

Satellite Executive BRIEFING

Vol. 14 No. 2 March 2021



Industry Trends, News Analysis, Market Intelligence and Opportunities

Comms on the Move Trends

by Bernardo Schneiderman

There are many exciting developments in the Satellite communication on the move (COTM) market. Among these developments, the most promising might just be the launch of flat panel antennas (FPAs) which are transforming the Land, Maritime and Aeronautical COTM markets. FPAs may just supplant the traditional parabolic antennas, if the cost and economics would make it a feasible solution.



(image courtesy of ThinKom)

innovative technologies are coming to market that will dramatically change COTM and COTP services.


Innovative Solutions

In the last ten years the development of high-powered Ku- and Ka-band satellites FPA solutions initially for the security and defense market has significantly enhanced the effectiveness of COTM solutions by providing higher bandwidth and greater flexibility.

FPAs are now in the commercial market with the with various companies providing or developing FPAs for COTM and COTP solutions such as Kymeta™, C-COM Satellite Systems, Thin-

Continued on page 4

What's Inside

- From the Editor.....3
- Virtual Executive Roundtable on COTM Market.....8**
- Executive Spotlight: Lou Dubin, SVP-Product Mgt. Comtech EF Data.....17**
- 
- The UK Space Industry by E. Tweedie.....20**
- Products Spotlight.....28
- In These 'Uncertain Times' by L. Zacharilla.....37**
- Cooperation in Satellite Services by P. Kirve.....39**
- The Terminal Paradigm Swap by Martin Jarrold.....41**
- Mergers and Acquisitions.....45
- Executive Moves.....47
- Market Trends.....49
- Stock Index.....50
- Vital Stats/ Ad Index.....51



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Towards a Post-Pandemic World



It's been exactly a year now since I, as with most of you in the industry, attended a live trade show. On March 11 2020, the Satellite show in Washington, D.C. abruptly cancelled the last day of the show. So I keep telling most of my friends in the industry that my last show was not even a full show but only 2/3rds of a show.

My last live contact with industry friends and clients was a customer event I organized on the last night of the show before it was cancelled. There was a lot of concern over the looming virus, which at that point was not yet officially a pandemic, but none would foresee that it was to have this lasting and devastating effect. Most of us at that time were still making plans for the next show in the summer of 2020. It turns out we were at least a year off.

Indicators are very encouraging that live industry events will be returning this year. It won't be the same as it was before the pandemic, but after a year of Zoom meetings, I think most will welcome some semblance of a live event.

Most likely, events will return in stages--perhaps starting out as hybrid events with both a virtual and live component. One thing is for certain--most of the events of this year will be crammed in the second half of this year--making us do a whole year's worth of shows in less than half of the year. That's makes for a lot of preparation and travelling.

The first major event of the year will be at CABSAT in Dubai in late May followed by ConnectTechAsia in Singapore and the Satellite show in Washington, D.C. in July. It remains to be seen whether these shows will be virtual, live or a hybrid. The IBC in Amsterdam is currently scheduled for September, but with a fallback schedule in December in case there are still restrictions in place. The NAB is in October and IBC potentially in December, that is indeed quite a change!

Whether hybrid, virtual or live, we will be there to cover it all for you. We'll keep you posted and we hope to see you all soon.

Virgil Labrador

Editor-in-Chief



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Satellite Executive Briefing
is published monthly by
Synthesis Publications LLC
and is available for free at
www.satellitemarkets.com
SYNTHESIS PUBLICATIONS LLC
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Comms on the Move...

from page 1

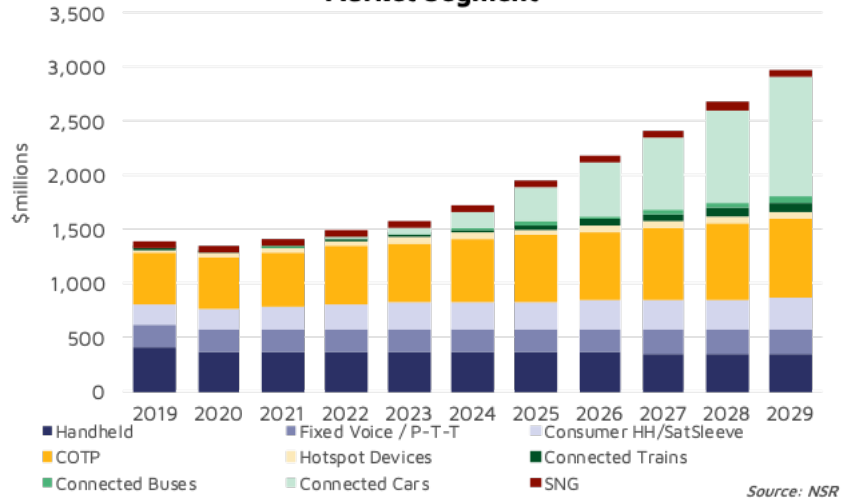
Kom Solutions, NXTCOMM, Isotropic Systems, AvL Technologies among others.

“FPAs is probably one of the most significant breakthroughs in the satellite industry in the past decade. It is exciting to see this technology originating as far back as 1950s finally coming to fruition in our time. These electronically steered antennas pave the way towards commercial non-geostationary satellite orbit (NGSO) constellations, which is another exciting development,” - said Maxim Usatov, Chief Technical Officer and Founder of BusinessCom.

Kymeta™ launched in the 4th quarter of 2020 its second generation FPA, the Kymeta™ u8 electronically steered satellite antenna platform and Kymeta Connect™, a unique offering that makes satellite and cellular hybrid connectivity as easy to purchase as a mobile plan. The u8 is a comprehensive connectivity solution that enables trusted, secure communications on the go with a host of new innovative features. The new terminal provides a complete connectivity solution for on-the-go communications when and where you need it. The Kymeta™ u8 covers the full Ku-band and it designed to be LEO upgradeable. It also supports MEO and GEO satellite constellations.

“The Kymeta™ u8 portfolio is the only land-based solution of its kind that fully supports always-on

Land-Mobile via Satellite Total Retail Revenues by Market Segment



The Land Mobile market will increase from US\$ 1.39 billion in 2019 to US\$ 2.98 billion in 2029, a growth rate of 7.9% across the decade, despite moderate COVID-19 impacts in the short term according to a recent report by NSR.

broadband communications over both satellite and cellular while mobile. This core feature which allows you to connect to a satellite while on the move, combined with our back-end support suite of services, Kymeta Connect, results in a seamless customer experience and a product that no other satellite antenna company offers today,” said Bill Marks, Chief Strategy Officer (CSO) of Kymeta™.

Key Drivers

One of the key drivers for COTM and COTP solutions is the increasing demand for mobile broadband connectivity, which has accelerated as a result of the global COVID-19 pandemic. “The global demand for mobile broadband connectivity continues to grow, driven by the insatiable consumption of data as well as the growth in new Internet of Things (IoT) applications.

Cellular networks alone will not provide the seamless coverage needed to satisfy always-on communications on the move. The combination of satellite and cellular technologies deployed across a variety of different uses cases will be a solution to that growing demand in only a matter of time. There remains a growing demand for mobile connectivity that cannot be met by the cellular industry alone. This demand creates a market for new satellite products and services that can only be met through innovation,” said Kymeta’s Bill Marks.

A recent report by NSR entitled “Land Mobile via Satellite, 8th Edition” revealed that the satcom land mobile market continues to have a strong future, with over 750,000 new in-service units coming over the next decade, across nine distinct applications. Many of these units will trend towards higher ARPU

Satellite Communications on the Move.



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The bandwidth can be provisioned either to a single remote or as a *Private Network* with a common bandwidth pool dynamically shared across a group of terminals. The flat panel metamaterial *antenna with no moving parts* can be integrated into any land vehicle or sea vessel.



Kymeta u8 Antenna

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levels with enhanced revenue prospects, despite a near-term COVID-19 revenue dip. Connected vehicles play a major role in long term growth, as broadband overtakes narrowband demand across all land mobile applications, according to NSR.

The report found that total revenues in the Land Mobile market will increase from US\$ 1.39 billion in 2019 to US\$ 2.98 billion in 2029, a growth rate of 7.9% across the decade, despite moderate COVID-19 impacts in the short term.

“As the connectivity marketplace becomes more competitive, the operators are becoming increasingly demanding. Commercial and military customers alike are looking for higher speeds and more competitive rates for bandwidth. The way to consume this data is changing as well and that puts constraints on the operators’ networks, as different platforms require new antenna types or ways to purchase connectivity. Some can evolve their networks and expand their capabilities, looking ahead to 5G, and some are going to struggle, requiring even more innovation on the ground segment. Much of this evolution will drive Research and Development and innovation over the next five years. Another expected demand is standardization in the industry which is long overdue. The cellular industry went through this a decade ago and it is time for Satcom to make real strides in that direction as well,” said Kymeta’s CSO Bill Marks.

“Longer-term, NSR sees ac-

“..A key driver for COTM and COTP is the influx of the new Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) constellations that are deploying at full speed in this decade...”

celerated revenue growth driven by a fundamental shift from narrowband applications and towards broadband as a share of revenues” said Alan Crisp, NSR senior analyst and report author. “Greater COTP usage, and the growth of connected vehicle markets, all point to additional life being injected into land mobile. Inmarsat Land Xpress, Iridium Certus, LEO-HTS constellations and more all contribute to new revenue opportunities over MSS narrowband data and voice usage,” he added.

Another key driver for COTM and COTP is the influx of the new Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) constellations that are deploying at full speed in this decade. Thousands of LEO and MEOs are coming online in the next few years from the likes of SpaceX’s Starlink, Amazon’s Kuiper and OneWeb, among others. The Non-GEO satellite systems has the potential to bring the COTM to the mass market.

Although not without its challenges, the Non-CEO constellations provide a unique advantage

over GEO for COTM applications. Non-GEO systems are far closer to earth than GEOs meaning they require less distance to travel, reducing latency and enabling higher data rates.

To shed light on this exciting market, Satellite Executive Briefing did a virtual roundtable of key executives from leading companies providing COTM solutions. The results of the roundtable discussion follows this article.

It is interesting to note, that the executives who participated in the roundtable were all in agreement that one of the key drivers for the COTM market will be the constellations in Non Geostationary Satellite Orbits (NGSO) ie. LEO and MEO. The deployments in the next 3-5 years will be crucial for the long-term viability of the NGSO constellations and COTM providers intend to make use of this opportunity. 



