Satellite Executive BRIEFING

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SATELLITE Markets & Research

Industry Trends, News Analysis, Market Intelligence and Opportunities

Satellite Market Trends

by Elisabeth Tweedie, Associate Editor

Pacôme Révillon, CEO of Euroconsult, opened World Satellite Business Week in Paris this year, by saying that the next three years were going to be "transformational". At VSAT Global in London, Steve Collar, CEO of SES Networks echoed that sentiment when he commented that "the industry was facing bigger changes than at any time in the last 30 years." Change, was the word that set the theme for all of the three conferences held in Europe, in September: World Satellite Business Week, IBC in Amsterdam and VSAT Global.

One of the main changes facing the industry is the reality of the LEO constellations, with OneWeb closing US$1.2 billion in financing and LeoSat, receiving an unspecified amount from JSat. According to Euroconsult there are around 10 broadband LEO constellations in the pipeline, although the common consensus was that only two or three of these would succeed. Will Porteous, General Partner and COO, RRE Ventures, commented that "the market is awash in innovation, what is lacking is great leadership." Interestingly, there was no talk of a repeat of the 1990s, when all of the then proposed LEO constellations, failed to provide a return to their original investors.

September was a busy month for satellite industry events featuring Euroconsult's World Satellite Business Week, IBC in Amsterdam and VSAT in London.

For the satellite manufacturers, the smallsat market was seen as either "critical" or "opportunistic." Hardly surprising, given that there have only been four orders for geostationary satellites, so far this year. When the manufacturers were asked to comment on this, Mark Spiwak, President of Boeing Satellite Systems International, Inc. went as far as to say that this (the number of GEO orders) "is not a relevant metric anymore." The other manufacturers generally agreed, Frank Culbertson, President of Space Systems Group, Orbital ATK, pointing out that "Orbital is going to deliver 54 satellites this year, only three of which are GEOs." Nevertheless, the manufacturers are expecting another six GEO orders by the end of the year.

The biggest announcement made during World Satellite Business Week, came from SES, who

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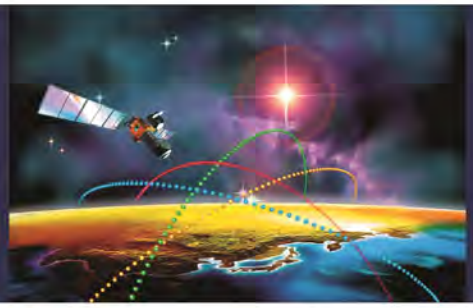

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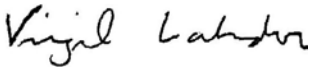
Future Prospects in the Satellite

September was a very busy month for events in the satellite industry. Last month we had the World Satellite Business Week organized by Euroconsult in Paris, the IBC in Amsterdam and the VSAT conference in London. There was also the ITU Telecom World conference and exhibition held in Busan, South Korea. I and our Associate Editor, Elisabeth Tweedie covered all these important events and she summarized the highlights in her comprehensive report on these events, which is our cover story this month. A separate report on the ITU is on page 22 of this issue.

As Elisabeth clearly highlighted in her cover story, there are many changes that will impacting the satellite industry in the next few years. Many of these changes are *transformational,* meaning they will result in revolutionary changes in the industry. Certainly the Low Earth Orbit constellations that are coming up are a key to some of these changes. One market that will be driving the transformation of our industry is broadband access. In many panel discussions at the aforementioned conferences, a recurring statistic cited by speakers is that almost four billion people still do not have access to basic internet. This certainly is a large untapped market. Things are also very encouraging for the satellite industry in key segments like the aeronautical, maritime and cellular markets. So, there is a lot to be optimistic about.

October will be likewise a busy month, we will be at the NAB New York and MILCOM in Baltimore. We look forward to seeing you at the and other future shows where we will continue to report on the trends and prospects in the global satellite industry.



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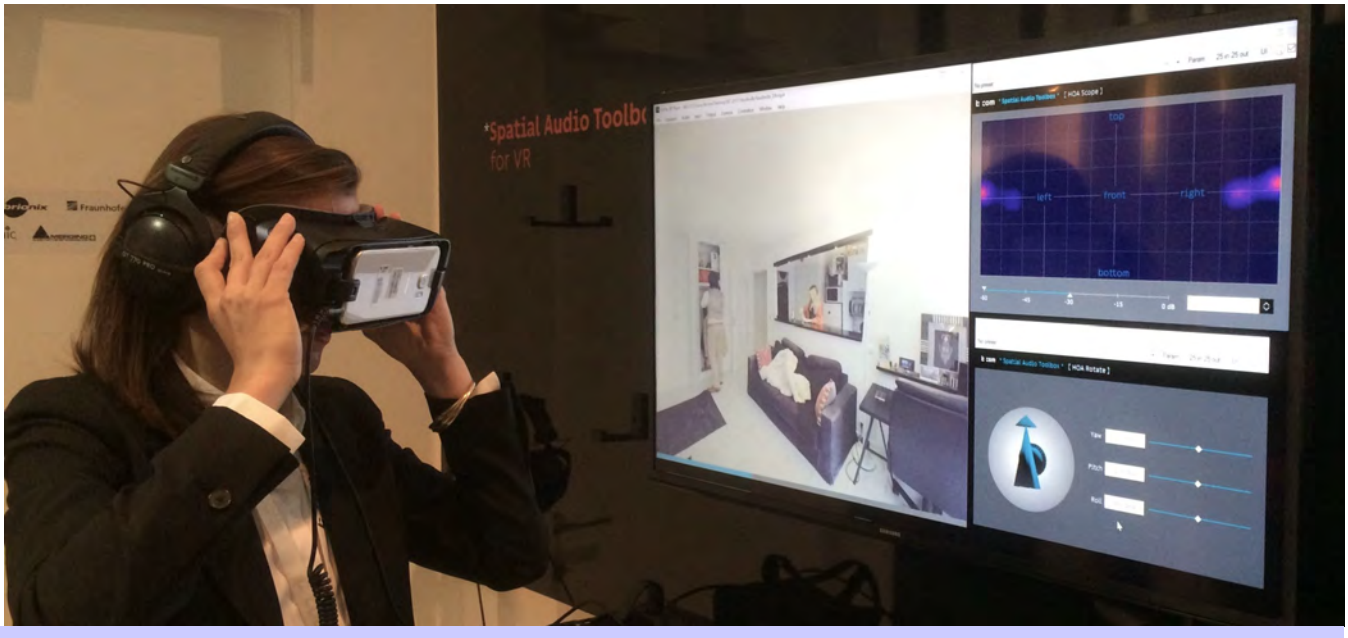
Satellite Market Trends...From page 1

announced that it had placed an order with Boeing Satellite Systems for seven MEO satellites, which probably explains why Mark Spiwak, felt that GEOs were no longer a relevant metric. These satellites will be the first satellites for O3b mPower, the follow-on constellation for O3b; and are due to be launched in 2021. The new system represents a step change from the current design. Each satellite will have 4,000 beams, vs. the 10 on the existing constellation. These beams can be dynamically allocated, meaning that

"...The new LEO constellations are not the only change facing the industry. Last year HTS accounted for just 12% of the revenue of the FSS operators. By 2026, Euroconsult is forecasting that it will account for 53%. ..."

Officer of Kymeta said that "It is absurd to think that we will take over the market, we will not compete with parabolic antennas." David Garrod, CSO, Phasor solutions echoed this statement, pointing out that the flat panel antennas were not as capable as parabolic antennas.



Virtual Reality technology was on display at the IBC 2017 in Amsterdam.

100% of capacity will be focused on customers, i.e. no coverage of empty oceans or land mass. Like the existing constellation, the satellites will be in an equatorial orbit, but will have a greater look angle, covering +/- 50 degrees latitude, vs +/- 45 degrees now.

The challenge for mPower, and for the LEO operators, will be on the ground. As Pacôme said in the opening session of WSBW, "can the flat panel manufacturers succeed in meeting their target prices of US$15-25,000 for a maritime antenna and US$300 for a consumer antenna?" At Global VSAT, Bill Marks, EVP and Chief Commercial

As yet, no decision has been made regarding suppliers of the ground system for mPower: however, it is intended that from day one, the terminals will contain storage, edge computing capabilities and be capable of dynamically interfacing with GEOs, MEOs and terrestrial systems; as needed and appropriate. The challenge will be doing this, at an affordable price, and one that closes the business case.

