Satellite Executive BRIEFING

Vol. 11 No. 10 December 2018 Issue

SATELLITE Markets & Research

Industry Trends, News Analysis, Market Intelligence and Opportunities

The Year That Was and Trends to Watch

by Virgil Labrador

For our year-end issue, we look back at the year that was and extrapolate the key trends to watch for the coming year and beyond.

Each of our correspondents strategically placed in the major regions of the world has written a report on the major events of 2018 and the trends to watch in the Europe, Middle East and Africa (EMEA), Asia-Pacific and Latin American for this issue. These articles are written by Associate Editors Elisabeth Tweedie on EMEA, Peter Galace on Asia-Pacific and our correspondent Bernardo Schneiderman on Latin America. It should be noted that all our writers are experienced business professionals who have extensive industry experience. In fact, it's one of the unique differentiators of our publications. We only accept contributions from experience satellite professionals who have actually worked in the industry.

As an added bonus for this issue, we have an extensive survey of a key emerging market segment: the small satellites and Internet of Things (IoT) makket by Hub Urlings.

IoT is one of the key market segments where satellites can have an impact. Another is the 5G rollouts, where satellite can play a complementary role in 5G networks. Satellite technology is also solidifying its hold in key market segments like maritime and inflight connectivity. Oil and

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What's Inside

EDITORIAL

...from cover page

gas is also making a comeback as a key vertical. These and other trends, we examine in this issue.

In keeping with one of our slogans: *local coverage, global focus*, this issue should give you a broad overview of the trends to watch in the global industry and provide regional focus. This is in keeping with our flagship website, www.satellitemakets.com which has a global site and three regional editions with unique regional content, namely: www.satellitemarkets.com/americas, www.satellitemarkets.com/emea and www.satellitemarkets.com/asia-pacific

So I do encourage you all to read on not just this issue but throughout the year in our regularly updated website with global and regional coverage. We know you have limited time and we make our content both in our online and print publications easily accessible so that you get a good overview of global trends and regional developments.

As we enter 2019--our 12th year of publication, we like to take this opportunity to thank all of our readers and sponsors for your continued patronage and support.

Virgil Labrador
Editor-in-Chief

Satellite Executive BRIEFING
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EDITORIAL

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YEAR-END REPORT

2018 Europe, Middle East and Africa Satellite Market Trends

by Elizabeth Tweedie

A year-end summary of key events is always a difficult task. How to select, which ones to highlight out of the many things that have happened and are still unfolding? This article focuses on Europe, the Middle East and Africa, (EMEA), so I have to start with Yahsat and Thuraya.

The acquisition was first announced in April of this year, and at the beginning of August, Yahsat stated that its subsidiary Star Satellite Communications, had acquired a majority stake in Thuraya. After meeting regulatory approval, Star purchased Etisalat's 28.042% stake in the company for US$37 million. Yahsat had previously set a condition that the stake acquired, must give Yahsat at least 75.001% of Thuraya.

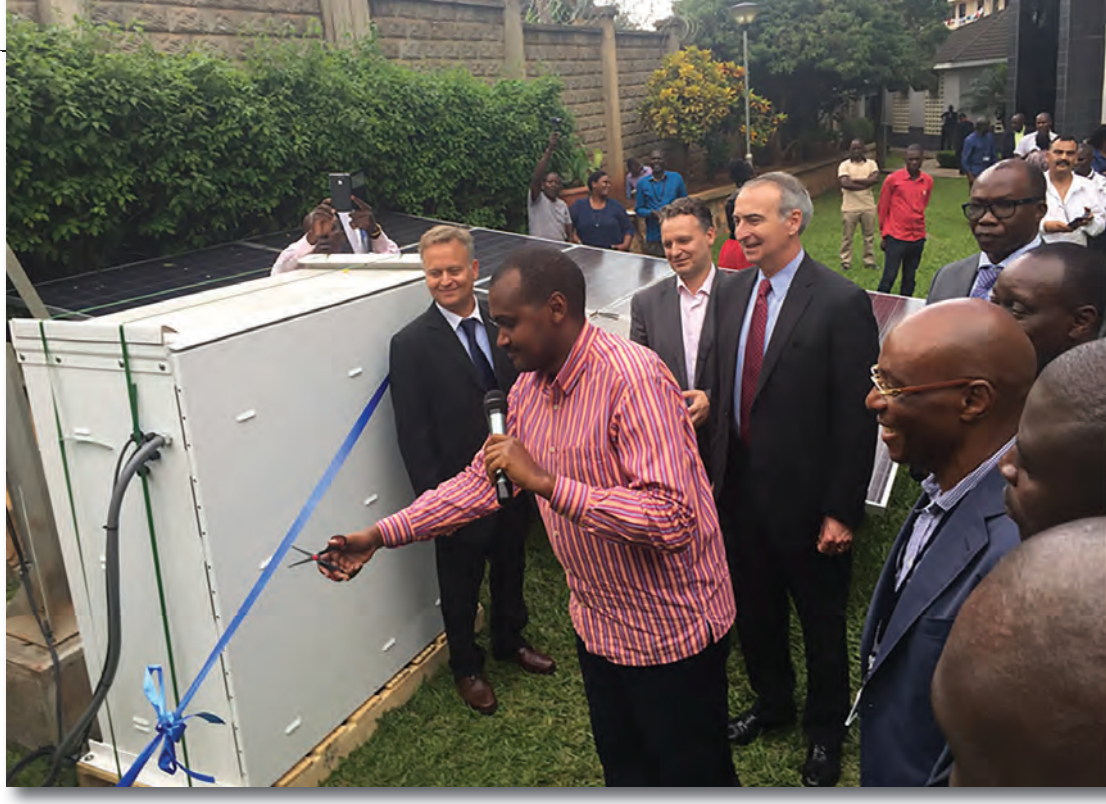
Thuraya operates two L-Band satellites (both of which are coming to the end of their life), providing mobile service over much of the world, with the exception of the Americas. Yahsat, operates three satellites in C, Ku and Ka-Band, covering EMEA and South America and Asia.

Yahsat has indicated that it is keen to be a player in the Internet-of-Things (IoT) market, and acquiring an L-Band operator, is expected to boost its capabilities in this segment. The CEO of Yahsat, Masood Sharif Mahmood, told The National (an English language, online news service, based in Abu Dhabi), that it "anticipates higher growth from its satellite broadband business as it looks to enter the mobility and IoT market, as well as possibly competing with telecoms service providers." According to International Data Corporation, the IoT market in the Middle East and Africa is set to grow 15 per cent to reach US$ 6.99 billion this year, and US$ 12.62 Billion by 2021. The company is particularly interested in live asset tracking, combined with analytics and artificial intelligence for regional mobility. Mubadala, Yahsat's owner, has significant investments in artificial intelligence and IoT solutions, amongst other things. And of course, cross border tracking, gives satellite a competitive edge compared to national telecoms operators.

Following the announcement in August, Yahsat has stated that it is intending to order two replacement L-Band satellites.

The relatively low connectivity rates in much of Africa, make this region a prime target for satellite operators hoping to help bridge the digital divide. According to Internet World Stats, at the

beginning of 2018, only 35.2% of Africans are internet users, compared to 58.4% for the rest of the world. Behind this average statistic however, lie some seriously low numbers. In Eritrea, only 1.4% of the population has access to the internet. Other countries with equally disturbing connectivity rates, include Niger, Chad, Burundi and Western Sahara, all with penetration rates below 6%.



The launch of rural connectivity project for Uganda with Intelsat partnering with Gilat on the project. (Gilat photo)

The correlation between investment in broadband connectivity and the growth of economic activity is well known. According to the World Bank, for every 10 per cent increase in broadband connectivity in developing nations, GDP rises by 1.38 per cent. This fact is not lost on satellite operators, many of whom see this as a business opportunity, even though the business case is notoriously hard to close.

Intelsat and Gilat, for example, have partnered in Uganda, for a pilot program, to provide connectivity to two rural communities. The aim of the pilot study is to demonstrate the ease of deploying a satellite solution and to study the commercial viability of the solution. The Ugandan government has a target of achieving 100% coverage of Uganda's rural areas by 2020, with a minimum connectivity speed of 3Mbps. Internet penetration in all of Uganda, currently stands at 42.9%. The solution uses, a turnkey, solar powered package that provides everything needed to expand 3G services over a 2.5-kilometer radius, known as Mobile Reach Solar 3G

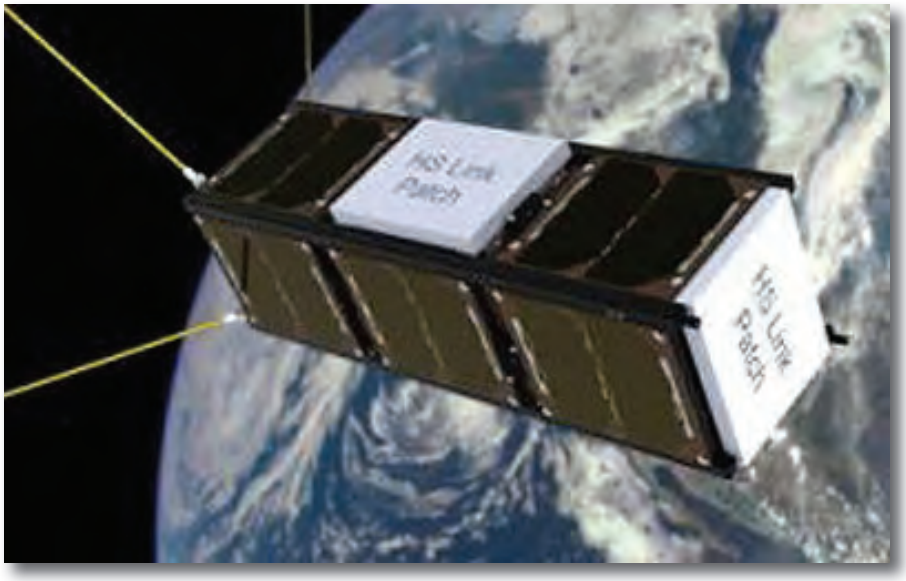
In October, Intelsat made a strategic investment in Africa Mobile Networks (AMN). AMN provides MNOs with a network-as-a-service (NaaS) solution, in which AMN will fund, build and operate the ultra-rural network for the operators. This enables, African mobile operators to extend their coverage with minimal opex and capex risk.

AMN's solution is a solar powered, low-cost, small cell solution which can be deployed and installed in less than 6 hours. Once installed, the sites will connect over the Intelsat fleet to the core of the mobile network and deliver 2G services, with the ability to upgrade the base stations to 3G and 4G as data demands allow.

Yahsat, through its YahClick service, already offers broadband connectivity in parts of Africa, and following introduction into service of Al Yah 3, earlier this year, availability has expanded to cover an additional 8 countries in the continent. In September, it announced a partnership with Hughes to provide commercial Ka-band satellite broadband services across Africa, the Middle East and southwest Asia.

The venture will continue to provide unserved and underserved communities with high-speed Internet services operating over Al Yah 2 and Al Yah 3 Ka-band satellites, coupled with the capabilities of Hughes Jupiter™ System. Hughes will also supply the Operating and Business Support System (OSS/BSS) solutions for network operations and management.

Initially, the venture will focus on "direct-to-premise ser-



Sky and Space Global are planning a network of nanosatellites for narrowband communications that it expects will cost US$ 160 million or less to complete. The company, located in the U.K., Israel and Australia, has fully funded the first three satellites to precede an initial constellation of 200 nanosatellites. The initial constellation will focus on equatorial coverage from 15 degrees south latitude to 15 degrees north.

vices" to homes and small- to medium-sized enterprises, and to community centers and schools that are served under local government programs across these regions. In parallel, there will be an increased focus on "community hotspot" solutions to make satellite-enabled broadband more accessible to many more users

Sky and Space Global (SAS), headquartered in the UK and listed on the Australian stock exchange, is a startup company, taking a different approach, but also aiming to further improve connectivity rates in Africa. The company plans to launch an S-Band, low-earth orbit (LEO) nano-satellite constellation, to provide voice, data and instant messaging services. The system will extend the reach of existing networks with no additional build-out. This coupled with the size of the satellites, enables SAS to provide a low-cost service. The service will be available in equatorial regions, and Africa is a key target market.

The company launched three proof-of-concept satellites, known as "diamonds" in September, and succeeded in demonstrating the first nano-satellite telephone call, financial transaction and PSTN gateway. Launch of the full constellation, known as "pearls" will commence in 2019. Like all potential new operators, SAS is still raising capital for the venture, so whether it actually launches remains to be seen.

Humanitarian issues, have also been at the forefront of the news this year, and in May members of the satellite community including: Arabsat, Eutelsat, Global Eagle, Hispasat, Inmarsat, Intelsat, SES, Thuraya and Yahsat (this was pre-acquisition) signed contribution agreements with the United Nations World Food Program (WFP), on behalf of the Emergency Telecommunications Cluster (ETC). These agreements expand their commitment to support global disaster relief. The WFP is the global lead agency of the ETC. This was the final step in bringing into operation, the Crisis Connectivity Charter signed in late 2015, between the EMEA Satellite Operators Association (ESOA), the Global VSAT Forum (GVF), the UN Office for the Coordination of Humanitarian Aid (OCHA) and the ETC. Under the agreement the Charter signatories are committing satellite capacity and equipment for humanitarian uses during times of emergencies and natural disasters. The ETC will be able to activate the charter when disaster strikes and identify which pre-planned solutions are available to meet a 24 hour deployment timeline.

Moving to Europe, the UK has been very active in establishing objectives for a space industry. In March of 2018, The Space Industry Bill was given Royal Assent. This bill, is aimed at further advancing the UK's position in the space economy. Dr. Graham Turnock, Chief Executive of the UK Space Agency, stated: "Whilst it doesn't have the pedigree of other space-faring nations, Britain now accounts for 40% of all small satellites currently in orbit."

More recently, in support of the bill's objectives a site in Sutherland, in the far north-east of Scotland, has been chosen as the site for the UK's first spaceport.