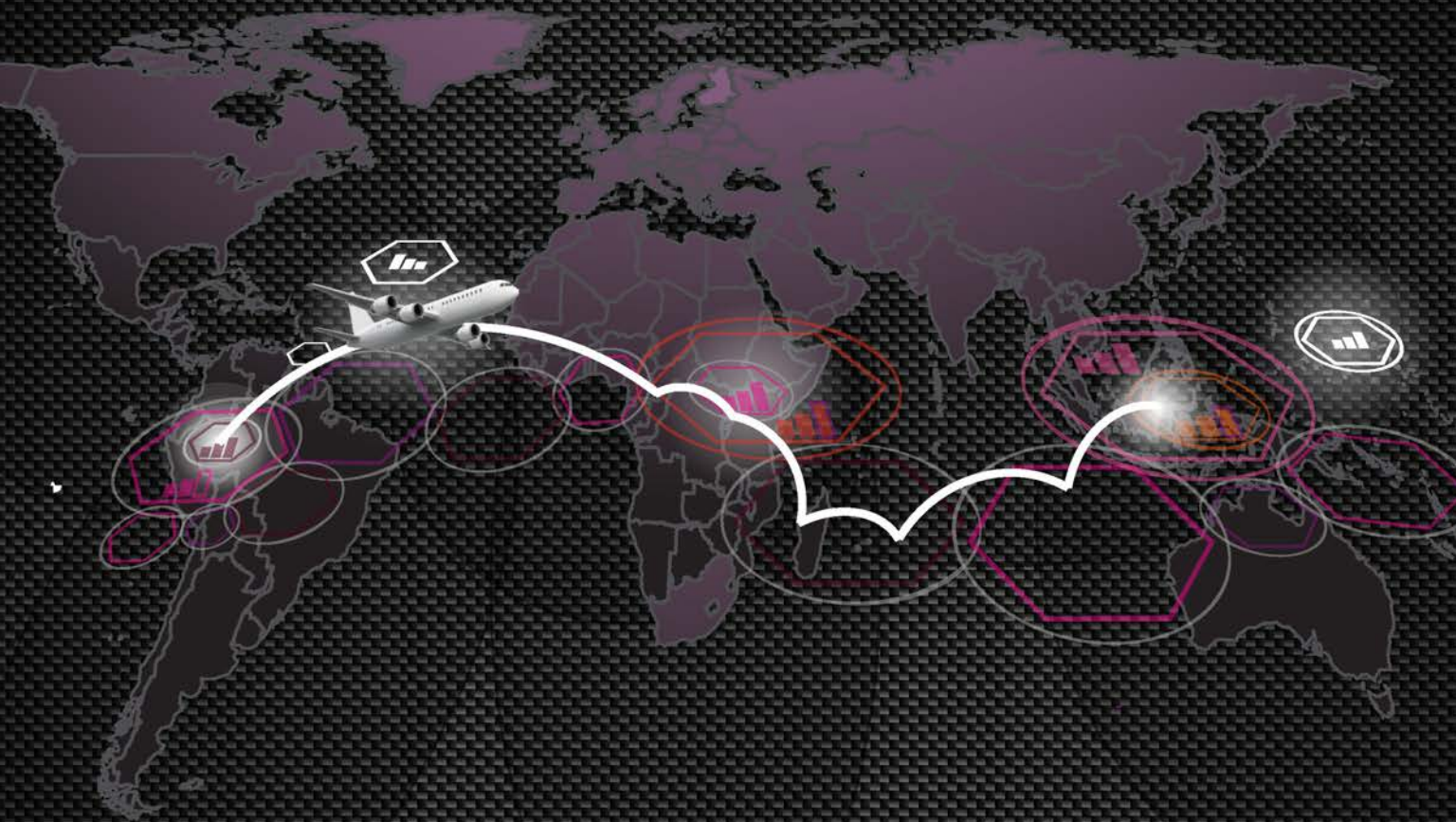
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Executive Roundtable: Trends in the Comms on the Move Market

The Satellite Executive Briefing (SEB) invited key companies providing satellite Comms on the Move (COTM) solutions to participate in a virtual roundtable on the current status and prospects in the global COTM market. The companies and their respective executives that agreed to participate in the virtual roundtable include **Krystal Dredge**, Marketing Director-**AVL Technologies**; **Leslie Klein**, President and CEO-**C-COM Satellite Systems**; **Brian Billman**, VP Product Development-**Isotropic Systems**; **Bill Marks**, Chief Strategy Officer, **Kymeta**; **Stephen Newell**, Chief Commercial Officer, **NXTCOMM**; and **Bill Milroy**, Chairman and CTO-**ThinKom Solutions**. Follows are excerpts of the virtual roundtable discussion:

Satellite Executive Briefing (SEB): Please describe your portfolio of antennas for communications on the move (COTM) applications for the broadcast, defense and commercial markets?

AvL: AvL Technologies specializes in communications on the pause (COTP) antennas for defense, broadcast and commercial markets that operate with GEO and MEO constellations. For these markets we make transportable (vehicle-mount and case-based) antennas ranging in size from 60cm to 4.6m. We also make fixed antennas as large as 5.0m. AvL Technologies has flat panel antennas now in development that will operate with communications on the move (COTM) applications.

C-COM: Presently C-COM only offers COTP (Communication on the Pause) in Ku-, Ka-, X- and C-band products (on the pause). We are developing a Ka-band Phased Array electronically steered antenna which is in its final stages of pattern testing and will be satellite tested in early 2021 over Ka-band LEO and GEO satellites both as stationary and on the move. The same modular technology will also be applied to small antenna arrays using our 2x2 and 4x4 (256) to be used for IoT on the move and on the pause applications.

ISOTROPIC: We are developing a range of

high-performance terminals using our patented optical beamforming technology. Our first products will be ruggedized Ka-Band mobility terminals that are capable of forming multiple full performance beams from a single terminal. They cover the full commercial and military frequency bands, are full duplex, can support any polarization (circular or linear), and are capable of wide instantaneous bandwidths to support spread spectrum waveforms.

KYMETA: Kymeta's connectivity solutions provide revolutionary mobile connectivity on satellite and hybrid satellite-cellular networks to customers around the world. Our next generation connectivity solutions are centered around the Kymeta™ u8 electronically steered satellite antenna platform and Kymeta Connect™, a unique offering that makes satellite and cellular hybrid connectivity as easy to purchase as a mobile plan. The u8 is the comprehensive connectivity solution that enables trusted, secure communications on the go with a host of new innovative features. The new terminal provides a complete connectivity solution for on-the-go communications when and where you need it. Redesigned with our revolutionary software-defined, electronic beam steering technology, the u8 terminal is low profile, mounting easily on vehicles and vessels. Our u8 terminals and u8 GO portable terminals deliver connectivity in a single integrated platform.

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BIG GAIN.**

MANUAL OPERATION WITH
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FULLY INTEGRATED TERMINAL

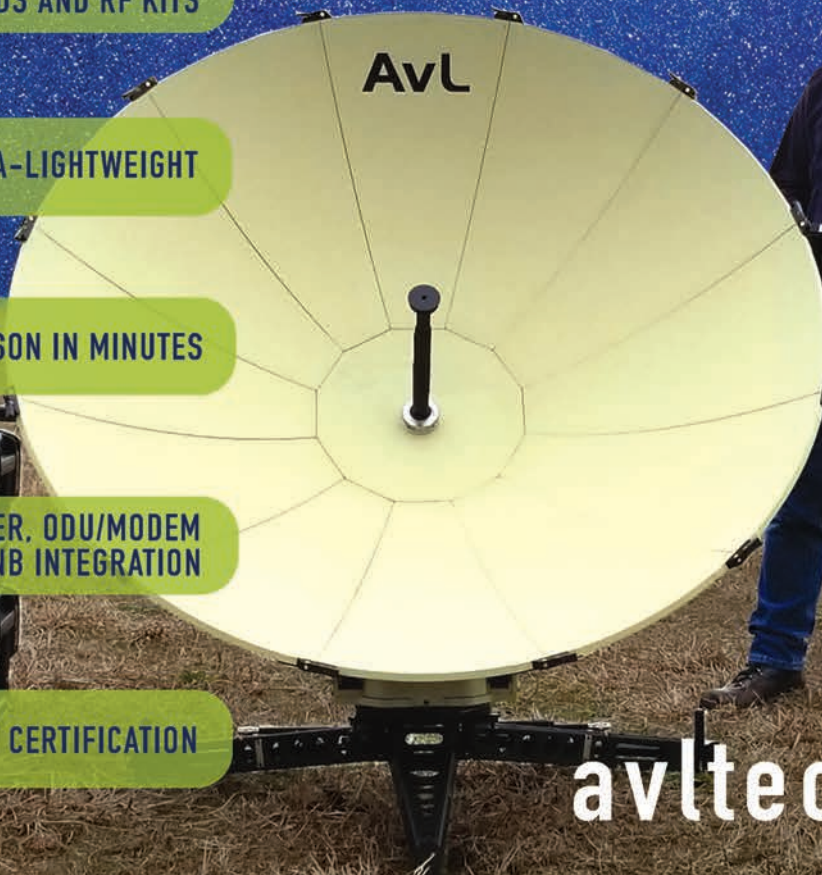
KU, KA AND X-BAND – QUICK
CHANGE FEEDS AND RF KITS

ULTRA-LIGHTWEIGHT

SET-UP BY ONE PERSON IN MINUTES

BEACON RECEIVER, ODU/MODEM
INTEGRATION & BUC/LNB INTEGRATION

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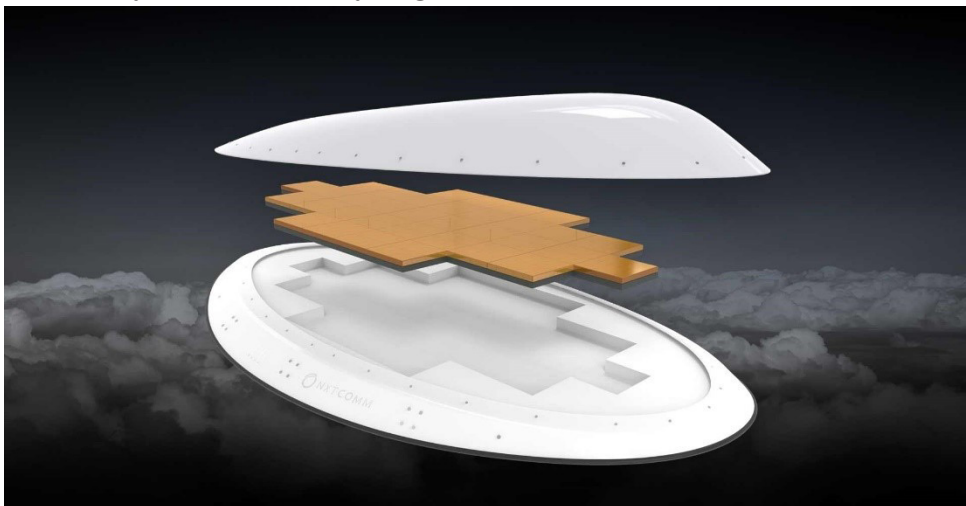
The Kymeta u8 portfolio is the only land-based solution of its kind that fully supports always-on broadband communications over both satellite and cellular while mobile. This core feature which allows you to connect to a satellite while on the move, combined with our back-end support suite of services, Kymeta Connect, results in a seamless customer experience and a product that no other satellite antenna company offers today.

NXTCOMM: We offer modular and scalable electronically scanned phased array antennas. NXTCOMM's flat-panel satellite antenna solution is initially targeted at defense and aerospace applications. Examples include commercial aero-connectivity, drone ISR applications and comms-on-the-move for Special Forces, which are most in need of portability, low-profile stealth, broadband capacity and high-level operational performance. Our antenna is based on the fragmented aperture technology that has only been previously deployed on U.S. military platforms. NXTCOMM's core undertaking is to transform money-is-no-object military development and bring that capability to the broader aerospace and defense satellite communications markets using well established manufacturing technologies. Typical antennas on aircraft today are mechanically steered and roughly 10 to 16 inches high, which means they fit under a fairly large radome that sits



on top of the commercial aircraft. In contrast, NXTCOMM's antennas are less than one inch tall, are electronically steered and have no moving parts. Within the defense market, NXTCOMM's antenna product line is designed for flexibility, with the ability to go from platform to platform – whether it be a vehicle-mounted or manpack solution. Because the antennas use an advanced silicon-based chipset and a novel combining network, NXTCOMM can manufacture its arrays on a single printed circuit board. Designed to be modular and conformal, NXTCOMM antennas can scale up or down based on the application. For example, an antenna could fit on the roof of a Humvee and deliver secure network for warfighters everywhere they are, easily transitioning from a Humvee to fixed site to a fast-moving watercraft. The base antenna measures about an inch thick, is completely electronically controlled, and, because it has no moving parts, provides high reliability.

THINKKOM: Our range of low-profile mobile satellite antennas encompass phased-array solutions from C- to W-band (3-96 GHz) for aeronautical, marine and land applications in defense and commercial markets. Our patented VICTS (Variable Inclination Continuous Transverse Stub) technology combines the technical benefits of mechanically steered and electronically scanned antennas, without their limitations. VICTS antennas provide spectral efficiencies 2x to 8x higher than other phased arrays, as well as higher reliability, lower prime power demand and the unique ability to scan



NXTCOMM's Flat Panel Antenna concept with radome

down to very low elevation angles (<10 degrees).