The new constellations are not the only change facing the industry. Last year HTS accounted for just 12% of the revenue of the FSS operators. By 2026, Euroconsult is forecasting that it will account for 53%. Whilst now, North America accounts for 57% of that revenue, by 2026 it will only account for 26%. By 2022, the combined HTS market will supply 9Tbps of capacity (of which 39% will be supplied by non-Geostationary satellites (NGSO)), a ten-fold increase from the 0.9Tbps currently supplied.

At least part of this increase, is no doubt being fueled by falling costs. Brent Prokosh, a Senior Consultant at Euroconsult, showed an interesting chart, documenting this. Including launch, insurance and ground infrastructure: Hylas 2, launched in 2012 cost US$12.9 million per Gbps, Jupiter 2 launched last year cost US$2.0 million per Gbps and Viasat 3, to be launched in 2020, costs US$0.7 million per Gbps.

As well as the (potential) new LEO operators, there are also new operators entering the GEO market. Euroconsult is projecting that there will be

around 60 satellite operators in 2020, up from approximately 40 in 2014. However, this comes at a price. Fill rates of only 36% for HTS capacity are also projected.

A falling cost basis, coupled with oversupply, means not only, that operators can afford to charge less, but they will be forced to do so, in order to keep and/or gain market share. During Global VSAT, there was heated debate as to whether we're on the brink of a race to the bottom, or whether the lower pricing would result in increased demand and open up new markets. Falling prices were also blamed for operators starting to move down the value chain, and SES in particular was singled out, for doing this. However, P.J. Beylier, CEO of Speedcast International, one of the largest service providers, stated that he was "not feeling stabbed in the back."

For video, which has long been the mainstay of satellite revenues, fill rates of 67% in 2020 are projected. However, as already mentioned, HTS is projected to account for 53% of revenues by 2026. In absolute terms, this means that non-HTS revenue will fall from US$9.52 million in 2016 to US$7.19 million in 2026. The decline in non-HTS revenue is attributed to a change in viewing habits from linear to Over-the-Top (OTT) Video on demand, the continued decline in transmitting channels in both standard definition (SD) and high definition (HD) and the transitioning of some applications to HTS.

For SES, however, the video picture remains very positive. The company has a 39% increase in SD channels transmitted since 2012 and a 69% increase in HD channels. The creation of MX1 has also been a very positive event. MX1 now distributes over 2,750 video channels and manages the playout of 500 of them, as well as syndicating content to 120 VoD platforms and delivering over 8,000 hours of streaming content every day. Customers include BBc Worldwide and Amazon Prime. As well as delivering multiple channels to Amazon Prime, MX1 is also responsible for the live streaming of Thursday night NFL games, with the capability to insert local advertising.

As would be expected, at IBC, there was much discussion of 4K, also known as ultra-high definition (UHD). As pointed out in my previous article, this has not taken off, as quickly as anticipated. SES showed a chart from Ovum, indicating that by 2020, 25% of TV households will be 4K households. However, owning a UHD television set, says more about the TV manufacturers ability to produce in volume,

and therefore minimize the price differential between a HD and a UHD set, than it does about the number of channels being broadcast in 4K. Globally, there are currently 80 satellite channels being broadcast in 4K. At 31 channels, SES has the lion's share of these. It also has the largest UHD neighborhood in the world, with 10 channels being broadcast in North America. However, many of the channels being broadcast worldwide are test, not commercial channels.

Virtual reality (VR) was also much on display at IBC, in both its variants: Type A (untethered) and Type B (tethered). David Wood, of the EBU, enthused about it, but pointed out, that, as with most technical developments, there are no shortage of groups trying to devise standards for VR. Over 50 to be precise! This December, the groups are meeting in San Diego to try and agree on a uniform standard. This should be an interesting meeting.

At Global VSAT, a great deal of the discussion centered around the significant growth in the industry, most of which comes from mobility. Susan Bull, from Comsys, presented data showing that in the five years to 2016, the number of sites has increased by 65%, and mobile revenues have grown 70% to US$1.7 billion.

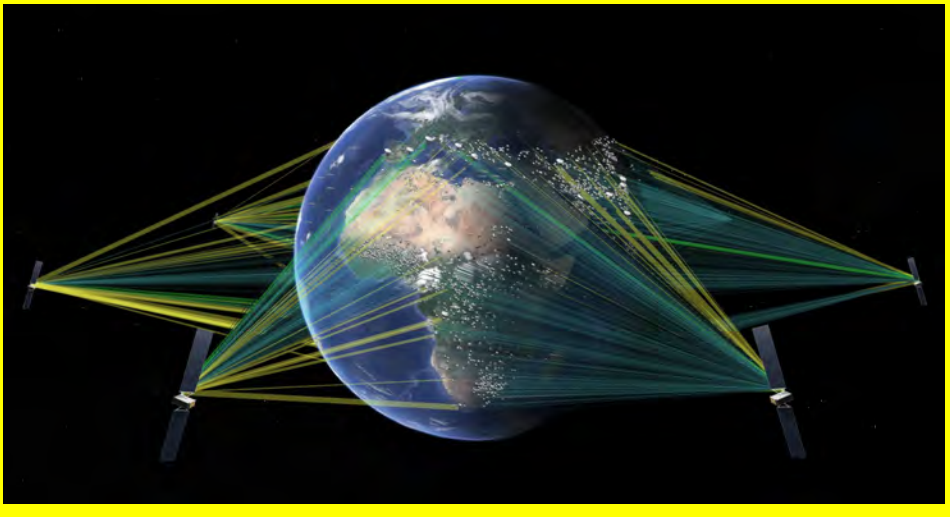
P.J. Beylier, likened the maritime market now, to the terrestrial market, 20 years ago; saying that it was effectively going through the transition from dial-up to broadband. Historically, Speedcast have installed 20-30 VSATs per month. In the last quarter, they have been installing 60 per month. At the same time, existing customers are demanding more bandwidth. In one recent contract renewal, the customer doubled its bandwidth requirements.

The increased demand for maritime is being driven by four things: business needs of the shipping companies, who want to be able to treat the ship as if it were another branch office; the Inter-

SES Launches O3b mPower

One of the biggest announcements at the Euroconsult World Satelltie Business Week and at IBC was SES announcing that it has placed an order with Boeing Satellite Systems for seven MEO satellites. These satellites will be the first satellites for O3b mPower, the follow-on constellation for O3b; and are due to be launched in 2021.

Steve Collar, CEO of SES Networks, was keen to point out, that the system was designed by focusing on future customer needs, not technical capabilities. Nevertheless, the new system represents a step change from the current design. Each satellite will have 4,000 beams, vs. the 10 on the existing constellation. These beams can be dynamically allocated, meaning that 100% of capacity will be focused on customers, i.e. no coverage of empty oceans or land mass. Like the existing constellation, satellites will be in an equatorial orbit, but will have a greater look angle, covering +/- 50 degrees latitude, vs +/- 45 degrees now.



According to Paul Rusnock, Chairman and CEO of Boeing Satellite Systems, the new platform being used for the satellites will contain some elements of the 702 platform, and the payload will be a "highly integrated phased array." Electric propulsion will be used and the satellites will be launched three or four at a time.

O3b was founded in 2007, In 2009, SES invested US$75M in the company, and in 2016 SES acquired 100%. O3b is now part of SES Networks, which also includes multiple GEO satellites. As yet, no decision has been made regarding suppliers of the ground system: however, it is intended that from day one, the terminals will contain storage, edge computing capabilities and be capable of dynamically interfacing with GEOs, MEOs and terrestrial systems; as needed and appropriate. The challenge will be doing this, at an affordable price, and one that closes the business case.

Target markets include: maritime and aeronautical, critical civil and defense operations, MNOs, enterprise, small businesses, schools and hospitals located outside good terrestrial coverage.

net of Things (IoT), whereby ships are fitted with a myriad of sensors; the changing cruise ship marketplace, where passengers now want to share their every move on Facebook, rather than using a cruise to "get away from it all;" and an increasing need to provide the crew with connectivity. This is becoming particularly significant as new young recruits expect to have access to all the same sites at sea as they do on land.