Discussing the bill, Science Minister Sam Gyimah, stated: "With one in four of all tele-

The first ever UK spaceport will be established at Sutherland Scotland site. It is hoped the first vertical rocket and satellite launches could take place by early 2020. UK Space Agency says space flights may eventually follow. (heraldscotland.com photo)

coms satellites substantially built in Britain, and our businesses at the forefront of hypersonic flight technology, through its Industrial Strategy, the government is working with industry to increase its global share of the space sector from 6.5% to 10% by 2030." Supporting the bill, Gyimah announced eight new projects, as part of the UK Space Agency's "Space for Smarter Government" program. These will demonstrate the potential of using satellite technology to solve challenges faced by the public sector. These range from using satellite data and machine learning to support the rollout of charging stations for electric vehicles, to deploying drones and satellites in the battle against marine waste.

No article on Europe would be complete without mention of Brexit. As discussed in my article on this subject in 2016, the UK will remain a member of the European Space Agency (ESA), which is not an EU institution. The government has also stated that post-Brexit, it plans to remain in collaboration with the EU on all space projects. However, major issues remain to be resolved, when it comes to Galileo, the European satellite navigation system, to which Britain has already contributed 12% of the total cost, which is expected to exceed euro 10 billion (US$11.4 Billion at current exchange rates), by the project's completion in 2020. Galileo, is run by ESA, but the European Commission makes key decisions on the project.

At the heart of the issue, is Britain's access to the Public Regulated Service (PRS). PRS is an encrypted signal, that cannot be jammed. It can be used by governments during national emergencies, and can also be used by the military to plan operations and guide missiles. Currently, non-EU members are excluded from building modules for the PRS and denied access to the signal. In 2016, Norway and US, asked to be allowed access to the PRS, but negotiations have been slow.

In October, The (British) Institute for Government, in an article about UK-EU defense and security cooperation after Brexit, stated that the EU has already said that UK contractors will not be able to participate in the military element of the Galileo satellite system.

The UK has made proposals to allow its continued participation the project as part of the wider security relationship, but has also indicated – and allocated £95 million to the project - that it will design a national alternative, if it cannot secure ongoing access to Galileo. The EU is reported to be considering offering the UK a special deal on access to the encrypted signal, but is still unwilling for UK companies to bid for contracts to build the system.

Resolution, or otherwise of this issue, could have wider implications for EU-UK post-Brexit cooperation on cross-border and domestic security. One of the many issues yet to be resolved!

Elizabeth Tweedie has over 20 years experience at the cutting edge of new commmunications entertainment technologies. She is the founder and President of Definitive Direction (www.definitive-direction.com), a consultancy that focuses on researching and evaluating the long-term potential for new ventures, initiating their development, and identifying and developing appropriate alliances. During her 10 years at Hughes Electronics, she worked on every acquisition and new business that the company considered during her time there. She can be reached at etweedie@definitivedirection.com.

Asia Pacific Satellite Trends

by Peter J. Galace

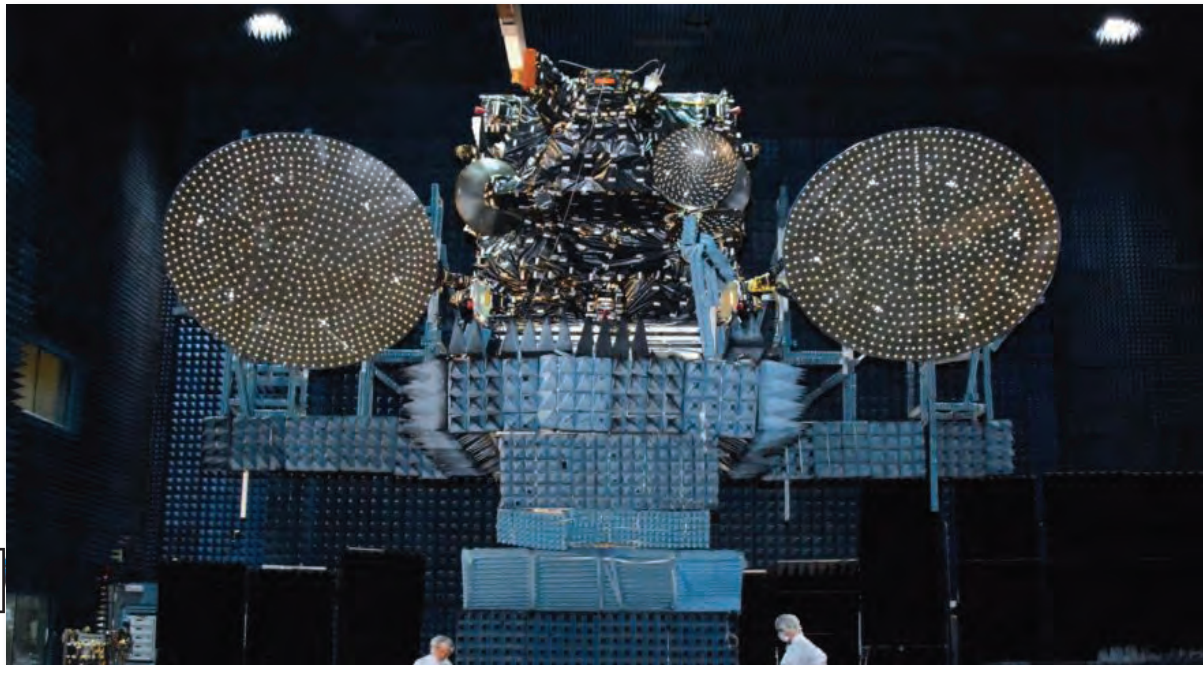
Fueled by a surge in global satellite transponder demand that is expected to reach US$ 28.65 billion by 2026, the Asia Pacific satellite industry, propped up by a projected 5.6% regional economic growth in 2018 and 2019, continues to be on the roll. Today, there is a rush for High Throughput Satellite (HTS) with the opening of new opportunities and capabilities in numerous vertical markets across the region to fulfil the growing connectivity demands well into the future.

The mobility and maritime markets' need for data to be delivered everywhere with 'Communications on the Move (COTM)' is becoming increasingly seen as the key. Commercial airlines in Asia are adopting new in-flight connectivity (IFC) solutions to enable passengers to utilize Wi-Fi and entertainment services while in the air. The massive throughput of HTS spot beams are also providing attractive options for delivering enterprise network and consumer broadband applications that require data-heavy usage within a small vicinity. This is true for oil exploration or mining operations taking place in remote parts of Asia with no terrestrial infrastructure.

Asia's vast land mass, which includes many rural in isolated areas, means terrestrial broadband is not always an option when deploying high-speed services. This makes HTS ideal for service providers looking to offer competitive broadband packages. Furthermore, HTS' wide beam feature allows service providers to deliver connectivity to a specific area or location, enabling them to tailor their data services – proving increasingly beneficial for Asia's aviation and maritime markets.

In broadcasting, HTS has also enabled operators to cope with the competition from terrestri-

There is a scramble for HTS satellite in the Asia-Pacific allowing operators to cope with competition from terrestrial networks. Photo shows Space Systems Loral-built JCSat-16 telecommunications satellite, owned by Sky Perfect JSat of Japan.



al networks on the 'cost per bit' race, by supplying large communication capacity, observes a satellite provider in the region.

HTS demand surges

NSR expects total GEO-HTS demand in APAC to exceed 1 Tbps by 2026, with the majority of demand being driven by enterprise data (of which the largest component is cellular backhaul) and consumer broadband. Despite capacity being sold at a significantly lower price point due to more purchases in bulk, NSR sees total APAC GEO-HTS revenues rising to nearly US$ 4 billion annually by 2026, with broadband access and enterprise data representing around US$ 1.5 billion each.

NSR says that as more HTS capacity is launched over APAC, the region's upper-middle class is expected to provide a significant opportunity for consumer broadband services.

Driven by in-flight connectivity, commercial mobility the market is expected to grow to ~$600M in annual revenues by 2026. A recent forecast by Boeing for airplane demand in the Chinese market indicated that airplane demand expectations have increased over the past year, and the expectation remains that air travel in APAC will continue to flourish over the coming decade. Despite regulatory hurdles to be overcome in some markets (India, China), it is seen as a matter of when, rather than if, the IFC market sees an explosion in demand in APAC. In particular, commercial mobility/IFC are not expected to be as addressable by the above-mentioned national satellite programs, due to the fact that these satellites tend to be country-focused or at best, regional-focused, whereas mobility demands tend to be more global, or at least multi-regional in nature.

In a region that has primarily been dominated by traditional TV, over-the-top video continues to gain traction and has been a major catalyst for HTS demand.

APAC tops digital pay TV market

In a region that has primarily been dominated by traditional TV, over-the-top (OTT) video continues to gain traction and has been a major catalyst for HTS demand. According to Media Partners Asia, the APAC online video industry is set to double its share of video industry revenues from 9% in 2017 to 20% by 2023. Furthermore, according to IHS Markit, in Asia Pacific there were three new OTT subscriptions for every new pay TV subscription in 2017 alone.

The Asia Pacific pay TV sector is due to grow its subscriber numbers by 12.8% between 2017 and 2023, bucking downward trends in much of the rest of the world, according to Digital TV Research. The Asia Pacific Pay TV Forecasts report claims that the number of pay TV subscribers across Asia Pacific will climb from 608.7 million in 2017 to 686.4 million in 2023. This marks an increase of some 77.7 million subscribers, with China and India remaining the top one and two countries respectively in 2023, followed by Japan and then South Korea.

"China and India together will account for 81% of the region's 686 million pay TV subscribers by 2023," said Simon Murray, principal analyst at Digital TV Research. "China will add 33 million subscribers between 2017 and 2023 and India will increase its total by 28 million. However, six of the 22 countries covered in this report will lose subscribers between 2017 and 2023. Taiwan

will be the biggest loser – with subscribers down by 10.3%."

Overall, IPTV is expected to account for an extra 67 million pay TV subscribers across the region, while pay satellite will climb by 26 million. Cable pay TV numbers are tipped to fall as a gain of 37 million digital cable subscribers fails to offset a decline of 52 million analogue cable subscribers.

Pay TV revenues across the region will grow by US$2.73 billion over the forecast period, according to Digital TV Research. India is expected to contribute US$1.6 billion in additional revenues, China an extra US$924 million and Indonesia an extra US$472 million. However, pay TV revenues are predicted to fall in six countries between 2017 and 2023 – including Japan, South Korea and Hong Kong.

By 2023, pay TV revenues are expected to reach US$37.89 billion – two thirds of which will be accounted for by China, India and Japan.

Digital pay TV growth is coming strong in the Asia-Pacific region, which accounts for 83% of net additions, largely driven by IPTV growth in China. However, led by an increase in smartphone penetration and improvements in mobile data accessibility and affordability, there were three new OTT subscriptions for every new pay TV subscription in 2017 in the region.

Piracy remains one of the biggest challenges in the region with operators employing cloud delivery and advanced mobile enabled STBs as counter measures. HIS Markit warns that regulatory barriers and competition from maturing OTT sector pose a threat to future growth.

"We expect to see OTT subscriptions growing globally over the next five years, as Amazon and Netflix continue to invest in local and localized content, and as virtual pay TV operators start to appear and grow outside the US," said Irina Kornilova, principal analyst of home entertainment, IHS Markit.

There is a caveat, however. The pay-TV industry in Asia will grow by 5% this year and may continue to expand at a headline rate of 3% until 2023. But parts of the sector are now in reverse, reflecting the impact of Internet-based distribution.

The latest edition of "Asia Pacific Pay-TV Distribution" report published by leading industry analysts Media Partners Asia, forecasts sector revenue of $56 billion in the region's 17 largest markets. By 2023 that could reach $66 billion.

Satellite Launches

On September 25, Intelsat and Azercosmos successfully Launched Intelsat 38/ Azerspace-2 satellite aboard an Ariane 5 launch vehicle from the Guiana Space Center in Kourou, French Guiana.

Intelsat 38 is a Ku-band satellite to be placed at the 45ºE orbital location and will replace Intelsat 12 and host DTH platforms for Central and Eastern Europe as well as the Asia-Pacific region. Intelsat 38 will also provide connectivity for corporate networks and government applications in Africa.

Azerspace-2 will help Azercosmos meet the growing demand for DTH television, government, and network services in Europe, Central and South Asia, the Middle East and Sub-Saharan Africa. The satellite will also provide high power Ku-band connectivity to the African continent from 45 degrees East. Azerspace-2 is ideally designed for smaller antennas and will deliver cross connectivity between East Africa, West Africa and Central Africa, Europe and Central Asia.

In September, Intelsat also announced the successful launch of the Horizons 3e satellite. Horizons 3e is owned by a joint venture between Intelsat and SKY Perfect JSAT. Built by Boeing and based on the Intelsat EpicNG design, Horizons 3e will bring high throughput satellite solutions in both C-and Ku-bands to Asia and the Pacific Ocean region from its orbital slot at 169ºE. The satellite will complete Intelsat EpicNG's global coverage and provide broadband, mobility and government customers with unmatched performance, resiliency and redundancy. Horizons 3e is expected to commence service in the first quarter of 2019.

On June 4, 2018, SpaceX also successfully launched SES 12 for Asia-Pacific, Middle East Services. SES-12, which is designed with wide beams and high throughput beams, will join SES-8 at 95 degrees East to meet the needs of video, fixed data, mobility and government customers across Asia-Pacific and the Middle East. This is the latest satellite SES has launched to that orbital position where it will operate under the authority of the Netherlands. It will replace and augment

The SES-12 satellite, launched in June 2018, will expand SES's capabilities to provide DTH broadcasting, VSAT, Mobility and High Throughput Satellite (HTS) data connectivity services in the Middle East and the Asia-Pacific region, including rapidly growing markets such as India and Indonesia.

the services currently being provided on SES' NSS-6 satellite.

Together with SES-8, SES-12 will reach 18 million TV homes, and provide pay-TV operators scalability by adding more content and delivering higher picture quality to address demand for High Definition (HD) and Ultra-HD content.