ThinKom is probably best known for our very strong position in the commercial aviation inflight connectivity (IFC) segment. Our proven Ku3030 flat-panel aero antennas, privately labeled by Gogo (2Ku), are operational on more than 1,550 aircraft with over 20 million accrued operational hours. They have achieved a reliability record of better than 100,000 hours MTBF.

In fact, our first Ku3030, installed on an Aeromexico aircraft in 2015, is still flying today and has never been removed or serviced. Because of their extremely low power dissipation, VICTS antennas provide gate-to-gate connectivity even under high ambient temperatures with full solar loading.

Our Ka-band aero antennas, now in full production, were recently chosen by Inmarsat for their new GX Aviation inflight broadband services, including the GX+ North American IFC service to be provided jointly by Inmarsat and Hughes Network Systems. We have started delivering Ka2517s for large-scale deployments on commercial aviation fleets. On the defense side, our Ka2517s are currently flying on a fleet of U.S. government aircraft with the industry's highest performance and reliability requirements.

Our ground-based COTM antenna business is also growing. We currently offer a range of X-, Ku-, Ka- and Q-band phased arrays for vehicle-mounted, man-portable and fixed solutions, working through partnerships with system integrators and prime contractors. Our COTM antennas are extremely flexible, can work with almost any modem or network and are the most efficient in terms of network bandwidth/satellite-capacity of terminals in their class.

We recently won a contract to supply ThinSat® 300 terminals for testing and evaluation for a major U.S. Department of Defense tactical armored command-post-vehicle program with a requirement for future LEO, MEO and GEO interoperability.

We're also moving into the maritime COTM segment, having recently won a contract from the Defense Innovation Unit to test and evalu-

ate a Ka2517 to meet U.S. Navy requirements for a low-risk COTS solution for deployment on a DDG-1000 Zumwalt-class destroyer. Our VICTS technology provides uncompromising emission controls to meet the stringent requirements for precision sidelobe control and grating lobe suppression – key factors on a modern naval ship.

SEB: Do you have any new products specifically for the new constellations of Non-GEO satellites (LEO and MEO)?

AvL: AvL Technologies has produced a family of tracking antennas for SES' O3b MEO network for many years, and is developing new products for SES and O3b. AvL also has new X/Y tracking antennas in development that will work with many LEO networks, and these antennas are on schedule to launch in 2021.



AvL 85cm transportable tracking antenna for MEO systems

C-COM: Not yet. We are about 12 months away from releasing a commercial Ka-band Phased Array conformal flat panel COTM antenna for LEO/GEO and MEO constellations.

ISOTROPIC: Yes, all of our products will be able to switch between LEO, MEO, and GEO satellites but that's just the tip of the iceberg! Our terminals can connect to multiple satellites at different orbits simultaneously while maintaining full performance on each link. Not only does this multiply the maximum throughput available within the footprint of a single antenna but it allows the user to dynamically route traffic across multiple communication pathways depending on their priorities. For example, they can route latency sensitive traffic over a LEO satellite while simultaneously receiving a multicast

stream from a GEO satellite. The combinations and use cases unlocked by this capability are endless.

KYMETA: The Kymeta u8 covers the full Ku-band and it designed to be LEO upgradeable. It also supports MEO and GEO satellite constellations.

NXTCOMM: Yes, our core flat panel antenna is ideal for next-generation, non-GEO constellations. NXTCOMM's antenna solutions are satellite orbit-agnostic, meaning they will work over GEO and NGSO (LEO, MEO or HEO) satellites. NXTCOMM offers a turn-key solution complete with all required hardware or integration with existing connectivity hardware.

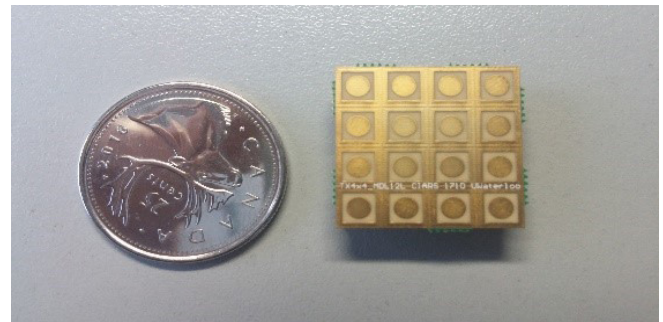
THINKOM: Our VICTS antennas are ready now for operation on current and future LEO, MEO and HEO satellite constellations as well as GEO HTS. Over the last 18 months, we have conducted successful live tests of our commercial off-the-shelf antennas across multiple commercial and military frequency bands on a wide range of GEO and NGSO satellites.

In all cases, ThinKom antennas met or exceeded all test parameters, including spectral efficiency, data throughput rates, beam agility, switching speeds, ASI interference, low-angle tracking and inter- and intra-constellation roaming. Inter-satellite handoffs—between LEOs and between LEOs and GEOs—were completed in less than one second. The live on-air testbeds included OneWeb, Telesat LEO 1, Inmarsat Global Xpress and SES GEO and O3b MEO satellites. We will continue our testing program on other current and emerging NGSO constellation in the coming months.

SEB: Do you have a Flat Panel Antenna in development or available now or in the future?

AvL: AvL Technologies has flat panel antennas now in development that will operate with communications on the move (COTM) applications. Some of the product development is with SBIR funding and collaboration with the U.S. Air Force.

C-COM: Not yet. We are about 12 months away from releasing a commercial Ka-band Phased Array conformal flat panel COTM an-



C-COM's phased array antenna concept. The concept is based on modules that are small, but contain everything — the antenna, plus the electronic circuit, parts of the control circuitry, and local memory.

tenna for LEO/GEO and MEO constellations.

C-COM in partnership with the University of Waterloo, tested its Ka-band Phased Array modules using the company's patented phase shifter technology in summer of 2018. The concept is based on modules that are small, but contain everything — the antenna, plus the electronic circuit, parts of the control circuitry, and local memory.

ISOTROPIC: Our first products will be planar and low profile. We also have the ability to conform our optical beamforming modules to a curved surface. This facilitates designs that maximize performance while minimizing profile which is invaluable for platforms such as aircraft that can save OPEX by reducing drag and fuel consumption while still enjoying a high performance multibeam antenna.

NXTCOMM: Yes. NXTCOMM only makes flat panel antennas. Our antenna combines a fragmented aperture with an active phased array architecture. Traditional active antennas have been known to be very power hungry and require exotic cooling. These two unwanted features are significantly decreased in NXTCOMM's design. By making our antenna more efficient at the RF layer, we make it more efficient to manufacture. Our foundational subarray design (25 cm x 25 cm) is modular and scalable to any form factor. Each subarray is built on a single printed circuit board.

THINKOM: Our VICTS conformal antennas—available today—are only 2 to 4 inches in height and

can be mounted in a low-profile radome enclosure or cavity-mounted, sub-flush to the skin of an aircraft, or discretely mounted on a vehicle or marine vessel.

SEB: What vertical markets are you focusing your COTM products?

AvL: AvL's COTM products are being developed for defense market applications, and will be applicable for some commercial markets.

C-COM: Initially for terrestrial applications, but we look forward to working with Aero and Maritime as well as Internet of Things (IoT) integrators interested in providing solutions using these modular phased array flat panel antennas into those verticals.

ISOTROPIC: While our first products will be focused on land mobility and maritime applications, the unique modularity of our optical beamforming technology allows us to create derivative products that will meet the needs of a wide range of users across commercial, government, fixed, mobility, land, sea, and air markets.

KYMETA: We are focused on government and military, public safety, and commercial markets today. As our solutions become more widely adopted, we will expand to additional markets. We believe that our solutions can improve the everyday lives of public safety workers, government and military agencies as well as make a power impact on connectivity for businesses, farmers, industrial workers and more. Integrated and seamless connectivity is no longer tied to a specific location and helps workers access information reliably no matter how remote their job site is. Kymeta's solutions are built for these users who demand simple yet reliable access to information in any location or condition

NXTCOMM: We are focused predominantly on two key vertical markets: Aerospace and Defense. For the commercial Aerospace, NXTCOMM's AeroMax® antenna delivers a high-performing inflight connectivity solution to transform the passenger experience. Our antenna solution allows airlines to deliver enhanced passenger internet, monitor system health, provision services and unlock



Isotropic antenna

ancillary revenue streams across their fleet. For the Defense market, NXTCOMM Defense antennas and antenna systems solve the mobile connectivity needs of warfighters with modular solutions that scale up or down to fit mobile vehicles, drones and watercraft. Our low-profile, multi-satellite, multi-mission solutions meet our military where it is today: on the move, portable and in stealth mode.

THINKOM: As stated earlier, ThinKom has enjoyed great success in the commercial and government aviation markets. This will continue to be a productive market for us, building upon our track record of proven performance and reliability. We see ample room for further growth in market share here, as new Ka-band services come into operation.

Our consistent year-on-year success in the land COTM market positions us strongly for greater penetration of these segments, as the new NGSO networks become commercially viable. We will focus more attention on government and security COTM markets, leveraging strategic partnerships with third-party integrators and contractors. We foresee increasing demand for terminals with multi-orbit capability at lower price points, giving partners and end-users a flexible choice of service offerings in Ku-, Ka-, X- and other frequency bands.

Late last year, we conducted successful over-the-air tests of a pair of 17-inch active diameter K/Q-band phased-array antennas communicating through an

Advanced Extremely High Frequency (AEHF) satellite. The tests verified that the VICTS antenna meets or exceeds all performance metrics for operating effectively with the frequency-hopping waveform of the protected communications satellite network.

This will open the door to a potentially new market segment for our VICTS technology in military Protected Tactical Waveform (PTW) applications on aero, naval and land-mobile platforms.

We're also continuing an active R&D effort aimed at adapting our core technology for enterprise and consumer applications.

SEB: What are the key trends that you see in the COTM market?

AvL: The COTM market always has been driven by application, and this is expected to continue. COTM is widely used in commercial air and rail travel, and the next large market is automotive. What remains to be seen is how satellite COTM will fare with the rollout of terrestrial 5G. At AvL we expect satellite COTM to have significant inroads for defense vehicles and applications, but not large commercial or consumer markets. Satellite COTM will be beneficial for some niche commercial markets, such as farming and fleet management.

C-COM: We believe that the right product at the right price using multiple of the many new constellations being launched, will make it possible to deliver COTM to a large number of potential customers world wide. Over the next 10 years it is expected that 1250+ satellites will be launched every year so there will be a lot of opportunities to deliver mobility to those who will need it.

ISOTROPIC: What has been adequate in the legacy GEO-centric satellite ecosystem will not be sufficient for long. With the upcoming LEO, MEO, and HEO constellations users will have more options of how to route their traffic than ever before. They won't be satisfied with archaic single link limitations and will demand the ability to dynamically route traffic based on latency, throughput, resiliency, security level, or even cost.

KYMETA: The global demand for mobile broadband connectivity continues to grow, driven by the insatiable consumption of data as well as the growth in new IoT applications. Cellular networks alone will not provide the seamless coverage needed to satisfy always-on communications on the move. The combination of satellite and cellular technologies deployed across a variety of different use cases will be a solution to that growing demand in only a matter of time. There remains a growing demand for mobile connectivity that cannot be met by the cellular industry alone. This demand creates a market for new satellite products and services that can only be met through innovation.

As the connectivity marketplace becomes more competitive, the operators are becoming increasingly demanding. Commercial and military customers alike are looking for higher speeds and more competitive rates for bandwidth. The way to consume this data is changing as well and that puts constraints on the operators' networks, as different platforms require new antenna types or ways to purchase connectivity. Some can evolve their networks and expand their capabilities, looking ahead to 5G, and some are going to struggle, requiring even more innovation on the ground segment. Much of this evolution will drive R&D innovation over the next five years. Another expected demand is standardization in the industry which is long overdue. The cellular industry went through this a decade ago and it is time for Satcom to make real strides in that direction as well.