Thomas van Driessche, CEO of Newtec, in presentations at IBC and VSAT, talked about both the increasing importance of the ground segment, pointing out that operators are now considering the ground segment at the same time as the payload, and also, of the significant challenges, in designing technology that will last for 15 years, three years in advance. He also pointed to the significant advances that have been made in both beam hopping and beam shaping, resulting in the capability to shape a beam precisely enough to match a LTE cell on the ground. However, he also warned of the significant challenges posed by the NGSO constellations, particularly if they succeed in launch targets of 2020-2022. These including inter-satellite links, the vast number of gateways, handover and Doppler, and the need for both flat panel and multifunction parabolic antennas, depending on the market. All these have to be developed and tested in the next three years.

So, transformation indeed. HTS, LEO constellations, falling costs, increasing importance of the ground segment, UHD, VR and significant growth in mobility.

Elisabeth Tweedie is Associate Editor of the Satellite Executive Briefing. She has over 20 years experience at the cutting edge of new communication and entertainment technologies. She is the founder and President of Definitive Direction 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. www.definitivedirection.com She can be reached at:: elisabeth@satellitemarkets.com

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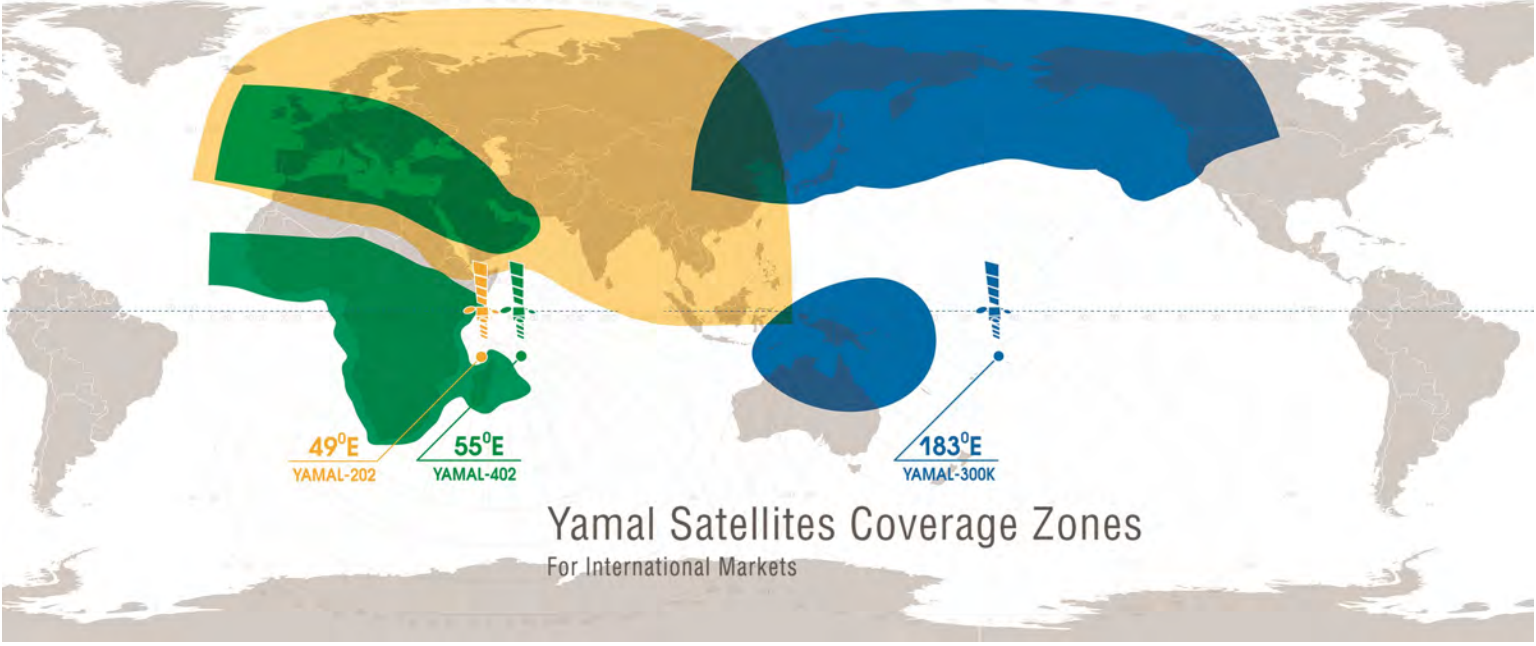

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For International Markets

The Pursuit of Continuous Connectivity

by Paul Scardino and James Brown

The 21st century is an exciting time for communications. The market effects that will drive improvements will only be limited by the ability of vendors to supply viable Applications, in software, that allow new Devices to communicate on existing and emerging Networks. The requirements will come in the form of configuration, command and control features to operate and administer the multitude of devices that will be a part of the IIoT, and for mobile systems, like autonomous vehicles, that may have a requirement for a tethered data connection. Not all vehicles will be autonomous, and many will fall into one of the following categories of rolling, floating, or flying. Although the markets can be deconstructed into two major classes, content consumption or device awareness. Each category will share a need for connectivity with one or more available network architectures.

Rolling

This is a vast marketplace encompassing physically operated railway vehicles, cars, trucks, tractors, and their soon-to-be commonplace autonomous counterparts. This market appears diverse but each segment shares common needs that connectivity provides. The service features of Safety, Informatics, Location, Voice/Video and Entertainment are the consumable benefits of available communications.

This market can be characterized as terrestrial-based with the majority of the devices as a whole well within established bounds of terrestrial wireless networks.

Floating

The floating market includes barge, cruise, yacht, and tanker/cargo vessels; basically anywhere water is the medium. The floating market is often referred to as Brown water or Blue water to denote the distance from shore, or better yet the distance from a terrestrial wireless network.

In any color water situation, these vessels are always a candidate for satellite-first network connectivity with the potential of a dual-mode handoff to cellular when an in-range carrier is detected. These vessels also have a significant requirement potential to deliver services for content consumption; that is, to support local area network (LAN) functions for large passenger and/or personnel groups on board. Considering the content consumption potential, additional functionality to interface with Wi-Fi to support, streaming media, Voice over IP (VoIP – telephony) as well as web-browsing services, the device and application requirements on-board are growing at significant rates. Depending on the service and the requirements for data management, these vessel installations may require billing applications that track usage and provide per-user details.

Flying

The core flying market covers commercial and consumer craft. Aircraft today produce over 500 GB of data per average flight simply from supervisory data collection from on-board systems. Couple this data along with the on-board content consumption and the throughputs needed for a seamless experience could be staggering. Today, those land traversing routes are served by both terrestrial wireless, as well as satellite-based systems.

While those routes over open water only have satellite

access, served by both Fixed Satellite Service (FSS) and Mobile Satellite Service (MSS) providers. In much the same way, the government market is characterized by satellite-based or dual-mode service connectivity for both manned and unmanned aerial vehicles (UAVs).

Although the government has been employing these capabilities for years, in the commercial world a potentially new regulatory license grant for flight Beyond Visible Line of Sight (BVLOS) of an operator would require a consistent control connection. This new market has multiple obstacles for connectivity based on the platform. The current platforms are either multi-prop copter drones, or fixed wing craft. Depending on payload, weight restrictions and on-board power plants cellular may be a primary service option until weight and physical size requirements of satellite based access equipment are resolved.

Connections

The future of the IIoT, mobile and device-based communications will need to interoperate with current and emerging spectrum-based systems to achieve connectivity.

Satellite

The mature Fixed Satellite System (FSS) will play an important part as a gateway connecting back-haul data utilizing the available C, X, Ku, and the emerging Ka frequency bands to link data centers supporting network management. The FSS marketplace is also moving into the implementation of High Throughput Satellites (HTS) to increase data delivery capacities. HTS platforms will provide increased capacities and augment the ability of FSS gateways to support larger user communities. Additional infrastructure provided are Mobile Satellite Systems (MSS) with the implementation of Medium Earth Orbit, and Low Earth Orbit (MEO, LEO) platforms using L-band frequencies. The MSS interface is the cross over point from the terrestrial cellular system. This interface provides the dual-mode connectivity that supports coverage gaps that are a part of the cellular infrastructure.

The trending devices to enhance the access of LEO platforms that are applicable to the mobile marketplace are the metamaterial, flat panel, electronically tuned, phased-array antennas offered by companies like Kymeta and Phasor Solutions. The commercial availability of these devices is proposed for later in 2017. In addition to these new technology companies, the traditional providers of monopole and blade (shark fin antenna) antennas are COTS (commercial-off-the-shelf), and support LEO, and MEO spectrum.