The SES-12 high throughput payload is intended to enhance connectivity in the aeronautical and maritime segments across Asia-Pacific and the Middle East. SES-12 will also enable governments to provide connectivity programs to bridge the digital divide, and in allowing telcos, mobile network operators and internet service providers to deliver more cellular backhaul and faster broadband services.

Telesat announced in October that its new Telstar 18 VANTAGE high throughput satellite became fully operational at 138 degrees East and has entered commercial service. Telstar 18 VANTAGE was launched by a SpaceX Falcon 9 rocket from Cape Canaveral Air Force Station in Florida on September 10 and will serve growing demand for mobility, enterprise and telecom services across the Asia Pacific region.

Built by SSL, a Maxar Technologies company, Telstar 18 VANTAGE is the latest in a new generation of Telesat satellites with capacity optimized to serve the types of bandwidth intensive applications increasingly in demand by users worldwide. It replaces and expands on Telesat's Telstar 18 satellite through extensive C-band capacity over Asia, Ku-band HTS spot beams over Indonesia and Malaysia, and five additional regional Ku-band beams.

The coverage of Telstar 18 VANTAGE reaches across Asia all the way to Hawaii – in both C and Ku-band – enabling direct connectivity between any point in Asia and the Americas. Its innovative Ku-band payloads of HTS spot beams and focused regional beams provide customers operating in Southeast Asia, Mongolia, Australia & New Zealand, and the North Pacific Ocean with greater choice and flexibility in deploying high performing broadband networks.

In October this year, SpaceX's Falcon 9 rocket blasted off from Cape Canaveral Air Force Station to put a commercial communications spacecraft into orbit for Thai satellite operator Thaicom. Thaicom 6, built by Virginia-based Orbital Sciences Corp., also is equipped to provide other communications services for customers in Southeast Asia and Africa, including Madagascar, Thaicom's website shows. Including launch services and insurance, the Thaicom 6 satellite cost about $160 million, according to Thai-

com. So far, about two-thirds of the satellite's capacity has been sold, according to Thaicom.

On March 29, 2018, the Indian Space Research Organisation launched the GSAT-6A communications satellite into orbit atop a Geosynchronous Satellite Launch Vehicle. But ISRO officials lost contact with the satellite 48 hours after launch. Until today, ISRO hasn't been able to re-establish communication with the GSAT-6A, although the exact location of the satellite has now been found and is being tracked in space by ISRO.

In May this year, China also launched the Apstar-6C communications satellite, from Xichang Satellite Launch Center in southwest China. Apstar-6C joins a fleet of four fully operational satellites belonging to APT Satellite of Hong Kong, operator of the Apstar constellation, which provide coverage of the Asia-Pacific region and beyond.

Apstar 6C will enter service at 134 degrees East longitude for a planned 15-year mission, providing in-flight connectivity for airliners, video distribution services, direct-to-home television broadcasts, and cellular backhaul capacity across China, Mongolia and Southeast Asia. Equipped with 45 C-band, Ku-band and Ka-band transponders, Apstar 6C's wider coverage zone will stretch from Siberia and India in the north and west, to Australia and Hawaii in the south and east.

Malaysian fleet operator Measat will soon join the increasingly crowded club of companies with high-throughput satellites in the Asia Pacific. Measat Chief Operating Officer Yau Chyong Lim said in July 3 that the company is preparing to order a high-throughput spacecraft it hopes to have in orbit in 2021 to provide broadband services mainly in Malaysia.

The new satellite, to be located at 91.5 degrees east where three other Measat spacecraft are positioned, will feature technology upgrades to give Measat a chance to compete where oversupply has ratcheted down the price of capacity.

On November 19, Eutelsat Communications ordered two new satellites from Airbus Defence and Space to replace the three existing HOTBIRD satellites at its 13° East flagship neighbourhood. These all-electric high-power satellites are set to enter into service in 2022, serving Europe, the Middle East and North Africa. The new satellites will reinforce and enhance the high quality of broadcasting services provided to Eutelsat customers on HOTBIRD, providing improved performances over Western Europe and Poland. Moreover, the satellites will offer advanced features in terms of uplink signal protection and resilience, as well as exceptional in-orbit redundancy. With a launch mass of 4.5 tonnes and an electric power of 22 kW, the all-electric propulsion satellites will be based on Airbus Defence and Space's innovative Eurostar Neo platform which will be produced, along with their high-performance payloads, in their UK facilities in Stevenage and Portsmouth as well as in their French facility in Toulouse.

On 11 January 2018, China Great Wall Industry Corporation (CGWIC), which is the international commercial arm of China's space program, announced that it has signed a framework agreement with the Royal Cambodia Group for a new communications satellite, Techo 1. Techo 1 will be Cambodia's first communications satellite.

This comes a few months after the Royal Group announced plans to launch its own satellite to facilitate its businesses such as the Cambodian Broadcasting Service Company (CBS) and Cellcard, Cambodia's third largest mobile network operator. The satellite will also be used for broadband, disaster management, national security and government services. The project appears to be heavily supported by the Cambodian government, which believes that satellites can improve connectivity in urban and rural areas, and aid the country's development.

Under the agreement, China will provide the Royal Group with end-to-end satellite services including satellite development, launch, ground station systems, and training and technology transfer. The satellite, which will have a design life of 15 years, is expected to launch in 2021.

Peter I. Galace is the Associate Editor of Satellite Markets and Research. He writes extensively on telecommunications and satellite developments in Asia and other regions for numerous publications and research firms. He can be reached at peter@satellitemarkets.com.

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InterBEE 2018 Highlights 4K, 8K Developments

by Naoakira Kamiya

There is no doubt that the buzz word at show floor of InterBEE2018, held last month, was 4K8K. It is because the advanced satellite broadcasting is scheduled to start from 10:00 A.M. on December 1, 2018.

At the booth of A-PAB (The Association for Promotion of Advanced Broadcasting Services), 14 broadcasters and their 19 channels are classified in three categories and displayed.

One group uses BS BSAT-4a Satellite operated by Broadcasting Satellite System Corporation and broadcasts 4K programs. These companies are NHK BS 4K, BS Asahi 4K, BS-TBS 4K, BS TV Tokyo 4K, BS Fuji 4K, BS Nippon TV 4K, Cinema 4K, Shop Channel 4K, 4K QVS, and WOWOW.

A-PAB unveiled 14 broadcasters and 19 channels participating in Advanced Satellite Broadcasting.

Second group uses BS and broadcasts 8K program. So far NHK is only one for this category.

Third group uses CS, (JCSAT-110A satellite operated by SKY Perfect JSAT Corp and broadcasts 4K programs. These are J-Sports 4K, 4K Nihon-eiga + Jidaigeki (Japanese Movie Channel), Star 4K, and Sukachan 4K (SKY Perfect TV channel). J-Sports plans to provide four channels and SKY Perfect TV two channels.

Attendant at A-PAB booth said "Regretfully two broadcasters, BS Nippon TV and WOWOW, will not be ready on December 1. They plan to start broadcasting one year later on December 1 2019."

A-PAB also unveiled seven tuner-installed 4K8K television sets. Two sets out of seven are 4K OLED television made by Toshiba and LG Electronics. Four sets are 4K LED television made by Sharp, Mitsubishi Electric, Pixela, and Hisense Japan. Sharp is only manufacture for 8K. According to A-PAB Toshiba and Mitsubishi Electric already started selling their TV sets and Sharp will follow from November 17.

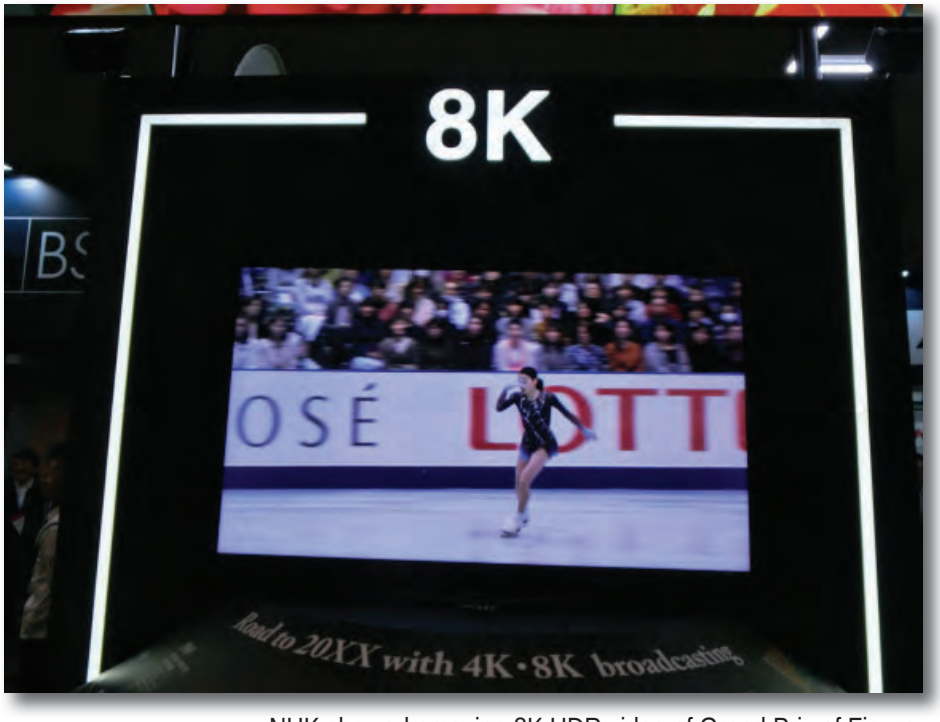
In addition A-PAB introduced eight 4K tuner boxes made by Panasonic, Sony, Sharp, Toshiba, and so forth.

Under such circumstances, NHK together with JEITA (The Japan Electronics and Information Technology Industries Association) set up one of the largest booths and engaged visitors by showing several 4K8K programs. The most amazing program was Grand Prix of Figure Skating 2018 (NHK Trophy), which was held from November 9 to 11 at Hiroshima Prefecture Sports Center. NHK used Sharp's 80 inches 8K TV for such demonstration,

which is supposed to be sold in the market soon.

In addition to 4K8K video, NHK showcased 4K OB Van named SK-1, which caters to live production of 2K4K video. NHK attendant said "NHK operates one 4K and three 8K OB Vans at present. Two more 4K OB Vans will be ready for operation by March 2019."

With a huge banner of "8K Unveils Reality," Astrodesign fascinated visitors with state-of-the-art 8K products such as Camcoder (8C-B60A), Camera Head (AH-40801-E/4081-G), Camera Control Unit (AC-4813), SSD Recorder (HR-7518/-7518A), Video Server (SR-8428/-8438), Cross Converter (SC-8219), 55 inch LCD Monitor (DM-3815) and so on. 8C-B60A Camcorder integrates capabilities for shooting, recording, playback, and line output. The attendant said "40 minutes continuous recording can be accomplished with 2TB SSD pack." With regard SSD recorder, two kinds are shown. One is for 8K 60Hz and another is for 8K 120Hz.



NHK showed amazing 8K HDR video of Grand Prix of Figure Skating 2018 (NHK Trophy).

Additionally 8K projector named Insight Laser 8K was introduced at the booth. It is a 3-chip 25,000 lumens digital projector jointly developed by Digital Projection and Astrodesign.

Besides Astrodesign, InterBEE2018 put the spotlight on other leading broadcasting equipment manufacturers such as Sony, Panasonic, Canon, Hitachi Kokusai Electric, Ikegami Tsushinki, FOR.A, and AZLAB among others at the show.

Sony exhibited Crystal LED Display System in front of their booth and unveiled UHC-8300 8K portable and HDC4800 4K slow motion camera. 440 inch Crystal LED display is 8K x 4K resolution (7,680 Pixel x 4,320 Pixel) and boasts 1,000nits. UHC-8300 can capture live 8K HDR video with maximum of 120fps.

Panasonic has been aggressively selling 8K video recorders to NHK and other users, but so far no sign of 8K camera. This year for the first time they exhibited prototype 8K multi-purpose camera at their booth. Unique feature is that OLED image sensor is installed to attain higher dynamic range. It is a good sign that Panasonic brand 8K camera will be in the market in 2019.

Canon set up a special 8K solution corner at their booth and introduced 8K camera and 55 inch 8K HDR display. They already tried to capture some Rugby matches and showed high resolution and high dynamic range video. As to 4K product they highlighted EOS C700FF and XF-705 camera this year.

Hitachi Kokusai Electric proudly showed 8K SK-UHD8060B camera in addition to 4K SK-UHD4000 and 4K SK-HD1500 high speed camera. 8K camera has been jointly developed with NHK.

Ikegami Tsushinki also exhibited both 4K/HD studio camera UHK-435 and 8K camera SHK-810.

FOR.A has been spearheaded live sports coverage with their next generation high speed camera. With this FT-ONE-SS4K camera, you can shoot 4K images up to 1,000fps. The attendant said "8K variable frame rate camera is under development but it would be maximum 500 fps."

To visitors' amazement AZLAB showcased the world's first 16K 120p display. It was non-compressed video of 120fps based on BT2020.

Major developments in the course of shifting broadcast systems to IP are again featured in InterBEE 2018.

Other companies that are proud of Made-in-Japan lineage were Fujifilm, NTT Group, and NEC.

As expected, Fujifilm exhibited four kinds of 8K lenses at their booth and attracted visitors' attention.

NTT Group showed prototype real time 8K 120p HEVC encoder. However the encoder shown is still consisting of four 4K 120p HEVC encoders and it is a must to integrated as one unit.

NEC exhibited latest version of 4K HEVC encoder and decoder based on ASI or IP. New feature added is ARQ function in case of IP transmission.

In the satellite communications and broadcasting equipment sector, SKY Perfect JSAT did not show up this year but three leading players such as AT Communications, Moubic, Kato Denki/Tokyo Keiki exhibited their latest products and services.

