	2.31	4.52
ViaSat Inc.	VSAT	67.50	55.93	97.31
Gilat Satellite Networks Ltd.	GILT	8.07	7.60	10.74
Service Providers				
DISH Network Corporation	DISH	33.52	23.22	44.66
Globalstar Inc.	GSAT	0.37	0.29	0.73
Orbcomm Inc.	ORBC	4.60	3.58	10.47
Sirius XM Holdings Inc.	SIRI	6.78	5.23	6.88
Speedcast International	SDA.AX	0.87	0.68	4.15

The Satellite Markets 20 Index™ is a composite of 20 publicly-traded satellite companies worldwide with five companies representing each major market segment of the industry: satellite operators; satellite manufacturers; equipment manufacturers; and service providers. The base data for the Satellite Markets Index is January 2, 2008 - the first day of operation for Satellite Markets and Research. The Index equals 1,000. The Satellite Markets Index™ provides an investment benchmark to gauge the overall health of the satellite industry.

INDEX	Index Value 6-Nov-19
Satellite Markets 20 Index™	2,675.64
S & P 500	3,076.78

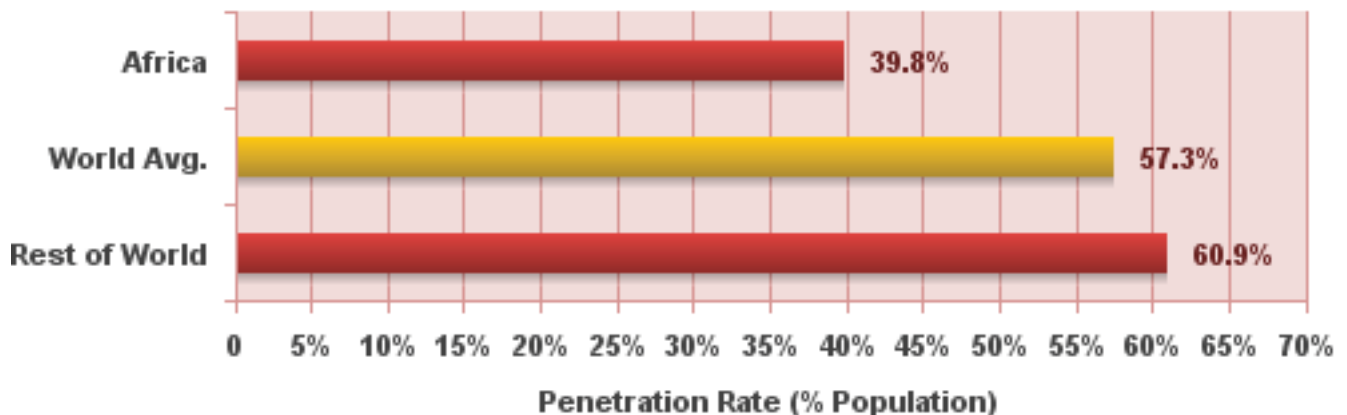
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VITAL STATS

Internet Penetration in Africa



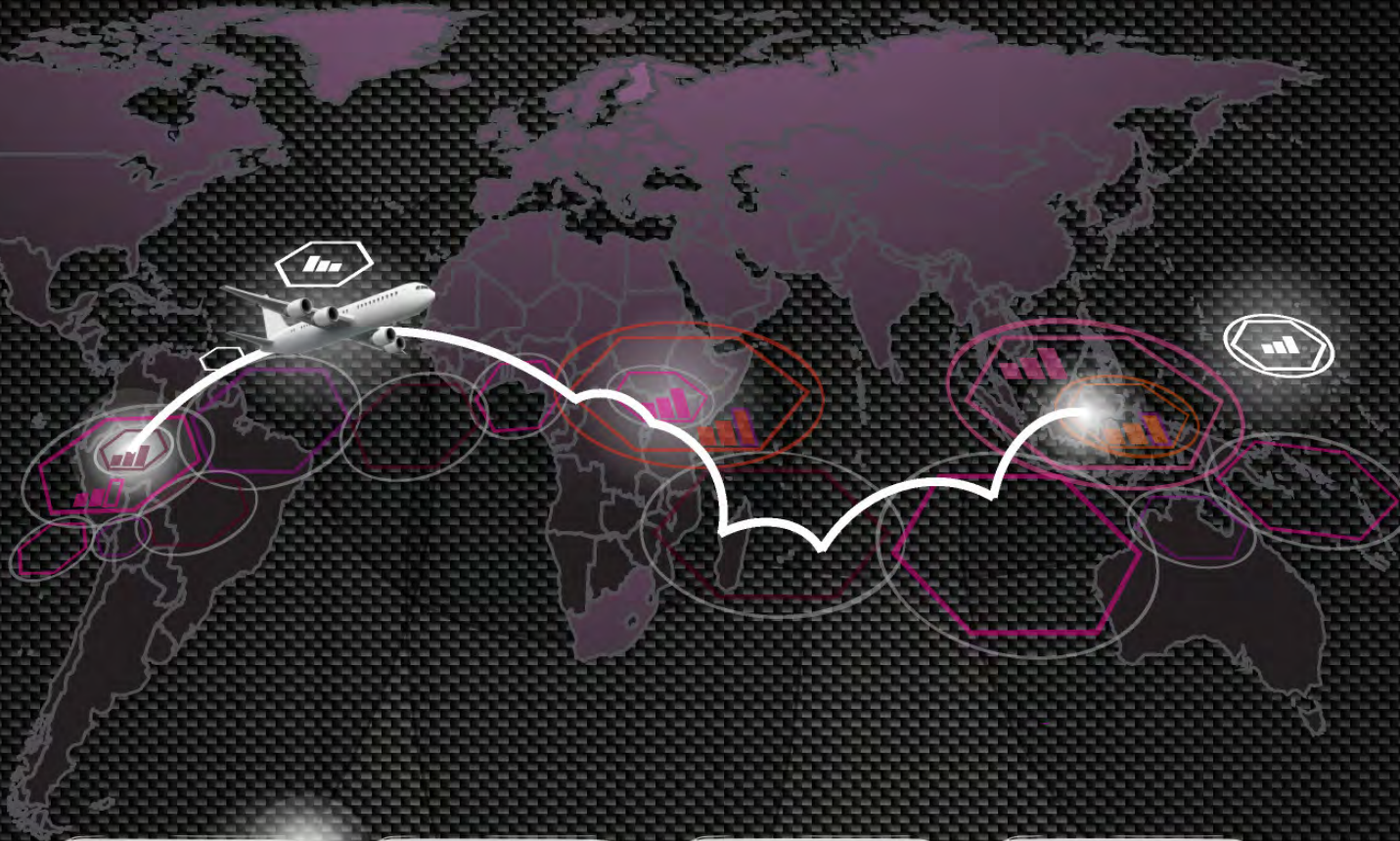
Internet penetration in Africa at 39.8 % of the population lags behind the world averages and the rest of the world.

Source: Internet World Stats.

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25W to 50W



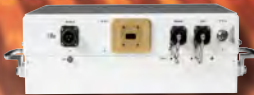
PAMIR

80W to 125W



DENALI

150W to 250W



CASCADE

300W to 500W



TAURUS

800W to 1kW



SUMMIT

1kW to 10kW

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