There are multiple providers of flat panel (FPA) type antennas. This vendor space consists of established providers like Boeing, Honeywell, and Rockwell Collins, to additional start-up providers Isotropic Systems, GetSat, and SatPro; however, for the most part there is not one vendor that provides an FPA product that could fit all applications. Each implementation will require engineering until the product lines reach greater implementation maturity. Furthermore, current technology for access to the higher frequency bands (e.g. C, Ku, and Ka) are not readily available for mobile (i.e. drone, and cars) use due to the inherent size restrictions imposed by transmit and receive satellite antenna(s).

The network suppliers and managed service vendors in this space are the usual suspects. Intelsat, Inmarsat, Iridium, Thuraya, Globalsat, Orbcomm, and Globecomm. A new operator that is in the process of launching and deploying a LEO satellite constellation is OneWeb. OneWeb filed application with the FCC for LEO constellation operations 28 April 2016.

In addition to this new LEO constellation, many of the platform providers are moving into the deployment of HTS (a technology viable in C, Ku, and Ka frequency bands). The following chart outlines these suppliers.

Cellular

As the capacities of FSS and MSS systems have grown with additional satellites, providers, and throughput, cellular infrastructure has matured and grown in the transitions from 3G cellular to 4G/LTE systems; however, the increases in use and the needs for higher throughputs of data to support growing capacities from both data and video content requirements is pushing the need for a cellular expansion of frequency, bandwidth and speed to the 5G platform which is expected to be available by 2018. The data throughput and speed offered by 5G systems will make more features and services realizable.

An example of device suppliers that provide both cellular and satellite dual mode connectivity is as follows (this is not an all-inclusive list of dual mode device manufacturers as additional makes and models are being produced monthly):CalAmp: LMU 4520; Quake: QPRO; Skywave: IDP

680/782; and Orbcomm: GT-1100, among others.

Providers of network and application management for the dual-mode space offer various levels of support; however, the leaders in this market are those that are meeting the needs of end-to-end management and delivery. These vendors are as follows: Globecomm, Orbcomm, Kore Telematics and Numerex.

Low Power and Narrowband

A subset of cellular spectrum is being investigated to keep up with demand for IIoT, and M2M data communications. These networks are LTE-MTC (Machine Type Communications) and NB-IoT (Narrow Band IoT). LTE-MTC is an edge low data rate technology that would be coordinated in 1.4 MHz spectrum blocks. The current chip sets to support this initiative are being developed.

Additional network topologies for low power, wide area networking are SigFox, and the LoRa Alliance (Long range, low power wireless platform).

There is also a contingency for connectivity using Wireless Fidelity (Wi-Fi); however, the build out of these networks to support public or enterprise scale requirements has stalled. Commercial, private and large campus network implementations of Wi-Fi have been deployed with free access, but most have restricted or credential challenge access requirements. This effort may gain new focus and capital with interest in the development of the "Smart City", but the implementation of these networks are still in planning.

Device suppliers for low power, narrow band implementations are developing chip sets to support this market. Examples of the manufactures in this space are Qualcomm, Ericsson and Huawei.

Networks based on these technologies will take time to implement components and coordinate spectrum use. Currently LoRa Alliance and SigFox networks are deployed in European markets and perform well. However, the integration with the FCC part 15 rule for the acceptance of interference has slowed the expansion of these networks into the United States.

The applications in this space are as sparse as the current component and networks deployments. However, in the M2M market for low data, specifically the implementation of supervisory control and data acquisition (SCADA), this is a mature control market providing monitoring and management software.

Security

With the growth of connected devices, the requirement for security and increased vigilance also grows. The IIoT and mobile devices will soon send more data into the network at large than has ever been created (meaning, all the data since communication could be digitized). This is the expected data stress level on modern networks that will occur on a daily basis. This data will occur in aggregate from the Internet, public and private cloud infrastructure, through wired and wirelessly connected end points.

This creates a very attractive landscape for cyber attacks. The more services connected to the cloud, the Internet, and the network at large present a threat to end point operations, and from potentially degraded speed and service quality. Most of the press on cyber threats centers on Internet related Distributed Denial of Service (DDOS) attacks against single companies or accounts. This does not seem to affect the lone Internet user, but the traffic is massive and with M2M and device traffic growing, any compromised device sending bad data is degrading the performance of the network.

For example, an amateur security researcher looking for holes in the Apple iPhone 0perating system (IOS) started a Telephone generated DDOS attack that shut down the 911 services in Philadelphia, PA. This was an unexpected consequence, but a viable public network service was shut down, and it was originated via the Internet application Twitter.

The researcher's script caused iPhone's to autodial 911. Had the Twitter audience of the researcher been larger, or international the effect of the service shut down could have extended beyond the Philadelphia area.

Therefore, the focus of security in the configuration and management of devices and services that attach to the network is high and systems need to be authenticated, authorized and auditable to ensure that no one gains access without the proper credentials.

Providing the greatest level of security support should begin with vetting the devices that will be attached to the network. Vetting should extend to each layer of the network that a device connects. Additionally, the devices

themselves will need to provide the ability to alter default passwords, as many of the current devices have embedded code that may not be altered. The management of the device password may need to be addressed in the communication gateway to ensure that the device has not been compromised for use as an unintended purpose. Physical access to sensor location and attachment will need to be engineered for the safety and security of the device, and to protect its ability to send recorded data. The data received will be monitored and the location of the sensor tracked. An alarm will be raised when a location has not contributed the expected input – due to failure or unauthorized tampering. Monitoring of the sensors for alarm conditions in conjunction with business rules will prioritize the severity of the alarm, and determine the necessity of an on-site maintenance call.

"…To meet the needs of continuous connectivity, the networks that support the delivery of services to mobile vehicles, vessels and crafts will be a partnership between cellular carriers, satellite service providers, and device manufactures that will be able to manage the integration of these devices, networks and applications into viable solutions…"

The network will need to be protected from physical compromise and intrusion. This may require biometric challenges as well as authentication and authorization of operational and user personnel. Biometric challenge to access the network, for some locations, may be cost prohibitive; however, this level of security for the network may be attainable as communication protocols improve in conjunction with strong encryption.

The applications will need the greatest security focus, as this is the entry point that presents the largest attack surface for unauthorized users. This is the point in the network where audits and authentication will make the most impact on keeping the service features active so that they may achieve the provisioned outcomes.

Management

The operation and management of communication services typically referred to, as a Network Operations Center (s) (NOC) is the point where the efficiency of the network may be measured. The NOC is the location that can identify, log and solve issues that arise in the operation of the network. Typically, the NOC is the point in the network that alarm conditions arise and are monitored. In a vehicle, or vessel-based service, this may allow for the interaction with the end user, and possibly from aircraft platforms. However, for unmanned vehicles, vessels, or aircraft, the alarm condition may be solely a machine-based flag that has been received from a preset condition not responding properly. In this case the NOC personnel would still respond, only they would communicate through an application to the device with an issue.

The NOC is also the point in the system that would track and manage the analytics from live events and or machine/software created communications, and turn captured data into useful reporting for decision makers. The NOC's strength is all about the tools it employs. The appropriate platform needs to be utilized to allow one to manage all of the IoT/M2M needs from a single point of interface.

Whether cellular, satellite, dual mode or low power connectivity, the platform needs to provide global, multi-connectivity options. It will combine several modules that build a uniquely robust and full IoT service delivery engine, through a single interface that allows prioritization of the best, most reliable, least cost connectivity option.

This single console is required for total control of connectivity, provisioning, device management and billing—total control of all aspects for continuous connectivity.

The device-network-application analysis of management may be determined through contracted services with set levels of performance driven by a service level agreement (SLA). However, a service provider operating with best practices, and the ability to manage the operation of a system down to a device interface for trouble shooting and issue resolution presents the best options.

Vendors with NOC capacities and software capacities that meet these requirements are as follows: Globecomm, Orbcomm and Numerex, among others.

Always Connected

In synthesizing, the above information as it pertains to the connectivity options, one must not overlook the total required availability of these networks. As we explored initially, the long-term objective is full autonomy that can only be achieved if the systems are always in full communication within the network. Thus, recognizing that all wireless networks have dead zones or coverage 'holes' we can assume that having a backup network that is completely decoupled from the primary network should suffice to overcome these holes.

As we all know, there isn't a single consumer network that can provide 100%guaranteed availability as well as 100% coverage as needed. There is a simple, yet elegant formula to carefully consider when designing network availability into the entire ecosystem.