AT Communications unveiled curious SNG vehicle equipped with storable SOTM (antenna diameter 75cm) and 55W SSPA. Unique feature is, whenever you need SOTM, it will be hydraulically elevated from storage position to the roof of the vehicle by oil pressed cylinder. "It is designed to elevate about 1.6 meter. With this up-and-down system, the driver can move around more safely under the bridge and tunnel" said Makio Komatsubara, President of AT Communications. He added "the world first storable SOTM system has been designed by AT Communications and built by EM Solutions in Australia. In Japan such SOTM is needed due to many lower bridges, small tunnels, and hanging electric wire cables."

Other notable products at AT Communications booth were portable Ku-band flat antenna made by SATCUBE in Sweden and 4K encoder by Socionext in Japan. Surprisingly enough it was found out 4K video can be transmitted by combining these two systems. SATCUBE flat antenna is as small as 445mm x 280mm x 58mm and weighs only 6kg.

Moubic is an operator of SNG vehicle and is very active in video contribution services. They are involved in up-linking Formula One Japanese Gran Prix 2018 at Suzzuka and MotoGP Japan 2018 race at Motegi. Besides contribution business, Moubic sells video-related products from such companies as Vislink, Media Kind, and Newtec. At this year's InterBEE2018, they introduced Vislink's Mantis MSAT with DVE6100/IRD6200, and Media Kind's contribution encoder AVP2000.

Kato Denki and Tokyo Keiki jointly offered 1.2 meter parabolic antenna on-the-move and tried to sell to broadcasters for SNG operation.

As was described above 54th InterBEE2018 was successfully held at Makuhari Messe Convention Center in Chiba City from 14 to 16 November. JEITA said a record number of 1,152 companies and organizations including 646 from 34 countries and regions overseas and the total attendees marked a record breaking 40,839.

Naoakira Kamiya is Managing Director, Satellite System Research Institute and Director of the Japan Satellite Business Association based in Tokyo, Japan. He is a frequent contributor to various satellite and broadcasting trade publications. He can be reached at: ZUM05241@nifty.ne.jp

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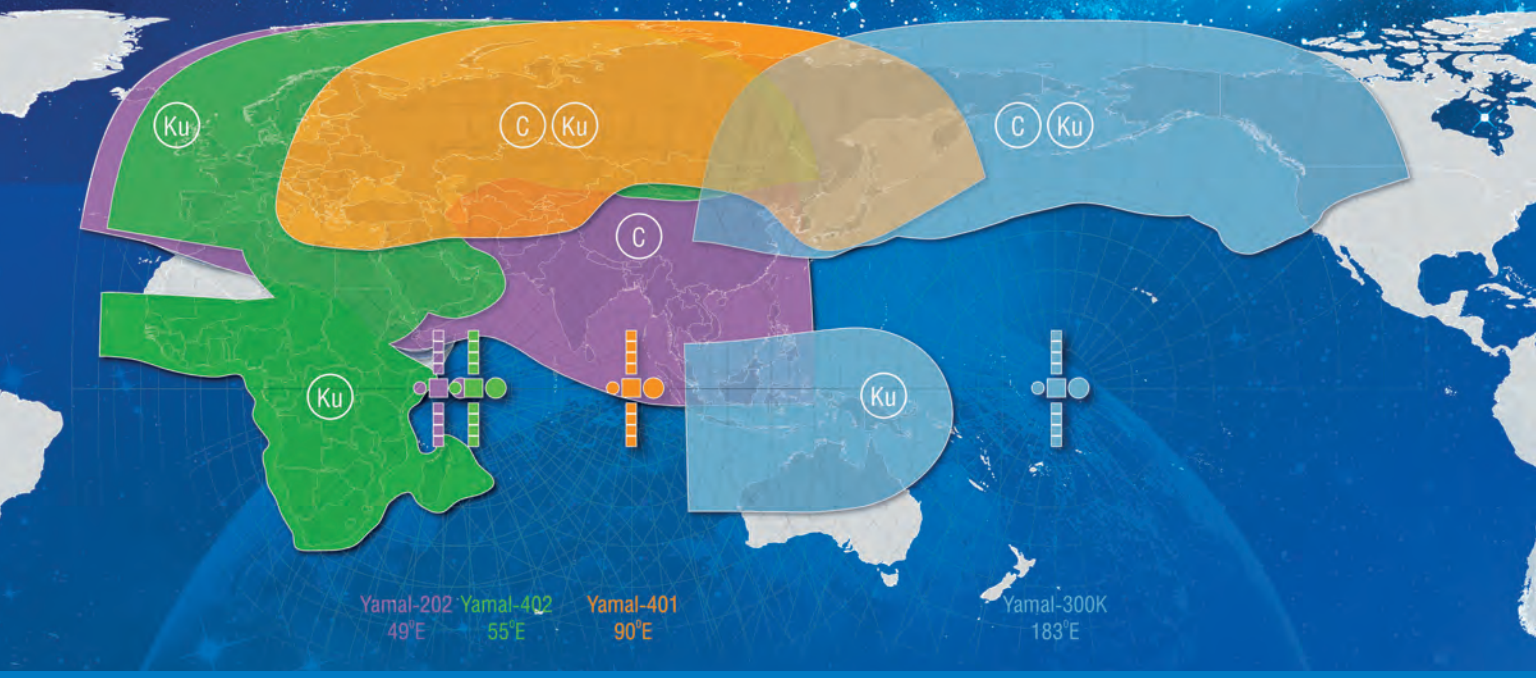

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Latin American Market Trends

by Bernardo Schneiderman

The Satellite Market in Latin America is moving to a new era marked by overcapacity with major satellite operators focusing in the major verticals market to promote growth. The major players are expecting for 2019 with new governments in power in Brazil and Mexico (key major markets for Latin America) a new demand is coming back in all verticals (Residential, Corporation, Government and Defense).

In terms of the economy outlook based in the IMF report Growth in Latin America and the Caribbean is picking up, thanks to a stronger demand at home and favorable Global Environment helped also by rebounding commodity prices. But to secure more durable growth with widespread benefits, the region needs to invest more in key sectors, like infrastructure and education to boost productivity over the longer-term, the IMF said in the latest regional assessment. The Regional Economic Outlook for the Western Hemisphere estimates growth for the region to increase from 1.3 percent in 2017 to 2 percent in 2018. For 2019, the report forecasts growth to continue to pick up to 2.8 percent. Following the recovery in private consumption in 2017, business investment is expected to rise and become the main driver of economic activity, after a three-year contraction. Despite this rebound, investment levels are expected to remain below the levels as seen in other regions, limiting the region's growth potential, according to the report.

As we write yearly about Latin America Satellite market we posed some key questions for the main players and we received feedback from the following satellite operators: ABS, Eutelsat, Hispamar/Hispasat, Intelsat, Iridium, SES and Telesat. We asked each company, What is your plan for the Latin American Market for the next two years and what verticals (Video, Data/IP, Mobility, IOT & others) are you pursuing now and are planning for the Latin America region?

Follows are excerpts of the responses from executives of the major satellite operators in the region:

Estevao Ghizoni, Managing Director of the Americas, ABS: ABS is a growing global satellite operator with 6 geostationary satellites. Its extensive teleport network provides comprehensive coverage to 93% of the world's population across the Americas, Europe, Middle East, Africa, Asia Pacific, CIS and Russia.

We have invested in building a strong team including the appointment of myself as MD of the Americas and Edison de Vito, Sales Director of Latin America. We have a teleport operation facility in Brazil with our partner Prime in Rio de Janeiro in providing engineering and technical support to customers.

As part of the global coverage, ABS-3A satellite provides dedicated C- and Ku-band coverage for the Americas over Brazil including the Atlantic Ocean. The satellite delivers satellite broadcasting and telecom services to leading broadcasters, service providers, enterprises and government customers. We see opportunities in cellular backhaul, broadband (rural and government initiatives), aeronautical and maritime connectivity, video contribution and distribution and occasional use application.

Mike Antonovich, CEO of Eutelsat Americas: Eutelsat launched three satellites focusing on Latin America between 2015 and 2016, allowing us to fortify our offer and ensure we

have the right capacity available for our customers to continue growing across the region.

In addition to our traditional video and data services, we are constantly working to stay ahead of the industry's changing needs and have developed a growing number of value-added solutions for a wide range of customers. We are actively pursuing our video strategy by building closer ties between the OTT world and the satellite ecosystem and are progressively putting into place the conditions needed for these two technologies to work together to deliver end-to-end services to our customers.

As the Internet of Things continues to expand, we are responding to the markets needs with our Smart LNB technology, a simple device that provides secure and cost-effective IoT connectivity. This solution is ideally suited for connected applications which exchange data with remote assets or infrastructure, enabling real-time live communication with potentially millions of devices to relay information to and from virtually anywhere.

Working closely with our customers to anticipate their needs, we expect these offers to continue growing for the Latin American market in the upcoming months and years.

Sergio Chaves, Business Development Director, Hispamar: The Hispasat group has launched in the last 1.5 years managed services in Latin America with Ka and Ku band platforms for the region for a total of four platforms. We believe that more and more satellite companies will have to offer something more in the value chain for its customers. We believe that we are in line with what the market is requesting.

Mexico and Brazil are the countries we are offering Ka-Band platforms. Colombia, South America and Central America we are offering Ku-Band. Our Strategy in the current model and have been always working in the B2B market

Amazonas 5, located at 61°W will be able to meet growing satellite capacity demand, mainly for satellite television platforms in Latin America and Brazil. In addition, it has 34 Ka-band spot beams that can provide new Internet connectivity services throughout Latin America.

Photo courtesy of SS/L.

With regards to where the demand in Latin America will be coming from in the near future we believe in verticals for Broadband, Backhaul and IOT are the major expansion market for satellite communications.

Juan Pablo Cofino, Intelsat's Regional VP, Latin America, Intelsat: With 5G on the horizon, it is imperative that network operators throw out the old playbook and rethink their approach to broadband connectivity. The future will be wireless - and satellite is a great wireless technology. Satellite has the essential ingredients necessary for the new, hybrid telecom infrastructure, or what is commonly referred to as the "network of networks." This is especially true in countries where digital inclusion is necessary to achieving economic growth.

Satellite provides reach, ubiquity, quality, efficiency and security. And the innovations that have come to market over the past few years have enabled satellite to bridge a performance and economics gap with terrestrial wireless solutions. This is largely due to the advent of powerful high-throughput satellites. When these are paired with more capable, smaller ground hardware designed to take advantage of the greater satellite throughput, we are improving economics and simplifying access for network operators and end users.

As 5G emerges as a driving framework for communications, it is clear that a monolithic architecture is not an answer to all the telecom problems. This is why Intelsat has focused on making it easier than ever to integrate satellite connectivity into terrestrial networks and introducing new economic models that help network operators close the business case for extending services. With this 21st century approach to solving problems, satellite operators

"...With regards to where the demand in Latin America will be coming from in the near future we believe in verticals for Broadband, Backhaul and IoT are the major expansion market for satellite communications..."

-Sergio Chaves, Business Dev. Director for Latin America, HISPAMAR

and mobile network providers can work together and use the respective strengths of their technologies to expand networks into regions that were once cost-prohibitive.

For satellite to fully participate in these sectors, satellite operators must be involved in the development of standards, namely the ground technology that makes it easier and more cost-efficient for end users to access HTS and unlock the full potential of M2M and IoT services. Focusing on the full ecosystem will grow the number of connected devices and spur additional demand for satellite-enabled services and applications in the future. The implementation of an integrated, hybrid approach to telecom will enable operators and service providers to meet the booming bandwidth requirements of Latin America and the world.

Mauricio Bouroncle, Vice President & General Manager, Americas, Iridium Communications: Iridium, a leading low-Earth orbit (LEO) satellite communications provider, is the only network with 100-percent global coverage, delivering reliable and robust connectivity. The network enables a broad scope of voice and data services across Latin America and the Caribbean, ranging from satellite phone communications and satellite Push-To-Talk (PTT) radio services to the Internet of Things, real-time tracking capabilities and remote asset management. Due to Iridium's proven network reliability, low latency and its suite of easy-to-use devices and services,

Iridium is the network of choice for mobile applications. For instance, worldwide organizations such as NGOs and armed forces, rely on Iridium's satellite devices and services for critical communications, especially when deploying emergency response efforts.

Global markets, especially mining and oil and gas all favor Iridium, and we expect to see continued growth across the mobile satellite market for many years to come.

As Iridium completes the launch and deployment of its new global, LEO satellite constellation called Iridium® NEXT, the market can expect to see new services, like Iridium CertusSM, become available. Iridium Certus is the company's next-generation specialty L-band broadband service, that will provide a high-speed, 100-percent global and cost-effective option to all vertical markets. Iridium Certus will debut at 352 Kbps and will be upgradable to 704 Kbps with a firmware update in 2019, eventually reaching speeds of approximately 1.4 Mbps. Multi-service terminals have been developed by our leading value-added manufacturers, Thales and Cobham, supporting the maritime, aviation and land-mobile markets. Specific to the Latin American region, where vast amounts of remote territory lack terrestrial infrastructure, Iridium is well positioned to be a key partner for local organizations seeking reliable, mobile connectivity regardless of geographic location. Iridium is continuously innovating for its customers, and as a result, sees continued growth through its expanding distribution network in Latin America and around the world.

SES responded in terms of two key segments: Video and Data:

Video - Jurandir Pitsch, Vice President, Sales & Market Development Latin America and Caribbean, SES Video

Data: Omar Trujillo, Vice President, Fixed Data, Latin America, SES Networks

To better serve the region, we have been investing into space and ground infrastructure.