NXTCOMM: Across all mobility markets, we are seeing the need for cheaper, faster connectivity, more broadband capacity, and a faster, more nimble ground infrastructure that can operate over GEO, LEO and MEO. And, everyone wants a better user experience. Some specific trends in our key COTM markets include:

Commercial Aero: The #1 connectivity problem facing airlines is the disconnect between the passengers' expectation of what internet service on board should be like, and the current capabilities of the whole satellite sector to deliver. As airlines resume flights post-Covid, they need to offer affordable and differentiated services such as allowing passengers



Kymeta's u8 terminal (inset photo) can be used for various COTM applications including military, government, public safety and commercial markets.

to easily connect and stream content while in the air for free. Unfortunately, that's not possible with the slow internet speeds and costly equipment on today's aircraft. The issue is with the limitations of today's airborne antennas that we seek to enhance in the future with lower cost terminals able to deliver a better internet experience over LEO satellites.

Defense: Today's mobile forces face an operating environment requiring more capacity and instantaneous reach. This need for more capacity, agility, and interoperability from their ground infrastructure can only be unlocked by electronically steered antennas that operate over LEO constellations.

THINKOM: On the commercial side, the COTM market will be shaped by both market and technology drivers. First will be the incredible surge in capacity (and competition) as the new NGSO satellite networks proliferate. Even if only a small percentage of the proposed LEO and MEO satellite constellations are actually deployed, they have the potential to be a major market disruptor.

The new generation of HTS GEO satellites

will also contribute to the increased capacity. This means the ideal COTM satellite antenna will be a truly integrated solution with the ability to switch rapidly between beams, satellites and constellations, providing seamless global horizon-to-horizon connectivity. Other considerations for antennas will include footprint, heat dissipation, sidelobe suppression and—of course—cost. Antennas should also be modem- and network-agnostic.

For Ka-band systems, careful attention will be needed to meet international regulatory requirements, including ITU Article 22, which restricts NGSO terminal interference with GEO satellites, as well as the new WRC-19 ESIM rules to protect terrestrial 5G networks operating in Ka-band from interference emitted by satellite terminals. I'm happy to say that our VICTS antennas (already) meet these requirements.

Military users are looking for embedded and low-observable phased-array antennas with no visible radome. This has proven difficult in the past due to power, thermal loading, reliability, size and cost limitations.

The military is pushing into the Q-, V- and E-bands to enable fiber-like throughput via satellite in coming years. We also see considerable potential for VICTS in protected comms, which employ techniques and waveforms that are difficult to detect, intercept and/or jam. ThinKom's phased arrays, based on a unique beam-stabilized feed architecture, supports frequency hopping and spread-spectrum waveform applications.

Finally, in the land COTM environment, there will always be the challenges associated with intermittent or even lengthy blockages, and reacquisition times and network lock optimization software algorithms will be essential for stable land mobility comms.

SEB: Anything else you would like to add?

C-COM: The next 3-5 years will be very exciting for the satellite industry and we are pleased to be able to be part of the solution providers delivering new technology which will make it possible for millions of new customers to get high speed broadband Internet access while on the move even in areas where no terrestrial infrastructure exists.

ISOTROPIC: A host of ambitious new satellite constellations from SpaceX, OneWeb, Amazon, SES and Telesat are currently being deployed to support COTM, but none of them will reach their full potential without equally innovative ground infrastructure. Our unique technology has cracked the connectivity code for unprecedented communications capabilities virtually anywhere and 2021 will be a year of important milestones as we complete critical trials of our high-performance terminals with Government and tech partners in the U.S. and Europe.

KYMETA: Kymeta's next generation solutions are leading the industry in a number of ways. The first is that we are changing the way that connectivity and mobile data is consumed and purchased by our industry. Kymeta Connect offers hybrid satellite-cellular connectivity services with an all-inclusive hardware connectivity and services monthly subscription starting at \$999, the lowest in the industry. The solution requires no up-front fees and makes broadband connectivity as

easy to purchase as a wireless connectivity plan.

Second the Kymeta u8 terminal is the world's only commercially available flat-panel electronically steered antenna built specifically for mobility and designed for the needs of the most demanding customers and beyond (DoD, emergency responder, rail, bus, commercial, etc.). The u8 is the world's first lightweight, low-profile, flat panel, cost-effective and self-configurable solution that uses metamaterials and holographic beamforming technology. The industry has desired this type of solution for years and the lack there of has been a major roadblock for mobile broadband customers, who are unable to seamlessly access mobile satellite and terrestrial services while on the move.

The technological innovation and development happening at Kymeta right now will evolve connectivity innovation around the world and what the future of global connectivity looks like. These developments are crucial toward not only accomplishing our company mission of completing the connectivity fabric but helping narrow the global digital divide. Kymeta next-generation solutions are positioned to bridge that gap.

NXTCOMM: We believe 2021 will be the year Electronically Steered Antennas come into their own. We are working to revolutionize high-performance flat panel antennas to provide mobile connectivity users, including operators, a path to greater satellite flexibility.

THINKOM: We're often asked how our VICTS antennas stand up when compared to the electronically steered antennas (ESAs) being developed. Let me just make a few comments on that subject. The fact is that despite many years and a staggering amount of investment, no affordable ESAs appear market ready; and independent of price, they face considerable technical challenges, such as high-power requirements, thermal dissipation, spectral efficiency, low-elevation-angle performance, and interference protection to meet international regulatory standards. Our VICTS antennas, which are commercially available now, have been field-proven to overcome all of these challenges.



Interview with Lou Dubin, SVP-Product Management-Comtech EF Data

Satellite Executive Briefing Editor-in-Chief Virgil Labrador spoke with Lou Dubin, Senior Vice-President of Product Management of Comtech EF Data. Lou joined Comtech EF Data in 2008, through the acquisition of Radyne Corporation. During his tenure at Radyne Corporation, he held the positions of President of Radyne's Phoenix, Arizona division and Vice President of Sales. He has over 30 years of experience in the telecommunications and transmission industry. He holds a degree in Electrical Engineering from the Florida Institute of Technology and completed the Stanford Executive program in Technology Management. Lou shares his insights on their company and products and his views on the key trends in the satellite ground segment market.

First of all, give us an update on Comtech EF Data on your how do you see your company's current position in the market?

First, thank you for the opportunity to discuss Comtech's business, Virgil. Comtech EF Data is in a strong and highly diversified position within the satellite community. Our business and products cover a wide range of customers, verticals and product solutions. We service government, MNO, mobility and enterprise verticals, and our customers are satellite operators, service providers and end users. For these reasons, a strong downturn in markets such as aero or cruise really do not have significant impact on our overall business.

We are also very excited about our merger with UHP Networks. UHP has a track record of strong growth, highly satisfied returning customers and a quality to price point that is unmatched. The UHP story is highly synergistic. They bring to the table a high volume, quality VSAT product that can reach great scale and compliment our high performance VSAT networking solutions at very competitive price points.

There's been a lot of changes in the industry in the past year since the global pandemic hit, how has it change your company or your company's focus going forward?

As mentioned, our business is very balanced. Because of this balance, our overall sales have done well and we are weathering the storm. Other industries such as automotive and consumer elec-



Lou Dubin

tronics had pulled back their manufacturing during the pandemic, but demand didn't drop for their products. These industries are trying to catch up to the demand and their products use many of the same chips and components that satellite equipment manufacturers use. Our focus currently needs to be keeping our eyes on potential supply chain issues.

What products or services will you be highlighting this year?

Comtech has continued to lead the market in technologies and products that service the most demanding needs in terms of Quality of Service, Quality of Experience, satellite efficiency and security. We have introduced new products such as our HX load balancer, 3rd generation dynamic roaming technology and our smallest and most capable government outdoor CyberLynx™ software defined modem, the SLM-5650C.

The HX load balancer, can seamlessly balance satellite traffic between transponders, satellites, satellite constellations and wireless and wired infrastructure. It can dynamically detect congestion or link outages and gracefully move traffic from one resource to another without dropping or re-ordering packets.

Our 3rd generation dynamic roaming technology has been released on our Heights™ Networking Platform and provides a new level of asset management to our mobility users. When an asset moves satellites or beams in our Heights platform, that asset can move its Quality of Service attributes with it to the new service zone, scale its attributes up or down depending on the new zone's capacity or download completely new attributes assigned by the new zone. This gives our mobility customers a wide range of solution sets for mobile operations.

Our latest government modem, the SLM-5060C is roughly the size of a small tablet yet offers the widest possible range of U.S. Government and commercial standards in a single package. Commercial waveforms such as Sequential, TPC, LDPC, DVB-S2/S2X, government waveforms OM73, STANAG 4486, MIL-STD-188-165A/B and protected waveforms such as DSSS and DSSS-MA are software selectable. The SLM-5650C also offers NIST certified encryption for user data and control interfaces.

How do you see the market going forward for your products and services? What key trends and

“...The past year has been difficult for everyone in some way or another, but for the satellite community, it really is hard to imagine a time where more change and opportunity have been seen. Our industry is transforming on a non-linear scale and unlikely to slow anytime soon...”

opportunities do you see?

Large scale constellations and the rapid development and deployment of smallsat and microsat satellites are driving real opportunities. The scale of some of the larger constellations and the sheer volume of equipment needed to service these constellations will drive efficiencies in manufacturing, spread engineering development across large volume sales and drive innovation in terms of orchestration and business continuity between space segment, ground segment and IT / back office software and infrastructure. Smallsats are driving new ways of thinking about satellite communication and Internet of Things (IoT). They are pushing the boundaries of what satellites can address and markets that are addressable by space.

Anything else you would like to add?

The past year has been difficult for everyone in some way or another, but for the satellite community, it really is hard to imagine a time where more change and opportunity have been seen. Our industry is transforming on a non-linear scale and unlikely to slow anytime soon.

Listen to an audio podcast with Lou Dubin at:
www.satellitemarkets.com/dubin-podcast



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The UK Space Industry at a Crucial Crossroad

by **Elizabeth Tweedie**

The United Kingdom (UK) has always been home to companies working in various parts of the space and satellite ecosystem.

From Novella Satcoms in Horsforth, West Yorkshire, which has been supplying high performance RF

equipment and solutions for satellite earth stations and CATV systems since its founding in 1997; to Inmarsat, founded in 1979 as an intergovernmental organization for the maritime industry, privatized in 1999 and now listed on the London Stock Exchange. Inmarsat has 14 satellites on orbit, providing service to 160,000 maritime ves-

sels and 17,000 aircraft. From Surrey Satellite Technology Ltd. (SSTL), spun out from Surrey University nearly 30 years ago, and acquired by Airbus in 2009; to Goonhilly, home of some of the world's most memorable transmissions. SSTL has built 69 satellites for all orbits, and also runs a spacecraft operations center. Goonhilly's earth station received the first ever transatlantic broadcast in 1962, a speech by then US President Kennedy. Seven years later, Neil Armstrong's first steps on the Moon were

broadcast from there, to a global audience of around 600 million. Now Goonhilly has multiple antennas providing access to satellites in all orbits. While all of these are very obviously British companies, until recently, space per se, has been neither a point

sown just over ten years ago when the UK formalized its ambitions in space, with the publication of the "Space Innovation and Growth Strategy." Following the publication of that report several new organizations, focusing on space including: The UK Space Agency, Satellite Applications Catapult and the Space Leadership Council came into being. Not to be confused with the UK Space Agency, is UK Space, a trade association that has been in existence since 1990.

The UK's ambitions were further formalized in 2014 with the publication of the "UK Space Growth Action Plan 2014-30." This plan set the target of ob-

taining a 10% share of the projected £400 Billion (US\$554 Billion at current exchange rates) global space-enabled market by 2030. An interim target of accounting for £19 Billion (US\$26.3 Billion) by 2020 was also set. Part of this goal is to be accomplished by increasing the export market from £2 Billion (US\$2.8 Billion) to £25 Billion (US\$28.5 Billion). Accompanying the goal of accounting for 10% of the market, is the equal goal of the creation of 100,000 new jobs. Britain isn't quite there yet. Revenue at the



Image: Lockheed Martin

of national pride, nor something one would particularly associate with the UK.