Conclusion

By now everyone has heard of the explosive growth projections of the Internet of Things (IoT). American research

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and advisory firm Gartner reports that 5.5 million new IoT things will be connected every day. According to analysts, the number of connected objects has grown by 30 percent since 2015, to where we now have 6.4 billion connected things in use worldwide this year, 2016. That number will more than triple, to 20.8 billion connected IoT devices by 2020.

Cisco and Intel are even more optimistic in their projections. Cisco claims there are 15 billion IoT devices in use today, and there will be 50 billion IoT devices by 2020. And, while Gartner estimates 20 billion and Cisco estimates 50 billion, Intel estimates there will be a whopping 200 billion IoT connected devices in use by 2020.

Data services to support the use case of continuous connectivity are a challenge to currently available communication systems. However, the adaption of new technologies and hybrid connectivity of COTS systems are providing viable solutions. With the diverse requirements of mobility, the solutions that are available to fit the needs of Rolling, Floating and Flying use cases do not currently have a single solution. The solution options will require the integration of fixed radio networks (WiFi, low power/narrow band, etc...), cellular and satellite in multi-mode, hybrid connectivity scenarios, depending on the data throughputs required.

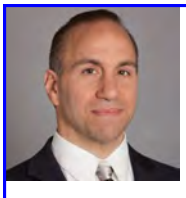
Data throughput is not the only challenge as capacities are being expanded with increases in frequency bands (e.g. Satellite Ka, and cellular 5G). These new higher frequencies have the benefit of decreasing the size of the antenna systems needed for transmission and reception, but they also come with tighter line-of-site (LOS) and transmission footprint requirements. In the case of 5G cellular, LOS and footprint issues are to be mitigated using Multiple Input Multiple Output (MIMO) systems. MIMO is an antenna technology for wireless communications in which multiple antennas are used at both the source (transmitter) and the destination (receiver). The antennas at each end of the communications circuit are combined to minimize errors and optimize data speed.

The challenges for continuous connectivity in the mobile marketplace are significant to maintain throughput, and security, are also physical. For mobile use cases that require a dual mode satellite connection to sustain their data connectivity, the malleable flat panel antenna offers access to the satellite platform that may be the best access option. These antennas offer sizing to achieve the desired signal quality for both transmit and receive of satellite signals, while at the same time allowing for conformal installation to the body of the vehicle, vessel or aircraft due to the malleable nature of the panel material. This fits well for planes, trains and automobiles; however, for the BVLOS drone that may be a small rotor based platform with limited weight to flight time requirements this type of satellite access does not meet the need for this use case.

Rockwell Collins in conjunction with the university of Iowa Operator Performance lab demonstrated BVLOS using a fixed wing drone using a Rockwell Collins integrated avionics system approved by both the United States and European aviation regulatory commissions in July 2016.

The remaining issue for any of these hybrid systems is how to integrate the access platforms to the user needs (e.g. Informatics, Entertainment, Location, and Safety.) There is still a requirement to be able to detect the best incoming signal based on availability, connectivity cost, or required protocol, and then switch or route specific data sets to that incoming/outgoing signal path from within the mobile system. This is a routing requirement and could be implemented using Least-Cost-Route path systems; however, the requirements that continuous connectivity will impose push past the limitation of "loss of connectivity" failover that routing systems provide. This will be a requirement for new software that will monitor and manage the service requirements, and the available "signals in the air" to determine - based on cost, signal strength and protocol - which path to implement, and to maintain the connection and preserve data throughput integrity. At the time this survey was conducted, an off-the-shelf solution that provides this level of management would only be available through custom software development.

To meet the needs of continuous connectivity, the networks that support the delivery of services to mobile vehicles, vessels and crafts will be a partnership between cellular carriers, satellite service providers, and device manufactures that will be able to manage the integration of these devices, networks and applications into viable solutions. The only way the promises of the explosive growth of IoT come true is through continuous connectivity delivered by a partnership that integrates many pieces into what looks and acts like a seamless whole.



Paul Scardino, Globecomm's Senior VP, is an integral part of the Globecomm Executive team. He is responsible for Globecomm's Corporate Sales Operations, Engineering and Marketing. He can be reached at pscardino@globecomm.com

James Brown, Solutions Engineering Architect, plays a key role gathering customer requirements and defining how the services and products of Globecomm may exceed the expectations of each customers need for technologically software and hardware required for the delivery of IP media content.

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Products and Services MarketPlace

A guide to key products and services to be showcased at NAB New 2017 from October 18-19, 2017 and MILCOM 2017 in Baltimore, Maryland from October 23-25, 2017.

ABS
NAB New York booth # N 702
www.absatellite.com

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

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iNetVu® iNmotion Ka antenna designed for the Eutelsat KA-SAT NewsSpotter and ViaSat Exede services. This unit will be available for outdoor demos - contact us to book a time and be one of the first to try the first Ka-band COMM-on-the-MOVE commercial Grade flat panel antenna.

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COMTECH EF Data
MILCOM booth # 815
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Comtech EF Data Corp. is the global leader in satellite bandwidth efficiency and link optimization. Our integrated SatCom infrastructure solutions encompass Advanced VSAT Solutions, Satellite Modems, RAN & WAN Optimization, Network & Bandwidth Management and RF Products. The offerings feature groundbreaking efficiency (industry-leading coding, modulation, compression and physical layer operation), robust intelligence (traffic shaping, dynamic bandwidth allocation and integrated network management) and unparalleled horsepower (processing power for your pps and Mbps transmission requirements).

COMTECH Xicom Technology
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Newtec
NAB New York booth # N 705
www.newtec.eu

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

Norsat International
MILCOM booth # 1026
www.norsat.com

At MILCOM, **Norsat** will be showcasing the GLOBETrekker™, the world's most intelligent fly-away satellite terminal. With a modular architecture that enables easy component swapping in the field, a simple one touch interface, and intelligent LinkControl™ software for automatic satellite acquisition, the GLOBETrekker is both powerful and easy-to-use. Currently deployed by militaries around the world, the GLOBETrekker includes sealed equipment (IP66 compliant) for all-weather use and digital levelling technology for deployment in uneven terrain. Tested to meet MIL-STD 810G standards, and packaged for IATA compliant airline transportation, the GLOBETrekker is ideal for short notice military and commercial deployments, anywhere in the world.

XMW
NAB New York booth # N 1010
www.xmwinc.com

XMW provides a comprehensive line of products for Ka-band. The product range includes BUCs and SSPAs from 1W to 40W with various frequency options of Single/Dual/Tri/Quad-band. A full line of LNB, LNA, and BDCs are also available and ready to be shipped as off-the-shelf items. The redundancy systems for BUC and LNB are ready to take orders from high-end customers as well.

Based on our core technologies in SATCOM Ka-band products, we've been expanding our business secondly to Terrestrial, mainly Mobile 5G and RADAR as they all require our core technologies in 20-40GHz. Three business domains of SATCOM, Mobile 5G, and RADAR will be the triangular axis for our growth for a few following years. Especially 2017 is the year of new product roll-out for Mobile 5G and RADAR that will trigger our rapid growth.

In 2016, XMW started investing in airborne products mainly used for SATCOM airborne applications to meet the customer needs. The BUCs, LNBs, and BDCs with smaller and lighter form factors will be released in 2017 and create a new market for SATCOM business. Aerospace is the XMW's ultimate destination as show its corporate slogan "Connecting the Earth to Space". To reach the ultimate destination, we are ready to face all challenges all and are open to the partnerships with aerospace industry leaders.

CABSAT Welcomes 2018 with 'SatExpo' Conference & GVF Satellite Hub Summit

by Martin Jarrold

The **GVF** and **Dubai World Trade Centre (DWTC)** have for another year announced an enhanced partnership agreement to bring a program of strategic debate on key issues for the current satellite industry technology and service marketplace to CABSAT in Dubai.

CABSAT 2018, which takes place at the Dubai International Convention & Exhibition Centre at DWTC, and which has been brought forward from its former March calendar-slot to 14th to 16th January, will again feature the **GVF Satellite Hub Summit** on the second and third days of the exhibition. It will again be preceded on the first day of the show by the **SATEXPO** conference. Both **SATEXPO** and the **GVF Satellite Hub Summit** will be chaired by me for GVF.

SATEXPO and the **Summit** will comprise mutually-reinforcing programs of satellite sector and satellite solutions end-user perspectives, with a day one emphasis on strategic analysis of various user markets and a day two and day three focus on interactive panel sessions which will offer detailed examination of core themes within today's industry environment, such as the VSAT mobility market, spectrum for new satcoms generations, HTS dynamics, satellite & 5G, interference initiatives, cyber security dynamics, and orbital debris.