Video Networks - We are focusing on three key areas in video. First, we will continue to leverage our prime orbital slots to bring more content to viewers across the region after having launched two GEO satellites in the past two years to serve Latin America. SES-10 and SES-14 are strengthening our premium video neighborhoods and enabling our customers to leverage our strong reach to embrace its growth potential. Secondly, we will accelerate the adoption of higher picture quality. While HD keeps growing, we are now helping broadcasters and TV operators jumpstart their UHD services via our UHD platform, launched in Latin America in April. The end-to-end solution brings together UHD content (4 channels for now), satellite distribution and reception equipment. Finally, we intend to support broadcasters in satisfying the increasing demand for

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always-on access to video content. Through our affiliate MX1, they can streamline their content management operations, and deliver content to any online or linear platform, and any type of screen. We are also pushing Video-on-Demand Everywhere technology so that everyone can have enjoy the experience even without reliable broadband access.

Data networks – whether in Government, mobility (maritime & aero) or enterprise -- are key areas of growth as they are being driven by a rising number of connected devices, IoT and data rich applications. Our O3b MEO (Medium Earth Orbit) fleet is the only successful non-geostationary constellation to deliver commercial broadband services across the globe, enabling SES to truly differentiate itself. Together with our GEO fleet, we can support universal service obligation (USO) commitments and contribute to driving the digital economy across the region. The same satellite connectivity is enabling interoperability among different government agencies, supporting defense and security, rescue and disaster relief missions. On mobility, the number of commercial aircraft and ships connected via satellite is expected to increase exponentially in the Americas in the coming years, which will drive dramatic growth in bandwidth usage.

Mauro Wajnberg – General Manager Telesat Brazil: In July 2018, Telesat successfully launched our new Telstar 19 VANTAGE high throughput satellite (HTS) to the prime Brazilian orbital slot of 63 degrees West, the same used today by Telesat's Telstar 14R satellite. Telesat now has six GEO satellites serving Latin America – Anik F1 and Anik G1 at 107.3 West, Telstar 12 VANTAGE at 15 West, Telstar 11N at 37.5 West, along with Telstar 19 VANTAGE and Telstar 14R at 63 West.

Telesat's focus in Latin America the next two years will be on providing our telecom customers with high performing solutions for cell backhaul and trunking across the region, as well as providing our enterprise VSAT and mobility customers with services that offer improved performance and cost effectiveness. Service options on T19V include a powerful Ku-band regional beam, along with HTS spot beams that provide full coverage of Brazil and the Andean. T19V also has Caribbean and HTS spots ideal for mobility markets. Finally, there is tremendous interest across Latin America in Telesat's new LEO satellite system now in development. We will keep the market informed on our LEO progress and pursue projects with GEO capacity that could become a 'bridge to LEO" in cases where broadband connectivity needs are growing rapidly.

Conclusion

In a recent conference in Latin America, Anatel the regulatory body in Brazil gave a report that showed that the market still in a growing mode. The evolution of satellite capacity in Brazil will have 360% growth between 2015 and 2021, according to data presented by the president of Anatel, Juarez Quadros, in the Latin American Satellite Congress last August. Three years ago, there were 2.7 GHz in band Ka, 17.8 GHz in Ku-band and 17.9 GHz in C-band. In 2021, the Brazilian satellite market is expected to reach 128.5 GHz in Ka band, 28.8 GHz in Ku and 20, 2 GHz in C band. According to agency information, in 2017 this ratio was 41 GHz, 23.5 GHz and 19.7 GHz, respectively for Ka, Ku and C bands.

In the Brazilian market there are currently 17 satellites in national orbits, with 37 foreigners authorized and four with non-geostationary orbit (NGSO). Up to 2021, three new satellites are planned, according to Anatel. Today Brazil is one of the major user of Satellite Communications in Latin America.

In summary all the main players are looking forward for new markets both GEO, LEO's ranging from Video applications for Satellite TV, streaming and Broadcast HD; Backhaul that historical is one of the key vertical in Latin America because lack of infrastructure to provide cellular services in remote areas will be growing with the penetration of LTE and 5G in the near future: Consumer Broadband is another area that already have Hughes in Brazil and expanding for other countries in Latin America during 2018, and now Yahasat that starting in Brazil with their own Ka-Band Satellite to provide residential and business internet via satellite working with local Partners and the new comer is Viasat that finally close the deal with Telebras to provide services in Brazil with the Government Satellite SGDC. Mobility is another market that is growing both for maritime, Aeronautical and terrestrial with the advance of Ka-Band satellite with small antennas has a big potential in the region. Finally, IOT and related application is a growing market in the region with the L-Band operators like Inmarsat, Iridium and Globalstar with new fleet of satellites to penetrate in this growing market in the region give us a good outlook in the Region for the 2019 and beyond.

Bernardo Schniederman is the Principal of Telematics Business Consultants. He can be reached at: info@tbc-telematics.com.

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Welcome to the Small Sat (IOT) Express!

byHub Urlings

Introduction

In the last quarter of 2018 a real small sat express consisting of the Indian PSLV and the American SpaceX Falcon-9 launchers will bring a large number of small satellites into an sun synchronous orbit. After long delays more than 80 small satellites from more than 30 customers from around 20 countries, that are waiting anxiously to have their small satellites launched into orbit.

On board of the small sat express one can find a full range of microsats and cubesats that together give a good sample of the new small sat market: universities (even a high school) with their scientific payloads, research institutes with tech demo's, earth observation companies just adding another eye to their constellation that is already orbiting. Most interesting however on the small sat express are half a dozen IoT satellites built by a new generation of space start ups.

The importance of the satellite express being succesful is high for this group of new space start up. The new IoT satellites operators are at the forefront of the strong growing commercial small satellite sector and they are showing the way for the new space business. The IoT small satellitess launched end of this year have the potential to become game-changers in the global IoT market and change the world. So let's have a closer look.

Can Small sat IoT bring a new era to the Global IoT market?

Much is said and written about the huge potential of the global IoT industry. Different IoT applications can be envisioned in a myriad of businesses and market segments connecting devices, processes, people and organizations worldwide. Critical for the development and growth of the IoT market are three things: low power devices, with low cost hardware and connectivity and last but not least global coverage. A match with these 3 requirements is exactly what the new generation small sat IoT networks are offering to the market.

Low power and cost efficient connectivity was already available in terrestrial networks like cellular, Lora or Sigfox, but they are all together not even covering 10% of the worlds surface. Global coverage is offered by satellite operators Iridium and Globalstar and (nearly global) by Inmarsat and Thuraya, but their solutions do not meet the extreme low cost / low power requirements to trigger a global boost for the IoT industry breaking out of the high end market segments.

It takes the innovations combined in the new generation small sat IoT networks (low cost satellite and communication nodes, improved and low power communication links between communication nodes on the ground and the satellite) to at last match the all power, costs and coverage requirements in the IoT market.

Exciting times ahead for the global IoT industry when the new space operators manage to get their small satellites launched. And the chances for that are good as a number of operators use two different launchers to minimize any launch risk. After a succesful launch on all three requirements for exponential growth of the global IoT will be met and world

is entering a new IoT era.

Who is on board of the Smallsat express?

The manifest of the PSLV and SpaceX launchers end this year contains a wide range of small satellite types: university (even high school) research missions, technology demonstrators, government and defense missions and, at the break of the NewSpace era, commercial small satellites. Around 75% of the satellites on the smallsat express is from the commercial sector, marking the birth of the new space industry.

Below we will have a closer look at the commercial satellites on board the small sat express, in particular at the new small sat IoT operators. Nearly all of them launching their first satellites as a first step for much larger planned constellations.

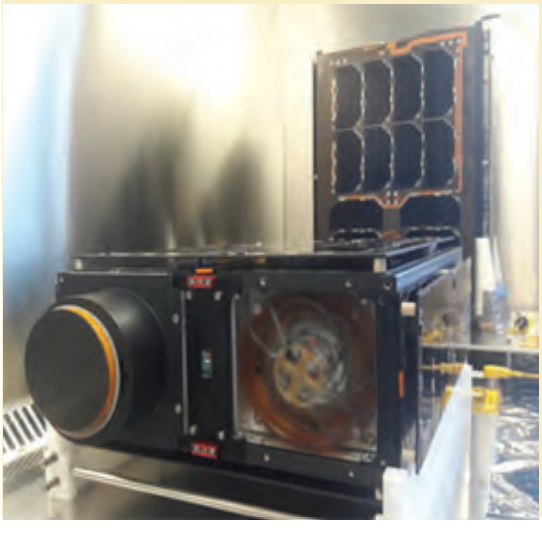
So who are those new sat-iot players and what are they offering? Let's have a closer look at some of these player and what they are offering in terms of global IoT connectivity.

Hiber

Amsterdam based Hiber (formerly Magnitude Space) is launching the Hiber One and Hiber Two. The name referring to the sleep mode their communication nodes are in during most of the time to save energy and power.

The Hiber One satellite is planned to be launched on an Indian PSLV rocket, Hiber Two is planned on a rideshare mission on a Falcon-9 rocket.

Hiber plans to start their services with the two initial twin satellites offering a once per day (144 Byte) messaging service end of the year.



Bye bye: Hiber One and Two just before they go into the deployer

The company was only established in 2016 and is regarded as an insider tip. The Hiber system is designed to provide low cost connectivity for IoT (Internet of Things) sensors and devices that run on very limited power and are not latency-sensitive. Core markets are non critical applications in Smart Agriculture, Energy, Logistics/Asset Tracking/Transportation, Environmental Monitoring.

In the next stage the Hiber constellation will grow up to 24 cube satellites, later to expanded to 50. The service level will grow along from 1 message per day to 100 messages per day.

AstroCast

The Swiss based company's Astrocast 0.1 and 0.2 identical satellites are an In-Orbit-Demonstration mission for the future constellation. They will also be launched with two different launch vehicles end of 2018.

The goal of the mission is to demonstrate all the satellite functionalities and multi satellite operations, and to characterize the radio frequency link between the objects on the ground for the demonstration and the satellites.

After integration of the NanoLink terminal, ground based assets can reliably and securely send any kind of sensor data to the constellation of nanosatellites that will acknowledge the reception. Astrocast enables transmission of 1KB/day from any region on the earth.

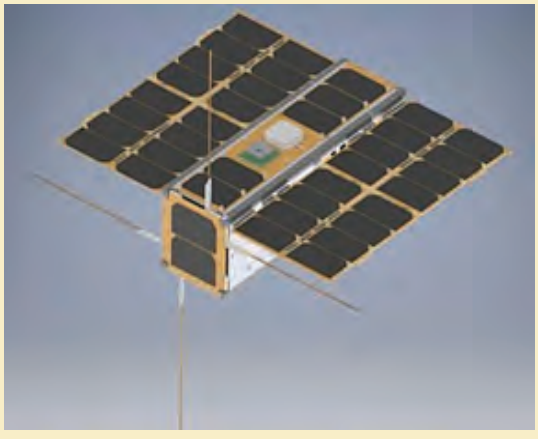
Astrocast estimates it can build, launch and operate a 64-cubesat constellation for less than $50 million to provide low-data-rate providing global L-band machine-to-machine (M2M) services. Target markets are mainly in the B2B area like monitoring and predictive maintenance. The next phase of the constellation will have 16 satellites in 2 planes and the final configuration consist of eight opera-

tional satellites per orbital plane, and eight different orbital planes in sun-synchronous polar orbits.

Fleet

Australian based Fleet Space Technologies will launch their Centauri 1 and 2 pathfinder satellites to prepare for their planned network for global satellite connectivity to the Internet of things.

The 3U twin Centauri 1 will be launched on an Indian PSLV brocket, while Centauri 2 flies on a SpaceX Falcon-9 in 2018.



The Centauri's are the first of a constellation with more than 100 nano satellites that Fleet is planning to launch, creating a global, free connectivity network that will plug directly into the millions of digital sensors already beginning to transform industries like agriculture, logistics, and the extractive sector like mining and gas.

Myriota

Another Australian company, is launching the 3U BRIO, built by SpaceQuest, Ltd. to be launched on the SpaceX Falcon 9 rocket to test and evaluate an advanced RF Transceiver developed by Myriota.

Myriota wants to evaluate the ability of this advanced radio to function in a space environment.

Myorita is established in 2015 and has a strong technology back ground and is a spin-off company from the University of South Australia. It has designed a novel communications protocol that uses advanced signal processing that allows very large numbers of low power signals from user terminals to be received on the same frequency channel. Myriota states its technology would be capable of supporting hundreds of millions of devices.

Myriota aims it's service a wide range of industries including agriculture, defense, utilities, environmental monitoring, asset tracking and logistics. Especially in areas like the less densely populated regions of Australia there's many industries that have remote and mobile operations that are going to benefit from their services.

Other IoT smallsats to keep an eye on

Lacuna Space

Lacuna is based out of the European Space Agency's Business Incubation Centre on the Harwell Campus. The company plans using the LoraWAN open protocol and standard Semtech based Lora devices and wireless radio frequency technology to communicate with their small satellites.

The first satellite (not launched yet) will explore how robust this protocol is when used from and to satellites and how the interference in the Lora frequency band is around the world.

The Lacuna payload will be integrated into the MP6 nanosat platform from NanoAvionics, that will also provide radio frequency allocations, satellite registration, launch integration and other services.

Kepler Communications

Toronto based Kepler was founded in 2015 and currently has one small satellite in orbit KIPP a pathfinder satellite that was launched in january 2018.

Kepler eventually plans to operate 140 satellites

in low Earth orbit to provide Internet of Things connectivity to devices on the ground and to act as a relay network for other satellites by using intersatellite links.

KIPP is the first commercial LEO spacecraft to operate in Ku-band. The Kepler system will offer store and forward services for large volume messages, using a ground terminal with an electronically steerable antenna supplied by Phasor Solutions and a custom-designed modem that will be available in 2019. Expected list price for the Kepler device is under $5000.

In August 2018 Kepler announced that it is accepting bids from launch providers to orbit its first-generation constellation of up to 15 cubesats, but with the stipulation that the launches must happen within two years third quarter of 2020. With that Kepler is actively seeking a close relationship with the new start up launcher companies.

What does it take to launch a Small satellite?

Building a small sat is a challenge but launching one is maybe even a bigger one. The Satellite Launching sector until recently focused on traditional (big) satellites and saw the new space small satellites more as a nice fill up for the empty space they had in the rocket's cargo bay anyway.