The UK space industry is facing a crucial crossroad. The industry must face the challenges of a post-Brexit and post-pandemic world with increasing competition and pressure from countries with greater ambition and resolve to developed their space resources and capabilities.

UK's Space Ambitions

The seeds of change were



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end of last year was £15 Billion (US\$20.9 Billion) and the sector employed 42,000 people.

However, important as all this is, none of it brought space to public attention in the UK, as much as Tim Peake's flight to the International Space Station in December 2015. Peake was in fact Britain's first European Space Agency (ESA) astronaut.

Fortunately for the UK, ESA is not a European Union (EU) institution. Norway and Canada are also participants, therefore the UK's membership remains intact. Therefore, ESA's European Centre for Space Applications & Telecommunications (ECSAT) remains at Harwell in Oxfordshire. ECSAT is the headquarters of ESA's program of Advanced Research in Telecommunications Systems (ARTES). Other activ-

ities include the development of new satellite-based services and applications, and the Telecommunications and Integrated Applications directorate, whose brief is to keep European and Canadian industry at the leading edge of satellite communications and applications.

Brexit Implications

Unfortunately for the UK, Galileo, the European Global Navigation Satellite System (GNSS), is an EU venture. This means that in spite of investing £1.2 Billion (US\$1.7 Billion) in the system, the UK no longer has access to the Public Regulated Service (PRS) — a secure, encrypted signal designed to be used by governments and the military. The regular service, which has al-

ready been built into many smartphones and satellite navigation systems, will be available to all, in the same way that the less precise part of the US GPS system is. The decision to exclude the UK from accessing this part of the signal, is a particularly hard blow for the UK in several ways. Firstly, without the help of SSTL, Galileo may have lost its frequency rights, so would never have come into existence. SSTL built and launched a small satellite Giove-A at the end of 2005 in order to make the mid 2006 deadline, to secure the frequencies; secondly, SSTL has built the payloads for all 34 satellites in the constellation, and thirdly the UK is one of the larger investors in the constellation. As if all that wasn't hard enough to swallow, a lot of the brain power that developed the precise signal

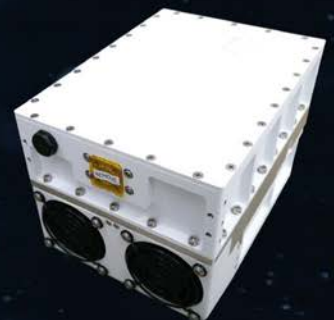
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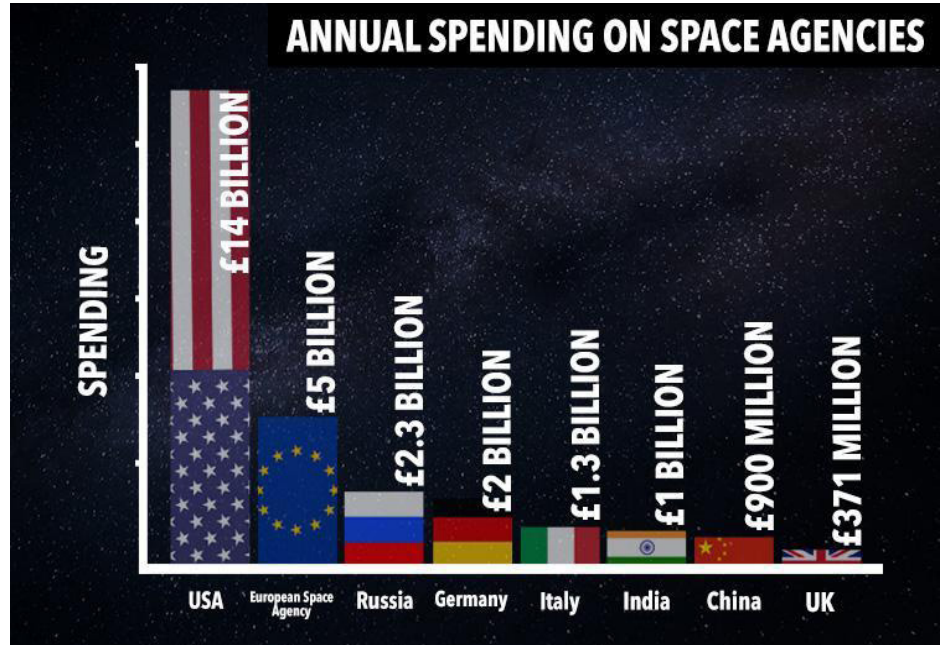
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for PRS, was British. Nevertheless, losing access is part of the price of Brexit. Similarly, the UK lost access to the European Geostationary Navigation Overlay System (EGNOS).

Britain’s exit from the EU was a rude awakening. According to Graham Turnock, the retiring CEO of the UK Space Agency: “it provided a real stimulus to get us to think about what we actually need as a country in space.”

The initial response from the UK to being shut out of Galileo, was to allocate £92 Million (US\$128 Million) to study building its own independent system. Given that at a minimum, it would cost several billion Pounds Sterling (£) to build a competing GNSS, (Galileo has cost around £10 Billion (US\$13.9)) this was a tall order for a nation the size of the UK.

Last September the Department for Business, Energy and Industrial Strategy (BEIS) said that the study would shift focus to “consider newer, more innovative ideas of delivering global satellite navigation and secure satellite services to meet public, government and industry needs.” In October the Space-Based Positioning, Navigation and Timing (PNT) Program was launched by the UK Space Agency. There is a clear nationalist drive for the UK to become independent in this area and not dependent on the US or any other nation’s GNSS system. Nonetheless, there is a recognition that collaboration will be needed and Requests for Information (RFI) have been sent to 170 organizations in the UK and other Five Eyes countries (USA,



The UK lags behind the major countries including India and China in in terms of their space agency budgets. Source: The Sun.

Canada, Australia and New Zealand).

Investment in OneWeb

This change of direction, may have been prompted at least in part, by the £400 Million (US\$556 Million) investment that the government decided to put into OneWeb last July. OneWeb, is a low earth (LEO) constellation, designed to provide broadband service. Nevertheless, the potential to use the constellation for satellite navigation was one of the rationales given for the investment. Judging from the comments in the British press, there is little doubt that the investment was driven more by politics than by sound business analysis. With the resumption of launches at the end of last year, OneWeb now has 110 satellites in orbit. The initial constellation needed for global service is 648 satellites, but OneWeb has a filing for a total of

6,372 satellites (this is a recent reduction from the ~48,000 filed for in May 2020, two months after filing for Chapter 11 bankruptcy in the US). It is almost inevitable that further investment will be needed before the constellation is fully operational as a broadband system and the ground infrastructure complete. There is speculation that OneWeb may move the manufacturing of its satellites from Airbus Florida to Airbus in the UK, but given that the Florida plant was built specifically to manufacture those satellites, this cannot be a foregone conclusion. OneWeb, initially had first mover advantage, but it has now lost that, as Musk’s Starlink constellation is already providing a beta commercial service in parts of the US, Canada and the UK. Putting a navigation payload onto the communications satellites, is a different proposition altogether. Opinions are divided, a few believe that it can be done,

most, including some in the UK-Space Agency feel that it cannot be done, or, the cost of adding an additional payload will be so great as to completely kill the business case for the investment - assuming, of course, that one exists.

Britain's ambitions in space are not confined to OneWeb, nor to finding an independent solution to satellite navigation. It has also recently put an unspecified sum into Isotropic Systems, as part of a funding round that raised over US\$40 Million for the company. Part of that money will be used to open a 20,000 square foot technology and testing facility near the company's headquarters in Reading in the UK. Commenting on this investment, Amanda Solloway, UK Science Minister said: "The UK space sector is thriving and with connectivity never having been more important, it's vital we support pioneering companies like Isotropic Systems who are tapping into the benefits that space technology can bring us all on Earth. Backed by UK government, these new multi beam antennas will improve connectivity for us all at home, and for emerging technologies such as driverless cars, while helping to create 150 highly skilled UK jobs as we build back better."

The UK as a Space Hub

The country is also pursuing investments in Spaceports and SpaceHubs. Ian Annett, Deputy CEO, UK Space Agency said: "We want the UK to be the first in Europe to launch small satellites into orbit, attracting innova-



An artist's rendition of Spaceport Cornwall which plans to host satellite launches from Virgin Orbit starting in 2022 from the Cornwall Airport Newquay. (image courtesy of Virgin Orbit)

tive businesses from all over the world, accelerating the development of new technologies and creating hundreds of high-skilled jobs across the whole of the UK." The rapidly proliferating market of smallsats and cubesats, all of which have far shorter lifespans than traditional large geostationary satellites, is driving a new market for cheaper launches to lower orbits, so creating the opportunity for new players to enter the launch market.

The first vertical launch is scheduled for 2022 from the new Shetland Space Center (SSC) in Unst, Britain's most northerly island. Last October Lockheed Martin announced that it was transferring its UK Pathfinder launch base to SSC, and since then has selected ABL Space Systems' (a US company based in California) rocket for the launch. Once in orbit the rocket will release a small launch orbital maneuvering vehicle, which can carry and de-

ploy up to 6U cubesats. Sutherland, also in Scotland is the site of another vertical launch pad. The first customer here, is expected to be Orbex. Several other sites are also under consideration in Scotland.

At the other end of the country, Spaceport Cornwall, will be a horizontal launch site. The first launch is targeted for spring of 2022. This will use a Virgin Launcher, similar to Launcher One, a rocket attached to the underside of a modified Boeing 747, that was launched in the Mojave Desert in California earlier this year. Once separated from the 747, the Launcher One rockets carry small satellites into low earth orbit.

The government is also investing in space "hubs". These will be funded by government and local authorities, with the aim of bringing together expertise to support a range of cutting-edge aerospace and space activities. £250 Mil-



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COUNTRY SPOTLIGHT

lion (US\$347 Million) has been invested in one of the first of these hubs in Ayrshire, Scotland. Part of this investment will be used to create a (horizontal) launch site at Prestwick Airport and to create a cluster of industry in the area for activities related to all parts of the value chain.

The British government is also placing an emphasis on education, and at the beginning of this year the Space Engineering Technician apprenticeship scheme was launched. This apprenticeship will provide trainees with space-specific technical skills, including spacecraft manufacturing and design, testing and satellite integration. It is hoped to recruit 50 trainees this year and more in the years to come. However, this is not the first apprenticeship for the space industry. Airbus has been providing apprenticeships in space manufacturing for the last 30 years.

Following Brexit, Britain's ambitions in space have assumed increasing importance and are becoming a point of national pride. Interestingly, in spite of all this attention, or maybe because of it, the UK Space Agency has just lost a large part of its remit. Responsibility for launch site development and space strategy has been moved to BEIS. Some speculate that this is as a result of the Agency raising questions about the viability of the OneWeb investment, but this has been denied by the government.

Will the UK succeed in becoming a major player in the space market? That remains to be seen. It is behind in the targets that it set for itself; but given that the 2020 target of £19 Billion of the global

space enabled market was set, pre-Brexit and pre-Covid, allowances have to be made.

There is undoubtedly a market for launches for small satellites, and right now the UK looks poised to be the first country in Europe to address that market; but that advantage is unlikely to last, and Brexit may dim European operators' willingness to launch from the UK. It's also hard to imagine that customers will want to ship small satellites from North and South America or Asia, to the UK for launch, unless it is offering a significant price advantage. So, the success of this market will depend to a large extent on local production of small and cube satellites. The UK has made space a priority and has demonstrated its willingness to invest not only in new ventures, but also to try and create the appropriate environment and incentives to grow new space related businesses, if it is successful, the market could grow to be large enough to support multiple spaceports.

Unfortunately, there is also the very real possibility that OneWeb will turn out to be a complete white elephant, devouring a large portion of the UK's space budget.

No Country is an Island

The UK may be an island, but



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

when it comes to space, no country is an island. Space is truly a global industry and competition in every part of the value chain can come from anywhere in the world.