Introduced to bring important content and keen industry debate to the **CABSAT** exhibition in 2015, the **GVF Satellite Hub Summit** has an already three-year proven track record in attracting exhibition attendees to join solutions provider and solutions user dialogs. Now, for 2018, the satellite program has again been extended with **SATEXPO** as a further platform to bring an enhanced value-added experience to the **CABSAT** exhibition attendees. With this in view, the combined focus of **SATEXPO** and the interactive panel-based **GVF Satellite Hub Summit** is now welcoming expressions of interest in participation from both solutions providers and solutions users. Virgil Labrador, editor-in-chief of this publication will take a key role as one of the Summit's Guest Moderators.

The thematic line-up for the 14th January SATEXPO conference will include a morning program comprising a series of keynote and presentation plus Q&A sessions. The afternoon program will feature various Vertical Market Sector Study Tracks with moderated sessions covering the Aeronautical, Maritime, Oil & Gas and Telecoms & Broadcast environments, primarily from the satellite solutions end-user perspective. The SATEXPO Conference Producer is Sarah Meredith who may be contacted at **t-Sarah.Meredith@dwtc.com.**

Over the two days 15th and 16th January the **GVF Satellite Hub Summit** will incorporate a series of nine themed moderated interactive panels. The first of these will examine ***Innovation in MENA's Satellite Technologies & Services Marketplace***, looking at Technological Advance, Value-Added Service Evolution, and New Markets… Emerging Verticals, among other themes.

Also featured in the 15th January program will be a Panel Session 2 focus on ***The New Mobility Paradigm for Air & Sea***, encompassing Ground Terminals & Antenna Performance, Space Segment Evolution & Mobility Markets, and Customers & Application Demand Evolution.

Panel Session 3, ***Spectrum for New SatComs Generations***, will examine Innovating the Ka, Q & V Spectrum-Scape, An Integrated Satellite-Wireless Networks Future? And, Expanding Satellite Spectrum Applications Ecosystems.

The final panel session for the first day of the **Hub Summit** is themed ***Innovation for the 'Ultra' High Throughput Dynamic*** and will cover HTS & the Emergence of UHTS, GEO & MEO… Onwards to LEO? And Broadband: From Everywhere… To Everywhere.

Opening the second day of the **Hub Summit**, the subject of Panel Session 5 is ***The Satellite Imperative in a 5G Future***. This interactive dialog will address Defining the 5G-Satellite Protocol Environment, Satellite in the Converging Communications Ecosphere, and IoT, 5G, Satellite… A New Paradigm.

Panel Session 6 is entitled ***The Application of Innovation in New Space***. Beginning by asking the question "What is New Space?" the session will look at The Smallsats Race to Orbit, and Earth Observation & Data Analytics: Emerging Applications… New Markets.

the Installer Training Toolbox.

The **GVF Satellite Hub Summit @ CABSAT 2018** not only features new key themes as part of the above program but will also enjoy a much-expanded theatre-style facility compared to previous shows in the series. We look forward to seeing you there in January.

Readers interested in contributing to the above program should contact me at martin.jarrold@gvf.org.

Martin Jarrold is Director of International Programs of the GVF. He can be reached at matin.jarrold@gvf.org

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Teleport Operators Target the Over-the-Top Media Opportunity

by Robert Bell

Once upon a time, satellite was the primary path for all forms of TV contribu-tion and distribution. The growth of gigabit fiber capacity and the rise of CDNs and OTT have changed the landscape forever. Content owners are piling into Over-the-Top (OTT) distribution even though the revenue and profit opportunities remain slim for now. It seems clear that technology tools will arise to make OTT distribution as uniform and efficient as automated playout has made linear distribution, and that the business model will be sorted out.

"...One category of satellite company stands to gain from the rise of OTT, and that is the teleport…"

When that happens, it will almost certainly be bad news for the satellite companies that have, over the decades, delivered most television content into our homes. The trend became clear several years ago, when the 10-year contracts from broadcasters that created the enviable backlog of satellite operators began to give way to shorter terms. Broadcasters saw big changes hitting their businesses and were increasingly unwilling to commit to contracts that extended far past their own horizons.

Thriving on Change

One category of satellite company, however, stands to gain from the rise of OTT, and that is the teleport. This ground-based operator is the point where the radio-frequency skyway meets the digital highway, and teleports specializing in media are already originating and distribution OTT programming – for the simple reason that so much television content already resides on their servers. It is rumored that one of America's largest teleport operators has copies of every television commercial played in the nation somewhere in storage.

For a recent report, *The Over-the-Top Video Distribution Opportunity*, the World Teleport Association asked leading teleport executives what they were doing in OTT, the technology and management changes it demanded of them, and the impact over-the-top distribution was having on their businesses.

Easing the Pain

TV production and distribution have become highly auto-mated but TV-to-OTT got its start as a manual process. To meet the demand for catch-up TV, broadcasters manually re-originate content that had already been assembled and distributed by their playout systems. The manual approach has persisted despite the increasing workload it creates. OTT, in other words, is a pain for content owners, though they are driving its growth. A customer pain-point is an opportunity for service providers – but that does not eliminate the pain.

What does it take to address the customer's pain-point? One option is to simply transfer the manual workload from customer to supplier, which is how most service providers have entered the market. But the teleport value proposition has always demanded advanced technology solutions that

can be cost-effectively offered to multiple customers.

Operators targeting this market budget for major process and technology changes in their operations. OTT standards are in flux, and the OTT production and distribution process must deliver to a plethora of devices and networks, each with its own aspect ratio, bit rate and resolu-tion. If coding all of this into a digital file sounds like a job for artifi-cial intelligence – it is.

One compelling reason for such automation is provided by Nielsen's C3 and D4 rating method. Under this system, introduced in 2015, Nielsen measures audiences for TV programs that have been made available for online viewing. For the first three days after the live airing, on-demand versions of shows – with their original advertising and Nielsen watermarks – are measured as though they were being watched live. Beginning on day 4 (D4), Nielsen no longer aggregates measure online and on-air viewing –but continued measurement of viewing creates a new advertising revenue opportunity.

C3 and D4 are where the current manual approach to OTT production begins to add not just extra expense but lost revenue as well. The manual processing of files takes most broadcasters hours to execute. While the clock ticks, the additional advertising value of the C3 window erodes. Taking full advantage of the D4 advertising opportunity, meanwhile, requires the ability to dynamically substitute new advertising based on the viewer's location or demographics – something far beyond the ability of manual production. Every respondent we interviewed aims to offer a complete, highly -automated end-to-end service, or already doing so.

How Big an Opportunity?

Growth in OTT ranges from "incredible" in the words of one teleport executive to "not that drastic" for another. Growth in demand, however, has yet to translate into significant revenue growth, though the trend points in the right direction. The business challenge for teleport operators is that it requires the same effort to deliver a linear OTT stream to a CDN or MVPD as it does to put a linear stream up on satellite. But according to two of the larger operators, the revenue from an OTT stream is about 10% of that for satellite. More revenue is available to those who provide an end-to-end solution – content re-origination with digital rights management, VOD and dynamic advertising insertion – but it still pales beside originating linear TV over satellite or CDN.

In a fast-changing media marketplace, the greatest value of OTT to teleport operators may be in serving a new class of customers interested only in going over the top. OTT has been a godsend for the owners of content that appeal to an audience too small for the economics of satellite distribution. One such is the audience of ex-pats and recent immigrants in most developed nations, who are hungry for "home" content. Another is niche sporting events. One of the operators reported developing a significant business just doing content contribution and aggregation for OTT.

The entire broadcast, cable and satellite TV industry is trying to figure out how the consumer's thirst for content delivered over the top can be turned into a thriving business. Whatever becomes of satellite transmission in the media space, teleports will play a leading role in feeding that thirst while finding the technology solutions needed for their customers to succeed.

***The Over-the-Top Video Distribution Opportunity* is available free to members and for sale to non-members. For more information go to: www.worldteleport.org**

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

ITU Telecom World 2017 Highlight Innovation in ICT Industry

ITU Telecom World 2017 wrapped up in Busan following a full four-day programme of tech innovation showcases, debate, networking and awards. The annual event brought together representatives of nations, leading industry players and small- and medium-sized enterprises (SMEs) from around the world – fostering valuable support for innovation and business partnerships, and facilitating knowledge exchanges and networking.