For a small sat operator to get his satellite launched this means that you have to find space alongside the primary payload in the launching rocket or to rideshare. Being a "secondary" payload however does not come easy. It means you have no control over the launch date what so ever (although some might argue this exercise in patience is good for the corporate soul), you have no control over the altitude or orbit where it will bring you (only limited launchers go to the right orbital plane), you have to pay for the launch costs way in advance without any guarantees on the actual launch (causing any small sat investor/financer to raise their eyebrows). Last but not least, the logistic process to get on board of a launcher is so complicated dedicated brokers are making a business out if it.

When we look at the small sat express it has been in preparation for already 3 years. Some of the IoT satellites on board are build in less time. Major delays were caused by failed launchers messing up the queue of anticipated launchers after that. The main launch risk for small sat operators is not that the launcher they are on will explode (there is insurance for that) but for the launcher just before them to explode, causing indefinite delays and business plan push backs.

For the growing commercial small sat industry launch currently is a major bottle neck. Remember the current generation of operators on the small sat express is just beginning. When the launch of the first generation pathfinder small satellites already takes so much effort and patience, imagine what it takes be when they want to launch their constellations. Some speak of a launch gap.

Luckily there are many start up heros in the launch sector that aim to fill up this launch gap and we should whole heartedly support them all. With nearly 7000 new small satellites planned to be launched up to 2025 there is a significant commercial opportunity for dedicated small sat launchers. The development of a reliable rocket launching system however takes a number of years, and no relief on the launch situation for small satellites is expected until 2020-2021.

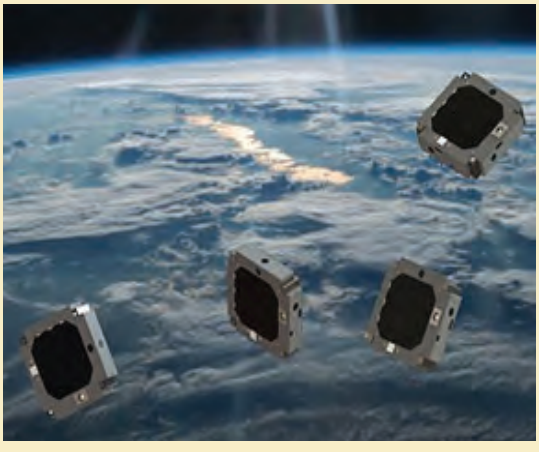
The proof of the pudding: What IoT markets will benefit from the newspace IoT networks?

After launch a new challenge is waiting for the new satellite IoT operators. With the IoT market characterized as "the market with the one million verticals" where will the small sat IoT operators fit in? We already see pilots and interest in small sat IoT from the maritime market, logistics and asset tracking, for monitoring industrial processes, provide grid management in the energy and utility sector, smart agriculture and wide area monitoring in the public infrastructure sector or the meteorological sector.

Other interesting missions on board the Small sat express

Technology demo: Audacy - 0

Audacy plans to provide spacecraft and launch operators with continuous space communications access using a MEO satellite constellation that can be used as a relay station for LEO systems. The Audacy 0 cubesat is a demonstration mission to test out Audacy's user communications terminal and first ground station in the San Francisco Bay Area.



BeeSat (TU Berlin Experimental and Educational Satellite) Beesat is a picosatellite swarm mission that is developed consisting of the four 0.25U CubeSats BEESAT-5 to BEESAT-8 with a mass of 330 grams each. The four satellites fit together in a 1U CubeSat form factor space. Mission of this distributed system is to demonstration essential functions are the communication and the relative navigation among the satellites.

Commercial small sat

The Elysium-Star 2 is a 1U CubeSat that provides a space burial service offered by Elysium Space. If you ever wanted to be buried in orbit this is a real option. The passive Cubesat holds trays with multiple individual capsules containing samples of cremated ashes.

Who is going to make it?

Some argue that the global IoT market is large enough to support a number of small sat IoT operators.

A proper evaluation of which system will succeed is not only depending on the technical capabilities of launching a satellite and getting the end-2-end network up and running. There is also financial, regulatory and commercial issues to consider. Is there enough financing available for the system to build out the complete constellation and to deal with the high launch costs and associated risks?

Is the frequency band the system is working on sustainable in future, will there not be interference in the band affecting service quality? And how will these start up operators manage to sell their equipment and services ? In particular as we talk of potentially tens of millions of devices? Building satellite is one thing, building up a global distribution network is another.

Hub Urlings was one of the pioneers of Satellite M2M as Product Manager Inmarsat-C at the famous KPN Station 12. The reliability and success of this "small data" satellite service, its global coverage and reliability made that the service was used for a myriad of applications: from sending messages, to truck fleet management, to pipeline monitoring and bringing back data from all types of sensors. At that time satellite was the only type of network that was able to offer global IoT coverage. Now, 25 years later that has not changed and he is again involved in the development of a new generation of Sat-IoT services working as Innovation Manager for the ESA program at Hiber.

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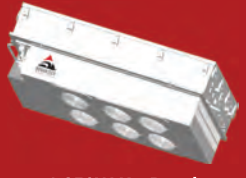

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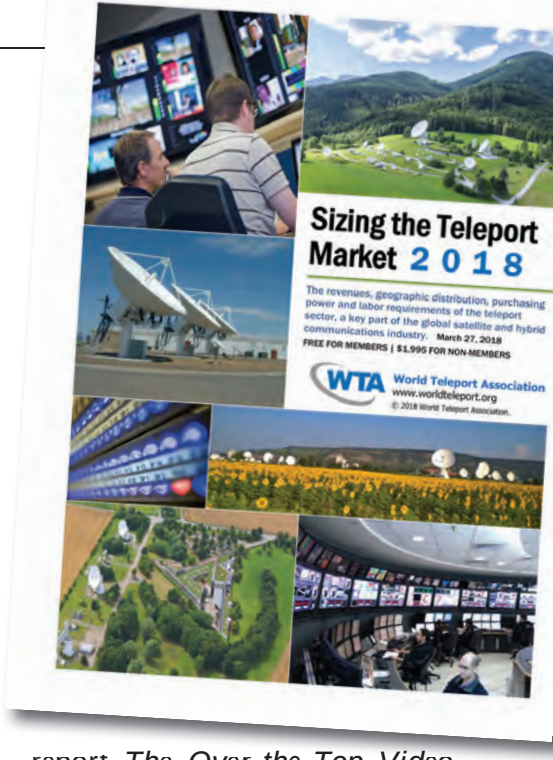
An Opportunity to Rise

by Robert Bell



Professional basketball great Koby Bryant once said "Everything negative – pressure, challenges – is all an opportunity for me to rise."

That is the story of 2018 for the global teleport industry. It has been navigating a period of unprecedented change in market demands, applications, pricing, costs and investment needs – and it has been creating opportunities for a new wave of growth in the process. Or as comic legend Milton Berle put it, "If opportunity doesn't knock, build a door."

Teleport Opportunities

In January, the World Teleport Association published, Teleport Opportunities 2018, the results of a survey of teleport operators around the world on the opportunities they were pursuing and the investment decisions they were making as a result. For teleport operators that specialize in serving media and entertainment customers, the top three investment priorities are OTT distribution, private cloud platforms and the Internet of Things (IoT). For operators specializing in data services, the top three priorities are gateway provision and collocation, mobility for commercial ground transportation, and IoT.

Those priorities form a clear picture of a changing market. Over-the-top distribution is

growing by leaps and bounds, even as the majority of content still traverses satellite networks and the OTT business model has yet to solidify. As major originators of TV channels, teleport operators are perfectly positioned to redirect that content into the new online distribution channels, performing all the reformatting, encoding and content replacement needed to meet complex distribution requirements. (See the WTA report *The Over-the-Top Video Distribution Opportunity*.)

The cloud opportunity is multifaceted. Operators serving media customers are far more likely to invest in developing their own private cloud platforms to protect the media assets their customers entrust them with. Data-centric operators see value only in integrating AWS and other third-party clouds into their operations to reduce costs, gain flexibility and connect with new customers. (See the WTA report, *Clear Skies or Stormy Weather? Cloud Services for Teleport Operators*.)

And the Internet of Things? Bain predicts that the IoT market will be worth about US$520 billion in 2021, more than double the $235bn spent in 2017, with data centers and analytics being the fastest-growing segments. Teleport operators are not about to let opportunities on that scale pass them by.

How the Market is Changing

In the past year, WTA also updated its global estimates of

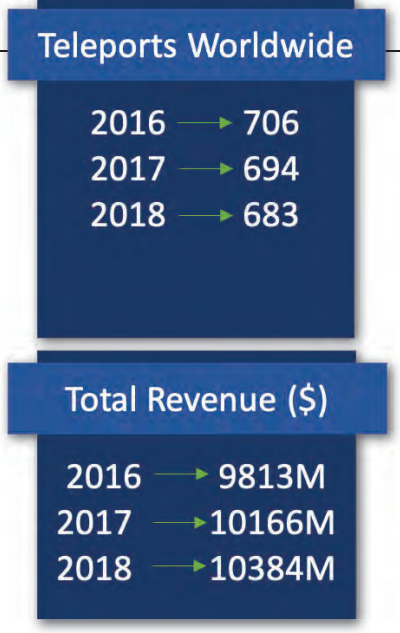
the size of the teleport market in *Sizing the Teleport Market 2018.* The sector has seen consolidation as companies build scale to gain cost efficiencies and improve their competitive position. This has produced an industry that is smaller in the number of facilities it operates but larger in total revenues. The number of commercial teleports worldwide decreased by 3% from 2016 to 2018.

Over the same period, however, estimated total revenues of the teleport sector grew 6% from US$9.813 billion in 2016 to $10.384 billion in 2018. On that basis, average revenue per teleport rose 9% from $13.9 million in 2016 to $15.2 million in 2018. For the sector as a whole, consolidation did its job of creating fewer, more productive assets.

Consolidation has not been the whole story. In a mature technology market, while midsize companies become larger and the largest seek further increases in scale, new players enter the market to exploit new demand created by technology and market change. The teleport itself keeps undergoing radical change: packing far more services into fewer antennas, virtualizing operations into software that once required massive hardware investments, and substituting terrestrial networks for satellite distribution where they can.

The Next Generation

The emerging 5G standard is the talk of the mobile industry. But with mobile backhaul a significant business for teleport and satellite operators, it is also on the minds of teleport executives. The opportunity is impressive: providing even a small part of networks that require 100 times the backhaul capacity to serve a great density of cell sites and that use virtualization to centralize much processing at data centers (from which it must be "fronthauled") instead of distributing it to base stations.



Ambitious operators, however, are looking past the present model, where less than 2% of all backhaul moves over satellite, to greater things. The 5G standard is not just a faster version of 4G; it aims to be an overarching architecture into which the full range of transmission technologies will fit. This accounts for the passion expressed by contributors to *Factoring 5G into the Future* about the need for teleport and satellite operators to have a voice in the specification that is due to be finalized in 2020. If that architecture is satellite-friendly, it has to potential to create major opportunities while helping mobile operators deploy farther and faster than, in their fiber-centric thinking, they currently expect.

Facing all these opportunities, teleport operators find themselves well-positioned to benefit from change. While their vendor-partner satellite operators face severe pressures on pricing and looming capacity gluts in some markets, teleports have become truly technology-agnostic. They use satellite where it makes sense – and lower prices for higher throughput are making it make sense in a growing range of applications. But they use every other form of transmission when it is a better price-performance match. In any case, transmission is no longer they primary business of the leaders in this industry. Their networks – and the expertise to connect them – will always have great value, but it is increasingly what they can do for customers in between the connections that bring the greatest success.

Robert Bell is Executive Director of the World Teleport Association, which represents the world's most innovative teleport operators, carriers and technology providers in 46 nations. He can be reached at rbell@worldteleport.org Factoring 5G into the Future is available free to members and for sale to non-members.

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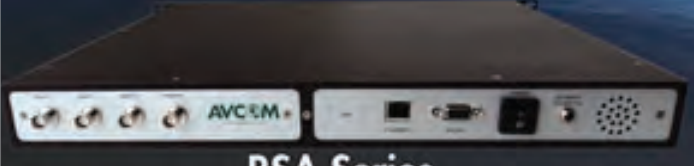

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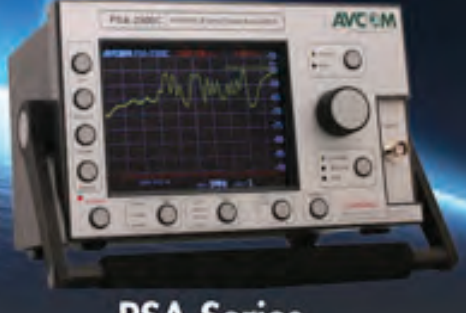

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MADE IN USA

United Technologies to Separate into 3 Independent Companies; Completes Acquisition of Rockwell Collins

Farmington, Connecticut, Nov. 26, 2018 — United Technologies has announced the completion of its acquisition of Rockwell Collins and the company's intention to separate its commercial businesses, Otis and Carrier (formerly CCS), into independent entities.

The separation will result in three global, industry-leading companies:

- United Technologies, comprised of Collins Aerospace Systems and Pratt & Whitney, will be the preeminent systems supplier to the aerospace and defense industry; Collins Aerospace was formed through the combination of UTC Aerospace Systems and Rockwell Collins;
- Otis, the world's leading manufacturer of elevators, escalators and moving walkways; and
- Carrier, a global provider of HVAC, refrigeration, building automation, fire safety and security products with leadership positions across its portfolio.

"Our decision to separate United Technologies is a pivotal moment in our history and will best position each independent company to drive sustained growth, lead its industry in innovation and customer focus, and maximize value creation," said United Technologies Chairman and Chief Executive Officer Gregory Hayes.

United Technologies Corp., based in Farmington, Connecticut, provides high technology products and services to the building and aerospace industries. By combining a passion for science with precision engineering, the company is creating smart, sustainable solutions the world needs.