The UK may have classified space as one of 13 critical national infrastructures; but as Rupert Pearce, former CEO of Inmarsat, pointed out in a recent op-ed in the Daily Telegraph: without more investment, focus, cooperation and education it will not be possible to stand up to the space "superpowers," the USA, Russia and Japan, nor to the other countries currently focusing on expanding their space industries: France, Germany, the UAE, Japan, Australia. While more investment and government incentives would undoubtedly help the industry, it must be remembered, that the UK is currently not only dealing with the costs associated with Brexit, but also like most of the rest of the world, with the economic impact of Covid-19. Right now, at close to £300 Billion, (US\$422 Billion) the country is running the largest deficit since the second world war. So, the question really becomes one of how important is space is to the government at a time when there are so many compelling and competing needs for resources?



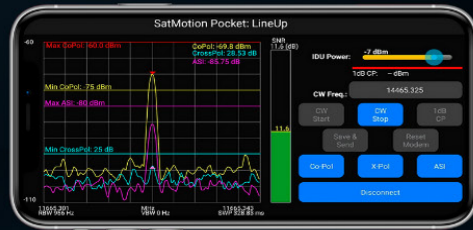


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ND SatCom Launches a New Addition to the TWTA Sphere: HPA 4-Series

Another dimension of ND SATCOM's satellite communications is unveiled: the 4th generation of HPAs in the TWT realm. Engineered and made in Germany, the ITAR-free HPA 4xxx series exemplifies next-gen excellence with these highlights:

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- New intuitive WebUI
- New graphics and event logging
- Simplified Automatic Level Control (ALC)

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- Reduced intermodulation
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- Halved warm-up time

Easy to maintain

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- M&C and dimensions identical to HPA 2xxx & 3xxx series

“ND SATCOM's quality engineering and flexible design enable customers from broadcast to medicine to choose among multiple off-the-shelf HPA variants – different power classes, frequency bands, chassis types, and BUC and Linearizer options – with quick delivery time,” said Michael Weixler, Director of Product Management & Training. “We have also refined size and performance, offering the smallest indoor chassis (3U in all power classes), 3dB less fan noise and 10% less power consumption. Both form and function are critical to how we innovate and deliver on our customer promise of installing reliability.”

ND SATCOM has a longstanding relationship with the German company WORK Microwave and offers WORK's superior quality L-band BUC as an option. For customers who opt for ND SATCOM's Linearizer, it provides a larger operating power range with typically 1dB less back-off required. These additions further enhance overall power and performance.

ND SATCOM is reshaping the TWTA sphere with its 4th generation HPAs. Dive into a new dimension of satellite communication with ND SATCOM.

With more than 30 years of experience in satellite communications, ND SATCOM is the world's leading supplier of satellite-based communications systems and ground stations and supports customers with critical operations anywhere in the world. Customers in more than 130 countries have chosen ND SATCOM as a reliable source for high quality and secure solutions that include turnkey and customized systems. The company's innovative technologies are used globally by governments, the military, television and radio broadcasting, telecommunications and enterprises.

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Satservice ACU2-ODM Step-Track Antenna Controller

SatService is proud to announce that it's well known step-track antenna controller module sat-nms ACU-ODM has now got a successor ACU2-ODM. It is based on a new and more powerful hardware platform and provides the following new key features:

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The new DIN Rail module sat-nms ACU2-ODM is fully compatible with the recent version and will therefore be used for all existing indoor and outdoor ACU systems and related upgrade kits. SatService ACUs can be used for all types of satellite communication ground station antennas.

SatService is a German manufacturer, system house and reseller for professional equipment and services for satellite ground stations.

For more information go to: www.satservicegmbh.de



XMW's SES mPower Series

XMW Inc. is very pleased to officially announce its upcoming launch of the SES mPower Series. This series fully covers a complete and extensive line of products including LNB and BUC, ranging from 5W up to 40W, fulfilling all requirements of SES. This new series of BUCs are engineered to have the smallest and lightest form in order to meet new mobile applications for airborne, maritime, and vehicle, as well as portable and fixed antenna systems. Redundancy systems for both LNB and BUC are also available for services that require the highest standards for reliability and function.



Ka Tri-band 20W BUC for mPower

Ka Tri-band LNB for mPower

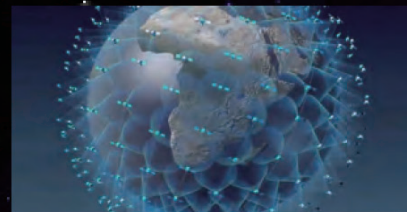
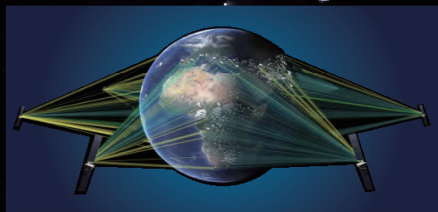
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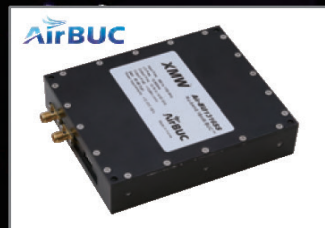


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In These ‘Uncertain Times’ a Little Satellite Goes a Long Way

by Lou Zacharilla

How many presentations, emails, articles and Zoom webinars start with the phrase, “In these uncertain times...”? I did a quick search: 549,000.

Occam’s Razor applies here. The simplest explanation is usually true. And in March 2021 the simple explanation is that we are in uncertain times because of COVID. Now can we please move on?

Isn’t it refreshing, in these uncertain times, that when you come across something close to certain that the flux seems not only manageable but inspiring? This explains the persistence of the entrepreneur and why we embrace them.

In a world that appears to be in a worse state of flux than Notre Dame’s defense against Alabama’s offense (!), entrepreneurs in the satellite industry offer inspiring certainty. Change and risk are not new. Philosophers like Frank White and science fiction writers before him said embracing this is the only way we would get to space.

(<https://www.sspi.org/articles/better-satellite-world-podcast-mind-the-gap-a-conversation-with-author-and-space-philosopher-frank-white>)

Commercial space is where the action is, along with low earth orbit and the next generation of network design that maximizes spectral value. These are each necessary for us to get our house in order HERE so that we can build another home “THERE.”

The world of RF expertise has had a special, narrow place in the world communications. Kind of like a Woody Allen movie to Hollywood. But now it is a deep source of opportunity for new businesses in data analytics that range across vertical industries

and drive the growth of start-ups. Satellites are relevant and RF expertise is a commodity that is hard to find.

But when you combine the engineering challenges and opportunities of the RF proposition with entrepreneurship you get something special.

Entrepreneurs Cannot Help Themselves

They are, to paraphrase the old Merrill Lynch commercial, “a breed apart.” Popular ones like Elon Musk and Jeff Bezos have an iconic shine. But “local” ones like Adam Maher of Ursa Space and Prateep Basu of India’s SatSure, as well as some of the men and women (mainly women) in the SSPI 20 under 35 cohort (<https://www.sspi.org/cpages/20-under-35>) prove that the breed is thriving. It also proves, decisively, that talent is distributed unevenly.

While youth is no longer wasted on the young in this industry it is not confined to the under-35 crowd. A start-up in Long Island, New York, STS Global (www.stsglobal.com) is led by a Hall of Fame inductee in his sixth decade as an entrepreneur in the business!

It has never gotten old for 83 year-old CEO David Hershberg. The man who sold Globecom for a reported US\$ 340 million has made a little satellite go a long way. During this uncertain period, he is on his second company named “STS,” having founded Satellite Transmission Systems in 1976.

Currently in the fifth year of his new venture--a dynamic satellite communications system integration company--the man who built the Hotline be-

“...Isn’t it refreshing, in these uncertain times, that when you come across something close to certain that the flux seems not only manageable but inspiring?...”

tween Moscow and Washington after the Cuban Missile Crisis (1962) is busy rolling out services for 5G, IoT and the power generation markets. The company's pipeline is filled and swelling. The self-funded STS Global reached profitability in 2020. Marquee name customers like SES get the highest performance and integration for the RF part of their network design and implementation from STSG.

The consummate entrepreneur is having a good time in 2021 along with his experienced engineering team from past decades. His philosophy of business has not changed.

“When my first company was bought, my new employer accused me of paying more attention to my employees than to stockholders.” He shrugged. “They went bankrupt after we left them. We are still in business.”

I have watched him for 25 years and believe he is graced with the skill to create successful companies. This cannot be inherited or taught.

But he was pointed in the right direction thanks to a “D” in college.

“I had been an amateur ham radio operator from age 11 and when I graduated from college to go into my father's engineering firm he saw that I got my only D in mechanical drawing. I was a sloppy map-maker. So he gave me some advice, ‘Dave, go into communications.’”

He did. The rest is history. His newest creation is seeking funding to scale, bring in more and youthful talent and do the work that keeps piling in. He is open to a strategic acquisition and has a solid idea for making the power generation industry more secure, the result of yet another patent and work being done for a Western USA utility that sees “the RF option” as a potential game-changer.

Like those other entrepreneurs that continue to pop-up in this industry, Hershberg is not affected by the phrase, “In these uncertain times.” For over 60 years he has been certain of one thing and makes his living knowing it: a little satellite goes a long way!



David Hershberg, who describes himself as a “serial entrepreneur,” founded several successful companies such as Globecomm and was the winner of the Visionary Executive of the Year award from Satellite Markets and Research in 2013.

SSPI's Better Satellite World Podcast has started its second season of “Risk.” On March 8th a special edition honoring International Women's Day will feature a discussion with leaders in the Industry. www.bettersatelliteworld.com



Lou Zacharilla is the Director of Innovation and Development of the Space and Satellite Professionals International (SSPI). He can be reached at: L.Zacharilla@sspi.org



Cooperation and Collaboration Key to Success in Satellite Services

by Pratik Kirve

Technological advancements have expanded the utilization of satellite services in almost every facet of everyday life. Market players have collaborated with other players to offer better services to their customers in terms of speed, reliability, and flexibility.

The demand for satellite services is increasing with its application in various areas. According to the report published by Allied Market Research, the global satellite services market is estimated to reach US\$ 144.5 billion by 2026. Following are some the activities taking place across the world.

Collaboration is one of the key strategies adopted by market players to offer better services to specific areas. Collaboration activity involves combination of expertise and resource to make services more reliable and faster than before. Gilat Telecom collaborated with Spacecom, a communications satellite operator to offer faster, reliable, and cost-effective satellite services to organizations across Africa. In this collaboration, Spacecom digital

and advanced High Throughput Satellite AMOS-17 on C and Ku band will be utilized with Gilat's SD-WAN MAX technology. This combination would be helpful for private and public connectivity for applications including e-education, e-learning, e-health applications, and video conferences.

customers can avail Smart traffic management with the help of Gilat's SD-WAN service providers and MNOs. This feature would enable them to take control of the route that has been traded with customers by satellite and fiber traffics. All of these features enable ease in use of different ap-

plications such as streaming, voice, and others.

"This partnership enables us to boost the services offered to customers along with fast returns on investments to these growing markets. We are sure this fruitful cooperation will lead us to many great business opportunities in Africa," said Ofer Asif, Senior VP Bus. Development and Market-



Satellite operator Spacecom and service provider Gilat Telecom worked together to provide much needed connectivity in Africa for applications including e-education, e-learning, e-health applications, and video conferences. (image courtesy of Spacecom)

Dan Zajicek, the CEO of Spacecom commented that the collaboration would boost services with rapid returns on investments. Both companies have been working on developing an ecosystem that would reduce costs and enhance capacity. African MNOs and ISPs can be benefited from various offerings such as high throughput at lesser costs and 20% rise in capacity. In addition,

ing at Spacecom.

In another collaborative approach, the companies have realized the need to offer security to satellite communications by combining resources. Leaf Space, an Italian provider of ground-segment services for smallsats collaborated with CYSEC, a Swiss cybersecurity firm. The collaboration is aimed at offering cybersecurity services for protection to

CASE STUDY

satellite communications. As the scenario has been changed drastically over the past few years, the security of satellite communications has become essential as it contains valuable and sensitive data. CYSEC will provide small satellite operators with an off-the-shelf solution for securing their data and infrastructure against cyberattacks.