"The insightful debates and cutting edge showcases we have experienced this week have shown how the smart digital transformation is reshaping not just our ICT industry, but the world around us," said ITU Secretary-General, Houlin Zhao.

"Conversations have also stressed the importance of collaboration between governments, leading ICT players and SMEs, to help guide this transformation. ITU Telecom World 2017 has provided the platform for this, connecting SMEs with key players and governments, for meaningful dialogue."

Busan Metropolitan City Mayor, Seo Byung-Soo commented that, "I am very pleased to see the successful completion of ITU Telecom World 2017, the largest ICT event ever held in our city, Busan, the Capital of Global Smart City. During ITU Telecom World 2017, we had many visiting experts from national delegations and companies from 126 countries, and I believe it was a great opportunity for the productive discussions about advanced technologies and future ICT developments. I will earnestly consider the ways to achieve harmony and convergence with the international communities, and strengthen the partnership of coexistence and cooperation in the near future."

Speaking at the Event Farewell Ceremony, Won Ho Choi, Director General, Minister of Science and ICT, Republic of Korea, noted that the event, "was a great opportunity for mutual growth and also a great opportunity to strengthen international partnerships."

Exhibition Highlights

The event featured a global line up of over 450 exhibitors, sponsors and partners, with national pavilions featured from across the world.

The pavilions also featured a host of partnership and investment opportunities, as well as tech innovations from both corporates and SMEs, including 5G, artificial intelligence (AI), virtual reality (VR), e-Health, e-Finance, Internet of Things (IoT), radio frequency spectrum solutions, spectrum management, smart city technologies, and self-driving vehicles. Many interactive displays gave event attendees the opportunity to see first-hand how these technologies worked.

"ITU Telecom World 2017 has presented Indonesia with extensive opportunities to showcase our ICT SMEs to a global audience and to discuss how to reduce the gap of wealth and income inequality. Innovative digital economy business models and frameworks enable a shared economy and workforce digitalization, while the fast-tracking development of telecommunication infrastructure will improve financial inclusion. Millions of micro, small and medium enterprises have the opportunity to enter the new economy, through the adoption of disruptive digital business models," said Minister Rudiantara of Indonesia's Ministry of Communication and Informatics.

Also featured in the exhibition were pavilions hosted by ITU's Radiocommunications sector ITU-R, ITU's Standardization bureau ITU-T, and ITU's Development bureau ITU-D, where event attendees could access knowledge and resources – including an interactive Smart ABC pavilion focused on smart AI, Banking and Cities (ABC).

Forum Debates

At least 125 speakers from 41 countries took part in plenaries, panel de-

bates, workshops, high-level roundtables and networking sessions as part of the event's Forum and Leadership Summit. Speakers included high-ranking government officials from across the globe, ICT industry leaders, SMEs, entrepreneurs and innovators – as well as representatives of international organizations, financial bodies and academia – providing truly global perspectives on smart digital transformation, with viewpoints from developed and developing countries alike.

Discussions kicked off with the high-level Leadership Summit, moderated by well-known Euronews reporter Jeremy Wilks, which brought together speakers from the public and private sectors to explore different visions of smart societies and debate the challenges of building a resilient digital future.

Forum sessions explored a host of topics crucial to smart digital transformation including: how digital transformation is impacting the telecommunication sector; new approaches to connectivity; the development of new technologies such as AI, IoT and 5G; the importance of content and capacity; digital literacy and skills for the smart era; digital resilience and cybersecurity. Other Forum highlights included ministerial roundtables on transforming the ICT sector, shaping smart industries, and digital citizens first; and economic industry expert roundtables exploring the economic impact of AI.

ITU Telecom World Awards

The ITU Telecom World Awards 2017 Ceremony took place on the last day with the much-awaited announcement of the winners and finalists. In keeping with ITU Telecom World's focus on SMEs and their role within the broader ICT ecosystem, these awards recognized excellence and innovation in ICT solutions with social impact from SMEs and corporations alike. During the week of the event, finalists pitched their ideas and innovations and fielded tough questions from the jury. SMEs could also take part in masterclasses and networking activities in the dedicated SME space.

ITU Telecom World 2018

The Government of South Africa conveyed its willingness to host ITU Telecom World 2018. Next year's event will continue to act as the international platform connecting tech SMEs together with governments and corporates attracting member states, regulators, heads of international organizations, global media, digital experts and visionaries, leading ICT corporations and cutting-edge tech SMEs from the region and across the globe.

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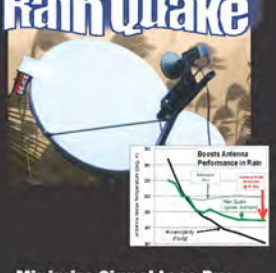

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HPS Investment Partners Acquires Globecomm

Hauppagge, NY, August 9, 2017--Globecomm Systems Inc., a service provider designing, integrating, and operating complex communication solutions differentiated by capabilities in satellite and wireless, announced that an investor group led by HPS Investment Partners, LLC and funds managed by Tennenbaum Capital Partners, LLC have entered into a definitive agreement to acquire Globecomm from a New York-based private equity firm. Terms of the transaction were not disclosed.

With nearly 400 employees and 200 engineers spanning 17 offices and 10 countries, Globecomm leverages unique innovations, world-class engineering, and global network connectivity to link anyone to anything, wherever in the world their customers' needs dictate, no matter how remote, hazardous or challenging. Globecomm is dedicated to improving communications and leverages its world class, global teleport and fiber network and data centers to offer end-to-end, managed service communication solutions worldwide, all supported by a 24/7 Network Operations Center.

"This transaction positions Globecomm's business for the future and accelerates our company's evolution to provide complex communication solutions to the connected world," said Jason D. Juranek, Chief Executive Officer of Globecomm. "I am excited about our strong and growing pipeline of opportunities within our core markets, as well as investments we are making in adjacent verticals, to further expand our diversification strategy. In the more than three years that we have partnered with HPS and TCP we've successfully delivered against our customer-focused strategy. With this transition, we have taken significant steps to recapitalize and strategically position Globecomm for long-term success. Their collective experience and extensive expertise collaborating with management teams and companies in our industry will further enhance our ability to grow our business and provide our customers with state-of-the art services and solutions. We are eager to work with our new owners that continue to share our passion in the industry in which we operate and are supportive of our long-term future."

The transaction is expected to be completed in the third calendar quarter of 2017, and is subject to customary regulatory approvals.

Artel Aquires ARG ElectroDesign Intellectual Property

Westford, Mass, August 29, 2017--Artel Video Systems announced the acquisition of selected intellectual property from ARG ElectroDesign. The transaction provides Artel with core IP switch technology from the Quarra 1G and 10G IP Switch family. In addition, Artel will take over the Automatic Repeat Query (ARQ) product line, which serves Reliable Internet Streaming Transport (RIST) for video applications.

"As we continue to expand our IP portfolio with organic developments, we also look for key technology partners to support additional areas of our short- and mid-term product roadmap," said Mike Rizzo, President and CEO of Artel.

In April, Artel announced a strategic, exclusive partnership to distribute both product lines in the North American market. As a result of this transaction, Artel will now manufacture and distribute the Quarra and ARQ product lines at its North American headquarters in Westford MA.

Richard Bell, previous Chief Technology Officer of ARG, has joined Artel on a full-time basis in an engineering leadership role.

In addition to expanding the company's IP portfolio, Artel will be establishing its relationship with industry partners and growing its distribution channels, according to the company.

Mission Microwave Appoints Steve Richeson as VP-Sales and Marketing

Los Angeles, Calif., October 2, 2017--**Mission Microwave Technologies,** Inc., a manufacturer of compact, highly efficient Solid State Power Amplifiers and Block Upconverters, announced that it is expanding its executive team with the appointment of **Steve Richeson** as VP Sales and Marketing.

Steve Richeson

Richeson is a 30 year veteran of the satellite communications industry and has previously held leadership positions with Advantech Wireless, Exelis Inc., Harris Corporation, Echostar and Scientific-Atlanta. Richeson is a registered professional engineer and a Senior Member of the IEEE. He has an MBA from Georgia State University and earned his electrical engineering degree at Georgia Tech.

Francis Auricchio, CEO of Mission Microwave commented: "As we expand our team to prepare for the growth of our business, we needed a sales leader who is credible with our customers and has a strong technical and commercial background. Steve's background and reputation in the industry fit well with our company's mission to bring the industry's best solutions, service and support to our customers."