Rohde & Schwarz Acquires Pixel Power

Munich, Germany, November 27, 2018 — Rohde & Schwarz has acquired Pixel Power Limited, a Cambridge, UK- based company, which offers innovative graphics, master control and integrated playout systems for broadcasters and playout facilities. These systems enable dynamic content to be delivered more efficiently for linear TV, mobile, online and OTT/VOD.

Pixel Power has consistently developed its portfolio of software-based IP solutions that are virtualizable for the private or public cloud, whilst offering new OPEX business models as part of the broadcast technology transformation. The company has been developing and deploying broadcast solutions for 31 years. With this acquisition Rohde & Schwarz further expands its portfolio to complement existing product lines.

Cornelius Heinemann, Head of Transmitter and Amplifier Systems, File Based Media Solutions, said the acquisition significantly expands Rohde & Schwarz's Broadcast & Media portfolio with new and exciting solutions. "Together we can combine the software defined technologies and virtualized environments to offer customers the very real benefits that they provide in broadcast playout and VOD markets," he said.

James Gilbert, co-founder and CEO of Pixel Power, adds, "Our virtualizable integrated playout technology is making a major contribution to Rohde & Schwarz reaching its ambitious goals for cloud-based solutions. Our modern license and payment model also contributes to this. In return, the Rohde & Schwarz size, stability, structures and competencies offer optimal opportunities for the further development of our products and the expansion of our worldwide sales. We believe this combination will benefit our customers enormously."

Advantech Satellite Networks is now Doing Business as Spacebridge

Cape Town, South Africa, November 13, 2018— Advantech Satellite Networks, an established vendor and global market leader of broadband satellite communications systems announced here at the Africacom Conference and Exhibition that it will now be doing business as Spacebridge Inc.

The company provides satellite equipment and services for deploying satellite communication networks: VSAT HUBs, VSAT Terminals in Point-to-Point, Point-to-Multi-Point, mesh topologies as well as SCPC and broadcast modems.

Spacebridge Inc. also provides Cloud-Based au-

tonomous managed services for its customers helping them to eliminate CapEx investments and save on network management OpEX.

It's diverse portfolio includes its ASAT™ product line supporting different verticals with various technologies and applications such as: Cellular backhaul, Industrial Internet of Things - IIoT, commercial and military Satcom-On-The-Move - STOM, high-speed broadband, multicast IPTV, voice over IP, videoconferencing, L2/L3 VPN, Virtual Network Operator and HD/UHD TV broadcasting

ASAT™ Wave Switch™ technology that SPACEBRIDGE INC. brought to the market in 2015, allowing return link dynamically selecting and switching to most-appropriate waveform - optimizing satellite resource usage for the network owner and operator.

As part of the significant revolution in the satellite market NGSO LEO/MEO satellite constellations takes off, SPACEBRIDGE INC. is working in close partnership with New-Space players, proactively participates in this change of the satellite communication landscape, developing VSAT systems which are capable of utilizing this capacity leap and deliver 4G, 5G backhauling, IIoT and many other applications to our customers.

Boeing, Safran Begin Joint Venture for Designing, Building and Servicing Auxiliary Power Units

Chicago, Il., Nov. 9, 2018 — Boeing [NYSE: BA] and Safran [EPA: SAF] have received regulatory approvals for a joint venture so they can begin designing, building and servicing aircraft Auxiliary Power Units (APUs)—onboard engines that are primarily used to start the main engines and power aircraft systems while on the ground and, if necessary, in flight. The companies also named Etienne Boisseau as Chief Executive Officer of the joint venture.

The agreement establishes a partnership between two of the world's leading aerospace companies to work together on APU products and expanded service capabilities to benefit customers and industry. Both companies have a 50 percent stake in the joint venture. The initial team will perform design work in San Diego, Calif.

"Safran is proud to launch this joint venture with Boeing in order to offer state-of-the-art APUs and enhance customer value. Together, we are committed to delivering innovative, highly technological and cost-competitive solutions to global customers. We are confident this joint team will provide first-class products and services within the best integrated industrial organization," said Philippe Petitcolin, CEO of Safran.

The joint venture combines Boeing's customer and airplane knowledge and Safran's experience designing and producing complex propulsion systems.

"We are open for business and excited to offer even more value to our customers throughout the lifecycle of their investment. This joint venture strengthens Boeing's vertical capabilities as we continue to expand our services portfolio. By making strategic investments that accelerate our growth plans, we also are providing our customers with expanded, innovative services solutions," said Stan Deal, President and CEO of Boeing Global Services.

The name of the joint venture as well as the location of the future headquarters and production and service facilities will be announced at a later date.

Verimatrix Acquires Akamai Identity Services

San Diego, Calif. – Verimatrix, a specialist in securing and enhancing revenue for network-connected devices and services, has announced the acquisition of the assets that comprise the Akamai Identity Services (AIS) product from Akamai (NASDAQ: AKAM), the intelligent edge platform for securing and delivering digital experiences. Adding TV Everywhere (TVE) type service capabilities to the Verimatrix portfolio underscores the importance of a common authentication system to reduce friction within the content distribution workflow and ultimately support new ways to increase the value of the content chain on a global level.

"This acquisition fits perfectly with our roadmap to streamline content workflows via cloud-based technologies to connect global consumers with great content," said Mike Kleiman, COO, Verimatrix. "We are able to extend the value of these global identity services under our solution umbrella and provide a more flexible, yet standards-based alternative that will improve the experience for consumers and open new markets for content providers and programmers."

Peter Cabooter Joins Aireon as VP of Customer Affairs

McLean, Va., Nov. 29, 2018 — Aireon announced today that Peter Cabooter has joined the executive team, fulfilling a newly created position, Vice President of Customer Affairs. In this role, Cabooter will lead Aireon's program to support existing customers around the world and developing new relationships with Air Navigation Service Providers (ANSPs) currently not subscribed to the AireonSM service.

Cabooter comes to Aireon with 17 years of sales and air traffic management experience including executive positions at NAVBLUE (previously Airbus ProSky) and Barco Orthogon (now a part of Harris Corporation). As part of his role, Cabooter will lead global sales initiatives for Aireon.

In addition to Cabooter's new executive role, Cyriel Kronenburg, Aireon's Vice President of Aviation Services, will now take on the responsibilities to lead Aireon's regulatory, marketing, product development, commercial data services and partner development activities.

Stephan Heimbecher Joins Imagine Communications from Sky Deutschland

Munich, Germany, November 27, 2018 – Imagine Communications has appointed Stephan Heimbecher as its new international director of consulting services, based out of Munich, Germany. Heimbecher joins Imagine Communications from Sky Deutschland, where he spent the last 16 years at the helm of innovation and standards for the German media company.

In his new role at Imagine Communications, Heimbecher will lead a team of industry experts focused on collaborating with customers to solve significant challenges that currently face the broadcast and media industries. In an effort to enable customers around the world, Imagine has focused its innovation efforts around IP production and playout, hybrid and IP facility implementation, cloud and virtualized deployment for playout and distribution, and multiplatform delivery and operations across traditional and OTT platforms.

Barbara Bergmeier Appointed Head of Operations of Airbus Defence and Space

Munich, Germany, November 26, 2018 – Airbus Defence and Space has appointed Barbara Bergmeier, 50, as Head of Operations and Member of the Executive Committee, effective 1 December 2018. She succeeds André-Hubert Roussel, 53, who will become Chief Executive Officer (CEO) of ArianeGroup, a 50-50 joint venture between Airbus and Safran, effective 1 January 2019.

Barbara Bergmeier joins Airbus Defence and Space from Vilsbiburg, Germany-based Dräxlmaier Group, where she has been Chief Operating Officer and an Executive Board Member since 2014. In that capacity, she has been in charge of 50 production sites in 20 countries and has been instrumental in expanding the company's industrial footprint in Asia and in the Americas.

Before joining Dräxlmaier Group in 2014, Barbara Bergmeier worked at automotive company BMW Group where she held various senior management positions from 1990. Among others, she was Senior Vice President HR Management/Services at the company's headquarters in Munich, Vice President Chassis & Drive Components in Dingolfing, Germany and Vice President Assembly and Logistics at BMW's Spartanburg plant in the U.S.

André-Hubert Roussel to Succeed Alain Charmeau as ArianeGroup CEO

Issy-les-Moulineaux, France, Nov. 26, 2018 — The Board of Directors of ArianeGroup has endorsed the proposal made by Airbus and Safran and has approved on November 22, 2019, the appointment of Andre-Hubert Roussel, 53, to succeed Alain Charmeau,62, as Chief Executive Officer of the company, effective January 1, 2019.

Andre-Hubert Roussel is

currently Head of Operations at Airbus Defence and Space and has been a member of ArianeGroup Board since July 2018.

Alain Charmeau will retire after a transition phase from January 1 st to March 31, 2019, during which he will serve as Special Advisor to the new CEO of ArianeGroup.

Since 2016, André-Hubert Roussel has been serving as Head of Operations and Member of the Executive Committee at Airbus Defence and Space. Previously, he was in charge of Engineering at Airbus Defence and Space.

KVH Promotes Bruun to COO; Woodhead Named EVP-Mobile Connectivity

Middletown, RI, Nov. 15, 2018 — KVH Industries today announced that Brent Bruun has expanded his responsibilities as chief operating officer, and Mark Woodhead has been named executive vice president of mobile connectivity.

In his role as chief operating officer, Bruun will now spearhead corporate business development; oversee all operational and financial aspects of KVH's mobile connectivity and inertial navigation businesses; lead financial planning and analysis; foster investor relations; and work toward organizational excellence across the global company. Bruun joined KVH in early 2008 and served as executive vice president of the mobile broadband group, the company's largest business unit. Prior to joining KVH, Bruun was senior vice president with satellite operator SES Americom, and gained his strong corporate financial background from positions held with GE Capital and KPMG earlier in his career.

Peraton Appoints Alan Stewart as its Chief Financial Officer

Herndon, VA, Nov. 5, 2018 — Peraton has announced the appointment of Alan Stewart as executive vice president and chief financial officer.

In this role, Stewart will have executive responsibility for all elements of the company's financial planning, accounting, government reporting, and auditing functions. He will also help to manage the company's external audit and lender relationships.

Stewart joins Peraton from Systems Planning and Analysis, Inc. where he served as senior vice president, chief financial officer and treasurer. In that role he led all financial functions for the company. Prior to this role, Stewart served as chief financial officer for Vistronix, now a part of ASRC, where he helped lead the complex integration of six acquisitions onto a common financial system over a 20-month period leading to the sale to ASRC.

ITU Re-elects Zhao as Director-General

Dubai, Nov. 1, 2018 — Member States of the International Telecommunication Union (ITU) have re-elected Houlin Zhao of China as ITU secretary-general. The election took place in Dubai, United Arab Emirates, during the Plenary session of the PP-18 conference this morning. Zhao won the position with 176 votes, from 178 ballot papers deposited. He contested the position unopposed.

Zhao, an information and communication technology (ICT) engineer who has served in a variety of senior management positions at ITU, will begin his second, and last, four-year term on 1 January 2019.

Prior to first being elected as ITU Secretary General in 2014, Zhao served eight years as ITU deputy secretary-general. He also served two elected terms as director of ITU's Telecommunication Standardization Bureau (TSB), which develops technical standards to ensure worldwide ICT interoperability. Before that, he was a senior counsellor with TSB for 12 years.

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*Source: Saudi General Entertainment Authority (GEA) Announcement – Feb 2018

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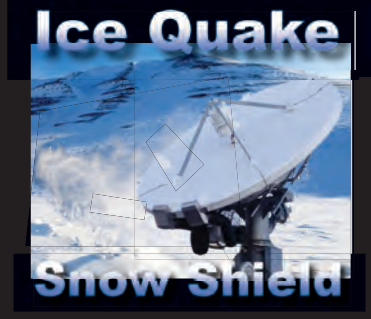

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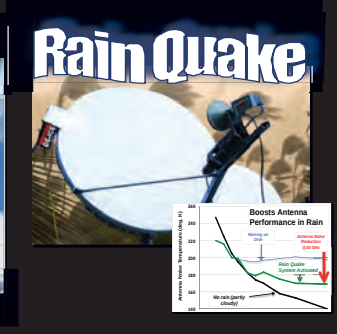

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MARKET TRENDS

Survey Finds 15% of Singaporean Consumers Use Illicit Streaming Devices to View Pirated TV Channels and Video-on-Demand Content

Singapore, Nov. 28, 2018 – A new study of the content viewing behavior of Singaporean consumers revealed that 15% of consumers use a TV box which can be used to stream pirated television and video content. These TV boxes, also known as Illicit Streaming Devices (ISDs), allow users to access hundreds of pirated television channels and video-on-demand (VOD) content, usually with a low annual subscription fee. TV boxes often come pre-loaded with illegal applications allowing 'plug-and-play' access to pirated content.

The survey found that My-IPTV, UBTV, WorldTV, Moon-HD, and Infinity TV, are some of the most popular illegal applications amongst Singapore consumers.

The survey, commissioned by the Asia Video Industry Association's (AVIA) Coalition Against Piracy (CAP) and conducted by YouGov, also highlights the detrimental effects of streaming piracy on legitimate subscription video services. Of the 15% of consumers who purchased a TV box for free streaming, more than one-quarter (28%) asserted that they cancelled their subscriptions to a Singaporean-based online video service as a direct consequence of owning an ISD. International subscription services, which include pan-Asia online offerings, were also impacted – nearly one in five (18%) Singaporean users have abandoned those services in favor of ISD purchases.

Of those consumers who own an ISD, more than half of respondents (62%) claim to have purchased their illicit streaming device from two of the largest Southeast Asia-based e-commerce stores. More than one-fifth of ISD owners (21%) say they acquired their devices via one of the world's most popular social media platforms. Over one-third (38%) of ISD owners said they purchased their pirate TV box from IT Exhibitions or physical retail stores in Singapore.

Fifteen percent of Singaporean consumers use TV box to view pirated TV and video content, a new survey reveals.