Jonata Puglia, the CEO of Leaf Space, highlighted the importance of cybersecurity services in the current scenario for companies operating their satellites. Along with providing ground infrastructure, the company aims to offer protection to data of customers and CYSEC proposed viable solutions to this issue. With complex architecture in satellites, there are many points through which hackers can eavesdrop, temper, and interrupt service. However, few steps related to security can prevent this from happening. CYSEC offers tools to satellite operators to protect ground operations with the help of ARCA platform. Most importantly, the collaboration would offer end-to-end protection from the ground stations to the mission control software of satellite operators.

Market players have been tapping on the potential of satellite services by offering connectivity to regions have not been privileged with such services. Kacific Broadband Satellites Group (Kacific) entered the agreement with Government of Tuvalu for offering nationwide high-speed broadband internet connectivity through satellite. In a five-year

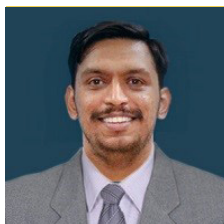


The partnership between satellite operator Kacific and the Government of Tuvalu has enabled the small archipelagic nation to offer nationwide high-speed broadband internet connectivity via satellite. (image courtesy of Kacific)

deal, the bandwidth will be provided by Kacific's high-throughput satellite Kacific1. Nine islands of Tuvalu will be equipped with internet connectivity. This high-quality connectivity is aimed at offering huge volume and flexibility for communications. Moreover, the company aims to offer affordability and ease in availability of internet. Based on the agreement, the company aims to offer 400Mbps to 600Mbps of satellite capacity based on the terminal size.

The company will deploy nearly 60 1.2 meter VSAT ter-

minals for schools, government agencies, medical clinics, and small businesses for offering rapid connections. Moreover, there will be 40 Wi-Fi access points for faster connection to hotspots. Kacific is expected to install 4.5 meter antennas along with providing training and technical support. With these services, Tuvalu can avail services of high quality for communications infrastructure. This game-changing project would change lives for many people in this small archipelagic nation. 🇹🇻



Pratik Kirve holds a bachelor degree in Electronics and Telecommunication Engineering and currently working as a Senior Specialist-Content Writer at **Allied Analytics LLP**.

For more information on research on satellite services go to:

www.alliedmarketresearch.com/satellite-services-market

The Terminal User Experience Paradigm SWaP

by **Martin Jarrold**

In considering the theme for this month's column my prompt came from threads of discussion featuring in GVF's continuing online events program (<https://gvf.org/webinars/>) which resumed in January, following our successful 2020 online content response to the limiting circumstances of a pandemic world. Mid-February's Zoom into the subject of ground segment attracted 400 registrations, 300 actual attendances from 60 countries, and over 30 live questions, in addition to the moderator-led Roundtable dialogue.

The initial 60-minute focus on transportable terminals will be developed and extended during March with additional explorations into (a) the frontiers of satellite systems size, weight, and power; and (b) the development and evolution of capability and performance of satellite networks solutions. A combination of these three threads serves to frame the below.

Providing solutions for today's cellular backhaul, consumer broadband, enterprise networks, IoT, managed services, rural connectivity, satcoms-on-the-move and other connectivity application requirements is the very stuff of the development path of the modern Very Small Aperture Terminal. However, the term VSAT is less common today; we hear fewer references to the assembly of the antenna, BUC/power amplifier, LNB, IDU, etc., in favor of transition to a more "holis-

tic" view of the terminal, or user equipment, i.e., a migration away from looking at the separate parts to looking at wholly integrated systems, from thinking of individual technical elements to focusing on overall functionality, and indeed of services too. This both reflects demand for, and is an enabler of, an improved user experience built on, and exemplified by, terminal deployment/installation simplification, use of graphical user interfaces, the placing of greater sophistication in the terminal with complexity taken away from the user, with the latter being based, in part, in software defined virtualization of networks.

It is also a reflection of changes in the way that customers express their requirements, less so in terms of such specifications as EIRP, or G/T, more so in terms of data rate throughput performance, or the requirements of a particular application, parameters which may need to be dynamically flexible over time.

The accelerating advances in the performance capabilities of terminal equipment brings elevated link optimization, and greater connection security, all whilst manufacture is achieved at progressively lower cost. Of course, ground segment technology development is richly paralleled by, and inter-related with, developments in the space segment, with both increasingly powerful individual satellites in GEO, and the assembly of constellations of NG-



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SOs the design and build parameters of which include reduced mass and volume.

As NGSO networks come into service, complementing existing and additional GEO systems, wider considerations relating to the "holistic" terminal come into play, pertaining to multi-network, multi-band, multi-orbit networking operations, supporting expanded and multiple user scenarios facilitated by the combination of greater capabilities and reduced cost.

Just as new design options for satellites have resulted from electronics manufacturing innovation, including Very High-Density Integrated Circuits (VHDCs), and from new methods for embedding COTS components; just as new frontiers in Size, Weight and Power (SWaP) have been established, suggesting the question, "Where is future of manufacturing of ever-smaller high-performance electronics taking satellite systems?", the direction of terminal design is towards smaller form-factors whilst meeting increased power targets to support RF signal performance.

Of course, application, capability, flexibility, performance, form factor, and various other characteristics, additionally inter-relate with the emerging new

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antenna environment, featuring the respective advantages of the parabolic reflector and various flat panel antenna (FPA) technologies.

FPA's have for long been a niche alternative to parabolic antennas, with the fixed phased array type in use since the 1950s. Due to high costs and variable performance market potential has been limited, until today's "Goldilocks Zone" with just the right coincidence of factors – new demand from evolving and expanding markets and associated opportunities for scale, radical technologies, advanced engineering techniques and manufacturing processes – combining to address the issue of unit cost. Additionally, the FPA market is benefiting from partnerships – arising from the widespread recognition that the satellite industry is in a state of fundamental transformation necessitating a deeper integration of the industry's value chain – with operators, service providers, ground equipment manufacturers, forming relationships to drive advances in antenna ecosystem development to achieve the right mix between performance and price.

The paradigm-shift in the nature, pace, and scale of the drivers of increased market demand for better performing satellite solutions, leveraging the inter-related advances in space and ground segments, has led us to great expectations for FPA's. Most specifically active electronically scanned arrays (AESAs) – characterized by such defining attributes as low aperture, high reliability and pointing accuracy, small form

COTS + VHDIC (= SWaP) + FPA > modularity > manufacturing scale > unit cost reduction + reliability/resilience/dependability + SDN (multi-networking operations) + user specifications = holistic terminal User Experience > achieving expanded user scenarios > increased terminal demand > R&D investment in VHDIC + FPA + manufacturing scale > unit cost...

The formula for ground segment service paradigm

factor, and low weight – wherein each antenna element has an individual transmitter/receiver unit, controlled by a computer, and hence AESAs can radiate multiple beams of radio waves in different directions, at multiple frequencies, at the same time. Also coming to market is optical beam forming FPA technology which, beginning from the simplicity and high efficiency of the parabolic antenna with its geometric structure focusing energy into a single feed source, features a structure of multiple beam-forming sources, each of which can support an individual beam.

The technology provides an integrated solution that includes modem, BUC and LNB components in a single package. The solution can handle GHz of instantaneous bandwidth, ensuring that the terminal is never the bottleneck, supporting any commercial carrier size currently available. These various FPA technologies have become one of the evolving pieces of the industry's complex re-engineering of the terminal, and of the users' experience.

Ground segment engineers,

like their space segment counterparts, are joining the mass production line-like industrialization of space with COTS components augmented by speed of innovation in miniaturization. Ground segment design is shifting from extremely high quality and low quantity to high quality and high quantity, maintaining reliability, resilience, and dependability, but at lower cost. Increased terminal modularity suggests the increasing significance of a satcoms-as-a-service paradigm which goes beyond managed platforms-as-a-service models which combine hub, teleport/data center uplinks, and terrestrial networking elements to enable easy global deployment of high-throughput connectivity to user customer locations. This paradigm would be reflected in a virtuous circle, something akin to the familiar decreasing launch costs > more satellites launched more often > reduced redundancies > reduced mass and volume > further reducing launch cost, but looking something like the formula pictured above (somewhat less elegant) summary of the thoughts conveyed here.



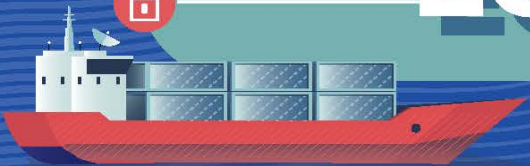
Martin Jarrold is Vice-President of International Program Development of GVF. He can be reached at: martin.jarold@gvf.org



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Comtech Telecommunications Closes Acquisition of UHP Networks

Melville, NY, Mar. 3, 2021- Comtech Telecommunications Corp. (NASDAQ: CMTL), a global leader in the advanced secure wireless communications market, announced today that it has closed the acquisition of UHP Networks Inc., a leading provider of innovative and disruptive satellite ground station technology solutions. Founded

advanced wireless communications solutions for our global customers. We are delighted to acquire UHP and expect use of its incredible technology to expand globally for many years to come.”

All UHP employees are expected to join Comtech, including Vagan Shakhgildian, the President of UHP, who will also assume the role of Senior Vice President of Net-

an earn-out payment of up to an additional US\$ 9.0 million (payable in cash and/or common stock at Comtech's option) if certain agreed upon sales milestones are reached over an eighteen-month period. Approximately 1.0 million shares of Comtech's common stock were issued at closing in respect of the initial payment and escrow arrangements under the terms of the purchase agreement.

Comtech is not purchasing UHP's sister company headquartered in Moscow; however, Comtech will be able to immediately market and sell UHP products to customers in that region. Except for five months of incremental amortization of intangible assets that is expected to approximate US\$ 1.0 million, the ac-



in 2011, UHP is based in Canada and has developed revolutionary technology that is transforming the growing Very Small Aperture Terminal (VSAT) market.


UHP's unique time divisional multiple access (TDMA) technology used in its VSAT platforms has software defined network functionality that offers best-in-class support for very large networks. With over 3 billion people globally who are not connected to any wireless services, the UHP acquisition allows Comtech's customers to cost-effectively provide service to end-users with the quality and reassurance of the Comtech brand and service offerings.

Fred Kornberg, Chairman of the Board and Chief Executive Officer of Comtech said, "The acquisition of UHP fits perfectly with our strategy of offering the most robust and

work Products, leading Comtech's efforts to expand the presence of both HEIGHTSTM and UHP's solutions in the mobile backhaul, maritime, enterprise and defense/government markets, which all have a growing need for high-speed satellite-based networks.

The initial up-front payment of approximately US\$ 24.0 million was paid in shares of Comtech common stock. An additional payment of US\$ 5.0 million (payable in cash and/or common stock at Comtech's option) is due upon certain conditions being met, all of which are expected to occur within the next twelve months. The purchase agreement also provides for

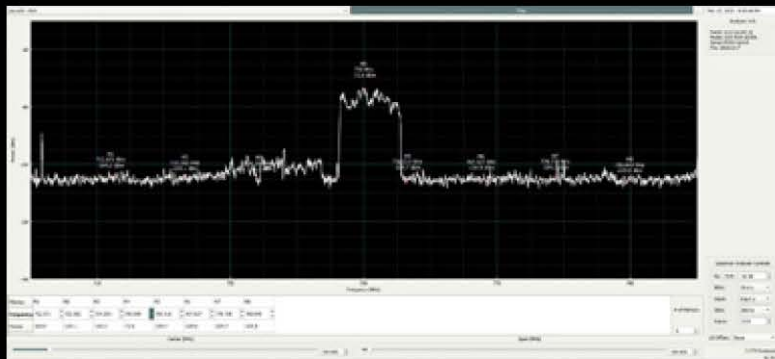


acquisition will not materially impact Comtech's fiscal 2021 consolidated net sales or Adjusted EBITDA guidance previously issued on December 9, 2020. 