New Appointments at AsiaSat

Hong Kong, September 6, 2017–**Asia Satellite Telecommunications Company Limited (AsiaSat),** announced new appointments across the company's sales, business development and human resources teams. New appointments include **Laurent Tran Dien,** Director of Sales Solutions; **Fabien Robineau,** Regional Director, EMEA; **Lara Kwok,** Director of Business Development and **Mary Wong,** Director of Human Resources.

Laurent Tran Dien will lead the sales solutions team to enhance the company's outreach to customers with a more robust service and innovative satellite and media solutions. Laurent has 10 years of satellite engineering and sales experience to match customers' requirement for relevant business and service solutions. Prior to AsiaSat, he has held various positions in teleport engineering and operations with a satellite company since 2008, and was pre-sales manager and director of sales and customer support for the Asian operation based in Singapore since 2013.

Fabien Robineau brings with him a wealth of sales and general management experience from his prior role at Arqiva and latterly Dock10 in both the broadcast and data sectors. Fabien will support and help drive market development initiatives and further strengthen the excellent relationships of AsiaSat's existing customer base in the EMEA region. Lara Kwok has joined as Director of Business Development, bringing more than 13 years of experience in private equity and investment banking. Prior to AsiaSat, Lara was employed by The Longreach Group between 2008 and 2015 as Principal of the Greater China investment team, and has held various positions in global investment banks in New York and Hong Kong.

Mary Wong, as Director of Human Resources, will be responsible for leading the HR team to provide services and support that further develop the talent pool, one of AsiaSat's most valuable assets. Mary has 20 years of experience in the HR and administration practice at professional services firms as well as local investment bank.

LeoSat Appoints Peter Schrickel as CFO

Paris, France, September 11, 2017 – LeoSat Enterprises announced that Peter Schrickel, previously Treasurer SES, joins LeoSat as Chief Financial Officer. In this role, Peter will be spearhead finance for the company including securing funding, managing financial planning and coordinating investor relations.

Schrickel has more than 20 years of experience in the finance sector. Prior to serving at SES, where as SVP & Group Treasurer, he was globally responsible for enhancing SES's capital structure, diversifying funding, and implementing a treasury roadmap, Schrickel worked for Volkswagen AG where he oversaw the financing of VW's activities worldwide and ensured the capital structure and financing of new projects.

Peter Schrickel

LeoSat recently announced that SKY Perfect JSAT had entered into an agreement to invest in LeoSat to open up new markets and deliver business growth. LeoSat is currently working with Thales Alenia Space to finalize the manufacturing plan, paving the way for the production and deployment of the entire constellation.

L-Band Satellite Operators Need to Reposition

Paris, France, September 28, 2017- According Euroconsult's latest report, Prospects for L-Band, IoT & M2M Markets, the Mobile Satellite Services (MSS) market will grow from 4.3 million MSS terminals in 2016 to more than 12 million terminals by 2026. M2M/IoT (machine-to-machine, Internet of Things) devices will have a significant share in this subscriber growth, while their contribution to operators' revenues should be more limited. MSS wholesale revenues are expected to grow at a CAGR of 2.2% between 2016 and 2026, driven by MSS aero broadband demand, M2M/IoT applications and other MSS services increasingly addressing lower-end segments and emerging regions, such as the promising small boats segment.

The diversification and improvement in MSS products should be enabled by recent and upcoming MSS systems including Iridium NEXT (under deployment), Inmarsat's I-6 (expected in 2020), Thuraya's next generation constellation (planned for 2020 but no satellite yet ordered) and a new generation of hybrid networks from Globalstar and Ligado Networks. These systems should allow for new, higher data-rate services, and will combine with new ground solutions and terminals.

"Increasing competition from VSAT mobile solutions, due to more efficient equipment and lower capacity costs, is expected to weigh on MSS's market share in the high-end, high-ARPU markets," said Pacôme Révillon, CEO of Euroconsult. "MSS operators will thus have to review their positioning and address new segments less addressable by VSAT solutions, such as smaller classes of ships, aircraft, not to mention potential upsides related to connected cars and IoT."

The global IoT market, including terrestrial IoT, should experience exponential growth in the coming years; MSS operators are reinforcing their position in the segment, with the number of M2M/IoT terminals reaching over 20% growth in just the first half of 2017. Moreover, about ten constellation projects targeting IoT are currently under consideration by start-ups, intending to benefit from the momentum of the sector.

Single-digit growth is expected for the global MSS market, despite lower global MSS ARPUs over the period due to increasing VSAT competition: Maritime MSS wholesale revenues are expected to decrease with a -2% CAGR over the next ten years, an effect of the migration toward VSAT solutions in the medium to high-end maritime markets, while low ARPUs of small boats should not offset that churn. The land market is expected to grow at a fast pace in number of terminals at a 10-year CAGR of 12%, with growth led by the increasing demand for M2M/IoT terminals.

Driven by strong growth in broadband terminals from business aviation as well as cockpit connectivity for commercial airlines, aeronautical wholesale revenues are expected to increase with a 4% CAGR over the coming decade.

About the Report

Prospects for L-Band, IoT & M2M Markets is an expert analysis of the mobile satellite industry, assessing key trends and drivers in this market characterized by both a number of growth opportunities and challenges for key players. Satellite operators, service providers, investors, manufacturers & launchers, telecom companies, space agencies and other actors use the exclusive ten-year forecasts in their business and investment planning and strategic decision-making.

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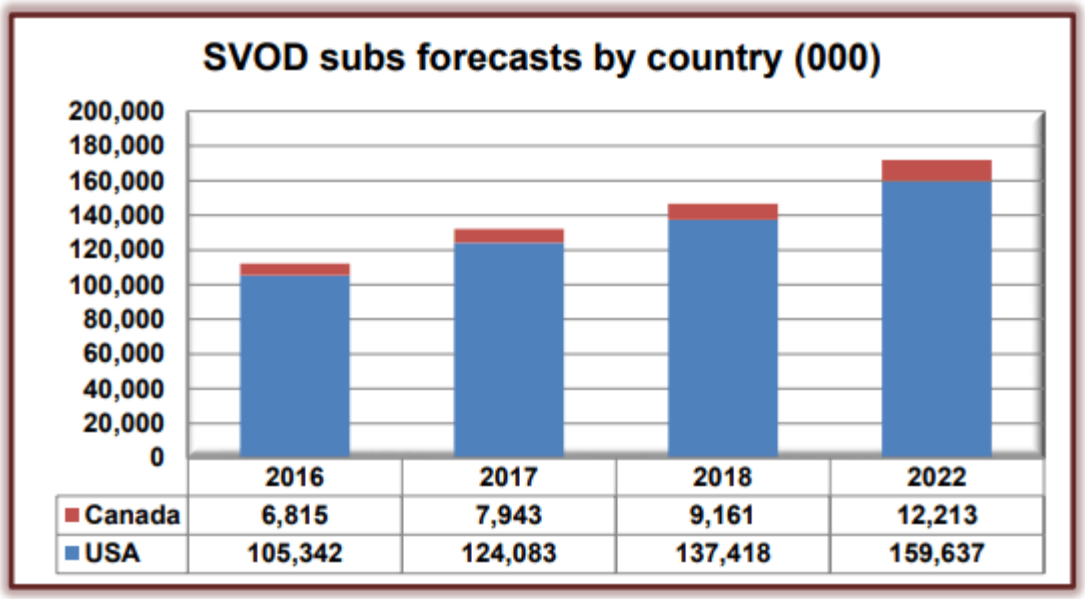

Source: Digital TV Research

SVOD [subscription video on demand] subscriptions are forecast to reach 546 million by 2022; double the 263 million recorded by end-2016, according to the Global SVOD Forecasts report which covers 621 platforms in 138 countries according to Digital TV Research. North America still has the largest SVOD subscribers but Asia-Pacific is forecast to overtake North America by the end of 2017.

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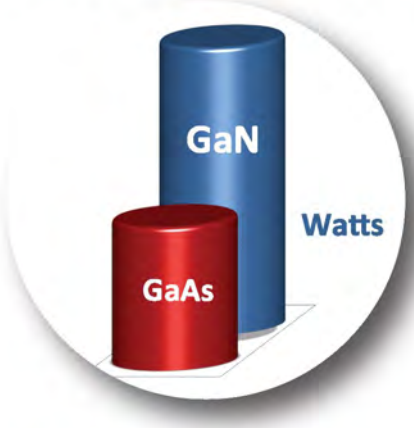

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