An important win in the industry's fight against piracy was the recent High Court injunction ordering Singapore's internet service providers to block access to popular illegal applications that are frequently pre-loaded on ISDs sold in Singapore. As a consequence of these High Court blocking orders, Gane added, "Consumers are wasting their money when purchasing new subscriptions to illegal applications when they find their ISD can no longer access live sports matches or their favorite TV shows. CAP will continue to prevent and disrupt illegal feeds of live sports, TV channels, and VOD content through judicial blocking orders against piracy applications. ISDs can never provide quality programming and a service guarantee."

Singapore currently has over a dozen online legal services providing an array of live sports, TV channels and video-on-demand content at varying flexible price-points.

A growing concern from the anti-cyber crime community remains the nexus between online piracy and pernicious malware such as spyware, malware mining and ransomware. In September 2018, the European Union Intellectual Property Office released a report entitled "Identification and Analysis of malware on selected suspected copyright in-

fringing websites" which found that most of the documented malware on piracy sites were trojans or other malware which, when installed on an end-user's, computer would cause "not only financial losses, but also theft of personal data and other risks of unwanted access and control."

Cisco Predicts More IP Traffic in the Next Five Years Than in the History of the Internet

By 2022, more IP traffic will cross global networks than in all prior 'internet years' combined up to the end of 2016.

San Jose, Calif., Nov. 27, 2018 — The internet is made up of thousands of public and private networks around the world. And since it came to life in 1984, more than 4.7 zettabytes of IP traffic have flowed across it. That's the same as all the movies ever made crossing global IP networks in less than a minute.Yet the new Visual Networking Index (VNI) by Cisco predicts that is just the beginning. By 2022, more IP traffic will cross global networks than in all prior 'internet years' combined up to the end of 2016. In other words, more traffic will be created in 2022 than in the 32 years since the internet started, says CISCO.

Where will that traffic come from? All of us, our machines and the way we use the internet. By 2022, 60 percent of the global population will be internet users. More than 28 billion devices and connections will be online. And video will make up 82 percent of all IP traffic.

"The size and complexity of the internet continues to grow in ways that many could not have imagined. Since we first started the VNI Forecast in 2005, traffic has increased 56-fold, amassing a 36 percent CAGR with more people, devices and applications accessing IP networks," said Jonathan Davidson, senior vice president and general manager, Service Provider Business, Cisco. "Global service providers are focused on transforming their networks to better manage and route traffic, while delivering premium experiences. Our ongoing research helps us gain and share valuable insights into technology and architectural transitions our customers must make to succeed."

Key predictions for 2022

Cisco's VNI looks at the impact that users, devices and other trends will have on global IP networks over a five-year period. From 2017 to 2022, Cisco predicts:

1. Global IP traffic will more than triple

- Global IP traffic is expected to reach 396 exabytes per month by 2022, up from 122 exabytes per month in 2017. That's 4.8 zettabytes of traffic per year by 2022.
- By 2022, the busiest hour of internet traffic will be six times more active than the average. Busy hour internet traffic will grow by nearly five times (37 percent CAGR) from 2017 to 2022, reaching 7.2 petabytes [1] per second by 2022. In comparison, average internet traffic will grow by nearly four times (30 percent CAGR) over the same period to reach 1 petabyte by 2022.

2. Global internet users will make up 60 percent of the world's population

- There will be 4.8 billion internet users by 2022. That's up from 3.4 billion in 2017 or 45 percent of the world's population.

3. Global networked devices and connections will reach 28.5 billion

- By 2022, there will be 28.5 billion fixed and mobile personal devices and connections, up from 18 billion in 2017—or 3.6 networked devices/connections per person, from 2.4 per person.
- More than half of all devices and connections will be machine-to-machine by 2022, up from 34 percent in 2017. That's

14.6 billion connections from smart speakers, fixtures, devices and everything else, up from 6.1 billion.

4. Global broadband, Wi-Fi and mobile speeds will double or more

- Average global fixed broadband speeds will nearly double from 39.0 Mbps to 75.4 Mbps.
- Average global Wi-Fi connection speeds will more than double from 24.4 Mbps to 54.0 Mbps.
- Average global mobile connection speeds will more than triple from 8.7 Mbps to 28.5 Mbps.

5. Video, gaming and multimedia will make up more than 85 percent of all traffic

- IP video traffic will quadruple by 2022. As a result, it will make up an even larger percentage of total IP traffic than before—up to 82 percent from 75 percent.
- Gaming traffic is expected to grow nine-fold from 2017 to 2022. It will represent four percent of overall IP traffic in 2022.
- Virtual and augmented reality traffic will skyrocket as more consumers and businesses use the technologies. By 2022, virtual and augmented reality traffic will reach 4.02 exabytes/month, up from 0.33 exabytes/month in 2017.

Regional IP traffic growth details (2017 – 2022)

- APAC: 173 exabytes/month by 2022, 32 percent CAGR, four-times growth
- North America: 108 exabytes/month by 2022, 21 percent CAGR, three-times growth
- Western Europe: 50 exabytes/month 2022, 22 percent CAGR, three-times growth
- Central & Eastern Europe: 25 exabytes/month by 2022, 26 percent CAGR, three-times growth
- Middle East and Africa: 21 exabytes/month by 2022, 41 percent CAGR, six-times growth
- Latin America: 19 exabytes/month by 2022, 21 percent CAGR, three-times growth

New Report Predicts 5G Deployment Trends 2018-2025

Bristol, UK, Nov. 22, 2018 — With the onset of 5G world, vendors are emphasizing new business models and trying to enable them but operator spending plans show they are more concerned about sustaining the growth curve on mobile broadband. According to RAN Research, the wireless research arm of Rethink Technology Research, this mismatch will show up in planned Capex expenditure and the order in which operators expect to deploy different aspects of 5G. It predicts that early 5G will be all about consumer mobile broadband delivering high speed to the handset, and ignoring new business models.

The report concluded that while one year ago, over 50% of Tier 1 and 2 operators said they planned to de-ploy 5G 'small cell-first', now the consensus is that two-thirds of 5G sites deployed in the first two years of commercial roll-out will be macro.

It said fully commercial-grade platforms and open interfaces have not matured as quickly as expected, while many MNOs believe they have to deploy 5G earlier than they had once planned. This has led to a misalignment between the availability of virtualized systems, and the pace of 5G roll-out. While 84% of MNOs aim to deploy a 5G vRAN, only 24% believe they will do that in the first two years.

The report also said that early 5G will be all about consumer mobile broadband. RAN said in its 2018 survey, the top goal for first phase 5G deployment are cost-related – lower cost to deliver high speeds and high capacity mobile broadband, largely to support the enhancement of conventional use cases. In the same survey, conducted two years earlier, three of the top five commercial goals for 5G related to new revenue streams – in-creased enterprise and IoT business was the top driver, placed in their top three by 40%.

Euroconsult: Evolving Chinese Space Ecosystem to Foster Innovative Environment

Paris, France, Nov. 20, 2018 — According to Euroconsult's latest report, China Space Industry 2018, the China space value chain had an estimated size of more than US$ 16 billion in 2017, with the downstream market accounting for just over 85%. Satellite Navigation, one of the key satellite applications in China, was the main revenue generator in 2017, ahead of Satellite Communications and Earth Observation.

This premier edition of the report provides a deep-dive analysis

of the current Chinese space ecosystem and future expected evolutions, from upstream to downstream, and covers each of the key satellite applications in China: Satellite Manufacturing, Launch, Satellite Communications, Earth Observation, Satellite Navigation and Space Exploration. For each of the markets, key current and potential future players expected to have an impact on the ecosystem are profiled, including details on their strategies, funding, technological competencies and potential future plans.

"China's space industry is rapidly evolving, with an increasing number of nominally private companies competing in different parts of the space industry in both China and abroad, and with the Chinese space industry starting to play a bigger role in cutting-edge technology," said Dimitri Buchs, Senior Consultant at Euroconsult and editor of the report. "Changes are occurring at a rapid pace across the value chain, for both upstream and downstream activities and for all application domains."

Key highlights per application domain include:

- Science & Exploration: China wants to cultivate its international leadership in space and the country has started a long-term manned space program with the Moon as a priority for space exploration and other exploration programs including a Mars mission to be confirmed. On the space science front, it has not been considered a main strategic priority area by China but the country is seeking to ramp-up its activities.
- Satellite Communications: Capacity leased by GEO satellite operators has remained largely stable in China in recent years, with demand for regular capacity dominant today. Historically the market has been dominated by China Satcom, the state-owned satellite operator, but an increasing number of Chinese companies are considering making a move into the satellite operator sphere, generally with the intention of providing services outside of China, including Huaxun Fangzhou (CCT Satcom) and Tatwah Group. Beyond this, several private constellation projects may also come to fruition (e.g. Commsat, OK Space...).
- Satellite Navigation: Given the strategic importance of satellite navigation to a variety of industries, China has for some time made it a goal of reducing its reliance on foreign navigation systems, thus the implementation of the Beidou program. The latter system is expected to achieve global coverage by 2021 with coverage of Belt and Road countries by YE 2018.
- Earth Observation: One of the most established private space industries in China, with the first nominally commercial/private Earth observation satellites having been procured in the early 2000s. Integration is continuing towards value-added services (VAS) development, even if still in the planning phase. Development of constellation fleets in both spectral and spatial resolutions is an opportunity to foster new services development. Several EO companies are quite well established (21at, Charming Globe, Space View, etc.), in parallel with several newcomers having the ability to design and operate EO satellites (Qian Sheng, etc.).

"The current changes in the space ecosystem are being brought about using different strategies, such as the opening of some markets to private enterprises and greater competition among incumbents, all of which are aimed at fostering greater innovation among companies within China," said Blaine Curcio, Senior Affiliate Consultant at Euroconsult and expert on the China commercial space market.

The Satellite Markets 20 Index™

Company Name	Symbol	Price Dec. 3	52-wk Range	
Satellite Operators				
Asia Satellite Telecommunications Holdings Li	1135.HK	5.25	4.62	7.20
Eutelsat Communications S.A.	ETL.PA	18.17	15.28	23.11
APT Satellite Holdings Limited	1045.HK	2.95	2.47	4.18
Inmarsat Plc	ISAT.L	421.30	334.30	646.00
SES S.A.	SES.F	19.00	10.64	20.81
Satellite Manufacturers				
The Boeing Company	BA	359.96	274.00	394.28
Maxar Technologies	MAXR	16.64	13.50	67.30
Lockheed Martin Corporation	LMT	296.79	291.52	363.00
OHB SE	OHB.DE	38	27.55	49.75
Honeywell International Inc.	HON	149.98	133.71	162.52
Equipment Manufacturers				
C-Com Satellite Systems Inc.	CMI.V	1.08	0.98	1.30
Comtech Telecommunications Corp.	CMTL	26.09	19.30	36.94
Harris Corporation	HRS	142.80	138.08	175.50
ViaSat Inc.	VSAT	70.58	59.16	80.26
Gilat Satellite Networks Ltd.	GILT	9.32	6.89	10.74
Service Providers				
DISH Network Corporation	DISH	33.39	27.54	52.53
Globalstar Inc.	GSAT	0.38	0.30	1.62
Orbcomm Inc.	ORBC	9.88	8.43	11.95
Sirius XM Holdings Inc.	SIRI	6.32	5.17	7.70
Sky plc	SKY.L	1727.50	943.50	1740.00

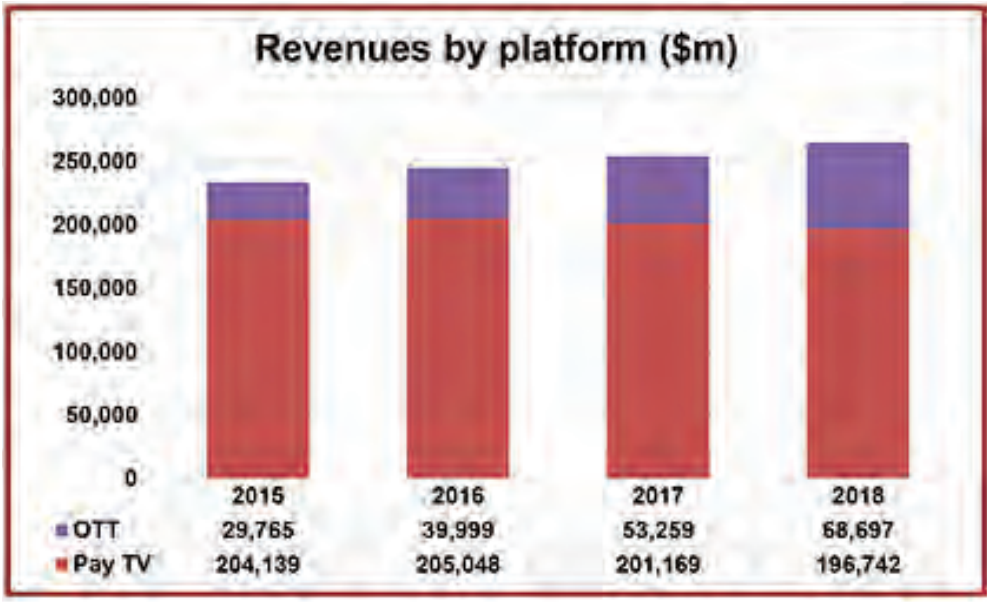
The Satellite Markets 20 Index™ is a composite of 20 publicly-traded satellite companies worldwide with five companies representing each major market segment of the industry: satellite operators; satellite manufacturers; equipment manufacturers; and service providers. The base data for the Satellite 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 Nov. 5
Satellite Markets 20 Index™	3,355.38
S & P 500	2,901.52

ADVERTISERS' INDEX

VITAL STATS

Global TV Revenues to Grow to US$ 265 Billion This year



Global revenues from traditional pay TV and OTT TV episodes and movies will reach US$ 265 billion in 2018; up from US$ 254 billion in 2017 and US$ 234 billion in 2015., according to Digital TV Research.