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Former Nokia CEO Rajeev Suri to Succeed Rupert Pearce at Inmarsat

London, UK, March 1, 2021--Inmarsat announced that Rajeev Suri, former Nokia CEO, will assume the role of CEO and become a director of Connect Bidco Limited, the holding company for Inmarsat, from 1 March 1, 2021. Rupert Pearce will step down as CEO as of February 28, 2021.



Rajeev Suri

Suri's most recent role was President and CEO of Nokia, a position he held for six years. Prior to that, he was the CEO of Nokia Siemens Networks for five years, a joint venture company that merged Nokia's and Siemens' networks businesses. Since stepping down in August 2020, Rajeev has worked in senior advisory roles with private equity firms Warburg Pincus and Apollo Global Management.

He has a record of accomplishments, including moving Nokia to one of the top two players in telecommunications infrastructure through both M&A and organic growth, doubling revenues to EUR 23 billion in 2019 and increasing non-IFRS operating profit from EUR 28 million in 2009 to over EUR 2 billion in 2019 during his eleven years of leadership. Suri led the consolidation of the network infrastructure sector from ten players to three major players in just over a decade, leaving the overall industry much healthier. During his time as Nokia CEO, large shareholder returns in the form of dividends and share buybacks of EUR 8.5 billion were made.

Suri most recently led Nokia's leadership in 5G for communication service providers and successfully

diversified Nokia into new business areas. He established an independent software business that became the leading telecom software business in the world, quadrupled the annual recurring revenue run rate of the patent licensing business and led a new foray into large enterprise networks with double digit revenue growth over the last several years. Suri will be based in the UK.

Virgin Orbit Hires former OneWeb CEO as COO

Long Beach, Calif., February 17, 2021--Virgin Orbit announced that Tony Gingiss has joined the team as their Chief Operating Officer (COO). As the first person to hold this position, Tony will oversee day-to-day operations at Virgin Orbit's state-of-the-art manufacturing facility in Long Beach, California. His arrival follows the successful LauncherOne mission in January and completes a sequence of enhancements to the company's executive team as Virgin Orbit pivots to commercial operations.

Gingiss brings more than 30 years of aerospace experience in design, production, operations and leadership to this new role. Most recently, he served as the Chief Executive Officer (CEO) of OneWeb Satellites, where he led that company through design, low-rate-initial production, pilot launches, and into full production. Under his leadership, the company built a new factory and scaled to a production rate of two satellites per day — the successful realization of a fundamentally new approach to aerospace manufacturing.

Prior to his role at OneWeb Satellites, Gingiss spent more than two decades with the Boeing (formerly Hughes) Satellites Systems group in roles spanning space, ground, engineering, operations, and leadership, including, most prominently, his role as the Director of Strategic

Integration and National Space Communications Programs. Gingiss received his Bachelor of Science in Aeronautical & Astronautical Engineering from Purdue University and was awarded Purdue's 2019 Outstanding Aerospace Engineer award. He was also awarded a Charles Stark Draper Laboratories Fellowship and received his Master of Science in Aeronautics and Astronautics at MIT.



Tony Gingiss

NXTCOMM Announces Board of Directors

Atlanta, Ga., Feb. 18, 2021-- Following successful validation tests of its next-generation Ku-band antenna design, NXT Communications Corporation (NXTCOMM) announced the formation of a new Board of Directors to help guide the next phase of its growth and commercial market introduction. Coming from the technology, aerospace, manufacturing, retail and satellite sectors, the board brings more than a century of experience and leadership to address the connectivity challenge. The board members include:

- Robert (Scott) Zimmer, Board Chairman, NXTCOMM
- David Horton, CEO, NXTCOMM
- Stephen Newell, Chief Commercial Officer, NXTCOMM
- Curtis C. Reusser, Board Member, NXTCOMM
- Lawrence Soriano, President, Western Pioneer, Inc.

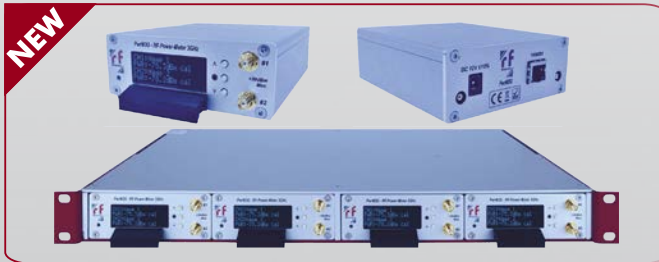
The board, a combination of NXTCOMM management and outside directors, collectively have significant market and technical expertise to guide the company forward.



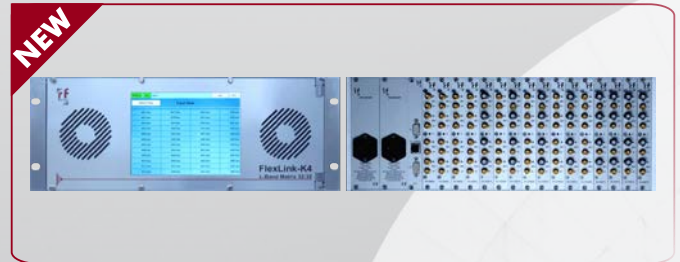


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- Active Splitters & Combiners
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- Perfectly Suited for Satellite Earth Stations, Teleports...



Satellite Constellations Drive US\$ 3 Bil. Optical Satcom Market in 2020

Cambridge, Mass., February 8, 2021--NSR's newly released Optical Satellite Communications, 3rd Edition (OSC3) report projects a US\$ 3 Billion cumulative revenue opportunity through 2030 for laser communication terminals (LCTs) in both space and airborne markets. The Optical Satcom market is largely equipment-centric, with a significant portion of the revenue flow going to LCT manufacturers.

Success in this market will be heavily dependent upon non-GEO constellation operators' ability to launch and close their business cases, as well as market adoption from government / military institutions looking for alternative solutions in RF-denied environments.

"The market for LCTs rests strongly on the deployment of Non-GEO HTS mega-constellations, particularly if terminal prices come down," states Shivaprakash Muruganandham, NSR Senior Analyst and report lead author. Muruganandham adds, "Free space optical communications (FSOC) is a niche alternative to today's RF links. As it matures, a new wave of interest rises in optical satellite

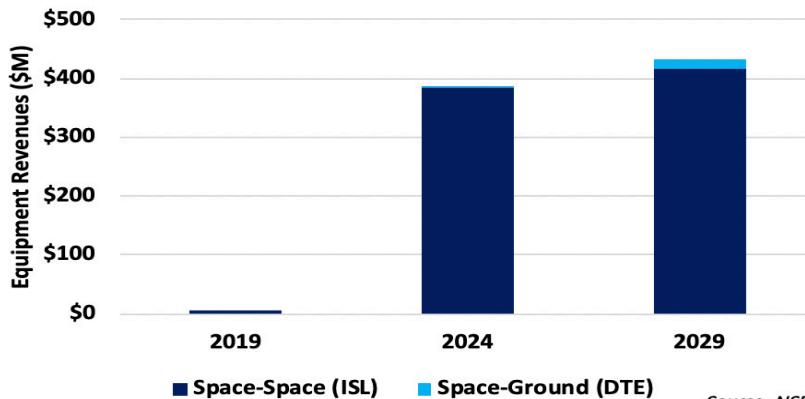
communications as a potential market gamechanger".

Currently, a handful of terminal manufacturers are eyeing this market, ranging from vertically integrated aerospace incumbents with volume production capabilities

"EO, for its part, is a smaller market, seeing very slow uptake in the commercial sector due to the competition from RF services".

Many equipment manufacturers are now racing to address the optical satellite communications market with a variety of products aimed at inter-satellite links or direct-to-earth optical connectivity solutions. OSC3 leverages NSR's extensive analytical experience to offer business-critical insights into what is shaping the optical satcom market and its target segments.

Optical Satcom Equipment Revenues, by Link



ties to newer, leaner, startups targeting niche adjacent segments. Within the next 3 years, over 20 different in-orbit demonstrations are planned to involve LCTs. These will be critical in determining the true potential of optical laser communications.

"On top of satellites, the airborne market for optical laser-comm, specifically for military UAS applications in RF-contested scenarios, will be very attractive in the short-term for terminal manufacturers" explains Arthur Van Eckhout, NSR Analyst and report co-author.



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The Satellite Markets 20 Index™

Company Name	Symbol	Price Mar 5, 2021	52-wk Range		Price Change Last Month
Satellite Operators					
Thaicom Public Company Limited	THCOM.BK	9.05	2.14	11.40	-1%
Eutelsat Communications S.A.	ETL.PA	10.06	7.98	11.24	7%
APT Satellite Holdings Limited	1045.HK	2.15	1.70	3.74	2%
Echostar	SATS	26.64	19.75	36.09	8%
SES S.A.	SES.F	6.78	4.88	8.55	-11%
Satellite Manufacturers					
The Boeing Company	BA	223.22	89.00	264.29	5%
Maxar Technologies	MAXR	43.04	7.18	58.75	-14%
Lockheed Martin Corporation	LMT	340.43	266.11	417.62	-4%
OHB SE	OHB.DE	35.1	25.65	49.85	-21%
Honeywell International Inc.	HON	206.58	101.08	216.70	-1%
Equipment Manufacturers					
C-Com Satellite Systems Inc.	CMLV	4.04	1.52	4.05	50%
Comtech Telecommunications Corp.	CMTL	28.17	11.48	29.80	26%
KVH Industries Inc.	KVHI	13.35	6.36	15.49	10%
ViaSat Inc.	VSAT	49.34	25.10	61.35	36%
Gilat Satellite Networks Ltd.	GILT	11.35	4.70	22.69	55%
Service Providers					
DISH Network Corporation	DISH	33.81	17.09	37.89	4%
Globalstar Inc.	GSAT	1.42	0.23	2.98	60%
Orbcomm Inc.	ORBC	6.87	1.24	9.25	-19%
Sirius XM Holdings Inc.	SIRI	5.89	4.11	8.14	1%
RigNet Inc.	RNET	8.90	0.77	11.19	33%

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.

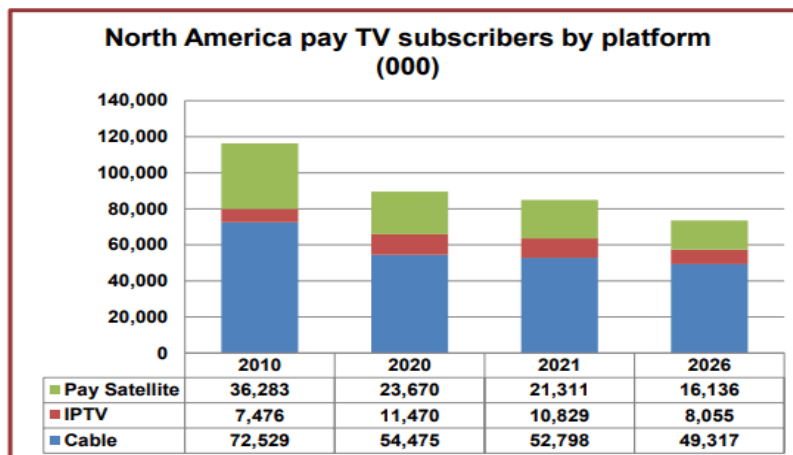
INDEX	Index Value March 5, 2021	2-Month Percentage Change January 15, 2021
Satellite Markets 20 Index™	2,509.09	1%
S & P 500	3,841.94	1%

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VITAL STATS



The number of pay TV subscribers in Canada and the US will fall by 43 million from 116 million in the peak year of 2010 to 74 million in 2026. The US will lose 41 million, with Canada down by nearly 2 million according to Digital TV Research. 

We have taken Summit to new heights



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Availability



Lowest
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No Single Point
of Failure



Available in C, X,
Ku and S-Band
Architectures

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To learn more about the **Summit II** high power systems, visit advantechwireless.com/summit-II/



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