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SATELLITE EVOLUTION GLOBAL

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Delivering the future - Comtech discusses key initiatives

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- Preventing downtime in an unpredictable climate
- The success of satcom's redefinition lies in the ground segment

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Crispin Littlehales, Executive Editor

More, more, more

Frank Lloyd Wright once said, "Less is more only when more is too much." The question is: how much is too much? The satellite industry and corresponding ground systems and stations are preparing for a future that includes not only machine learning (ML), artificial intelligence (AI), and virtual reality (VR) but also digital twins, volumetric video, holographic telepresence, the internet of senses, the metaverse, smart cities, industry 4.0, and connectivity for everyone on the planet.

This translates to a stunning amount of data. According to the International Telecommunication Union (ITU), the world will generate over five billion terabytes of data per month by 2030. Data generated in space is also growing at a rapid rate. Today, a typical EO constellation accumulates more than 100 terabytes of data each day. Northern Sky Research (NSR) anticipates that space data traffic will reach 566 exabytes over the next decade, with satellite communications accounting for 90 percent.

To handle all this data will require hybrid networks using LEO, MEO, and GEO; cloud technologies such as edge computing and virtualization; software-defined satellites and even space edge-hosted payloads. Traditional satellite network architectures and hardware components are in the process of morphing into software-defined networks (SDN) with network function virtualization infrastructure (NFVi) such as virtual modems. Although the challenges ahead require all the technological prowess, cooperation, and funding that can be mustered, the transformation is progressing rather quickly.

The first 3rd Generation Partnership Project (3GPP) standards release to include 6G is expected to be complete in 2030 and the satellite industry is poised to play a critical and lucrative role. According to STL Partners, satellite will represent a US$16 billion opportunity through 2029 in the cloud computing market.

ETL Systems' new C4 production building. Photo courtesy ETL Systems

In this issue of Satellite Evolution Global, we sit down with Ken Peterman, Chair, President, and CEO of Comtech who discusses the company's new branding, key initiatives, and the creation of EVOKE, an Innovation Foundry that is expected to keep Comtech on the bleeding edge. We also hear from Frederik Simoens, CTO at ST Engineering iDirect who provides insight on what the ground segment needs to do in order to shift the infrastructure to the cloud and better integrate with the terrestrial 5G networks. In addition, Andy Chambers, Director of industrials for Edison, explains why diligence and patience are key to investing in the NewSpace economy during 2023.

Laurence Russell interviews Kevin Steen, CEO of OneWeb Technologies who shares the company's strategy for growing its business offerings in the US to support different branches of the government, military, and federal as well as state-funded programs. Russell also catches up with ND Satcom's Head of Product Management, Michael Nebel, who gives us details about the company's SKYWAN 5G patch 2.2 which includes the integration of X.509 certificates to safeguard against malicious network impersonators. In addition, Russell speaks with Andrew Bond, Sales & Marketing Director for ETL Systems about the reasons behind their recent moves and how they plan to forge forward.

Regulars

Features & Market Reports

Executive Q&As

Michael Nebel, ND SATCOM, Head of Product Management

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Maxar to provide environmental monitoring for Government of Guyana

SOUTH AMERICA: Maxar Technologies, provider of comprehensive space solutions and secure, precise, geospatial intelligence, has announced that the Guyana Ministry of Natural Resources (MNR) has entered into a three-year contractual agreement with Maxar to provide the nation with environmental monitoring services for both offshore and terrestrial applications.

Guyana's Environmental Protection Agency (EPA) will utilize Maxar's Crow's Nest Maritime Monitoring and Security products to support offshore petroleum monitoring. The EPA will use the Crow's Nest Maritime Tipping and Cueing Service, which leverages Maxar's very-high resolution optical satellites, to monitor drilling vessels for regulatory compliance and safety. It will also use the Crow's Nest Multi-Sensor Oil Detection Service to identify potential spills.

The agreement with Guyana marks Maxar's first Crow's Nest contract in Latin America and the Caribbean and is an important milestone in the application of Crow's Nest to the environmentally critical use case of monitoring offshore petroleum activity.

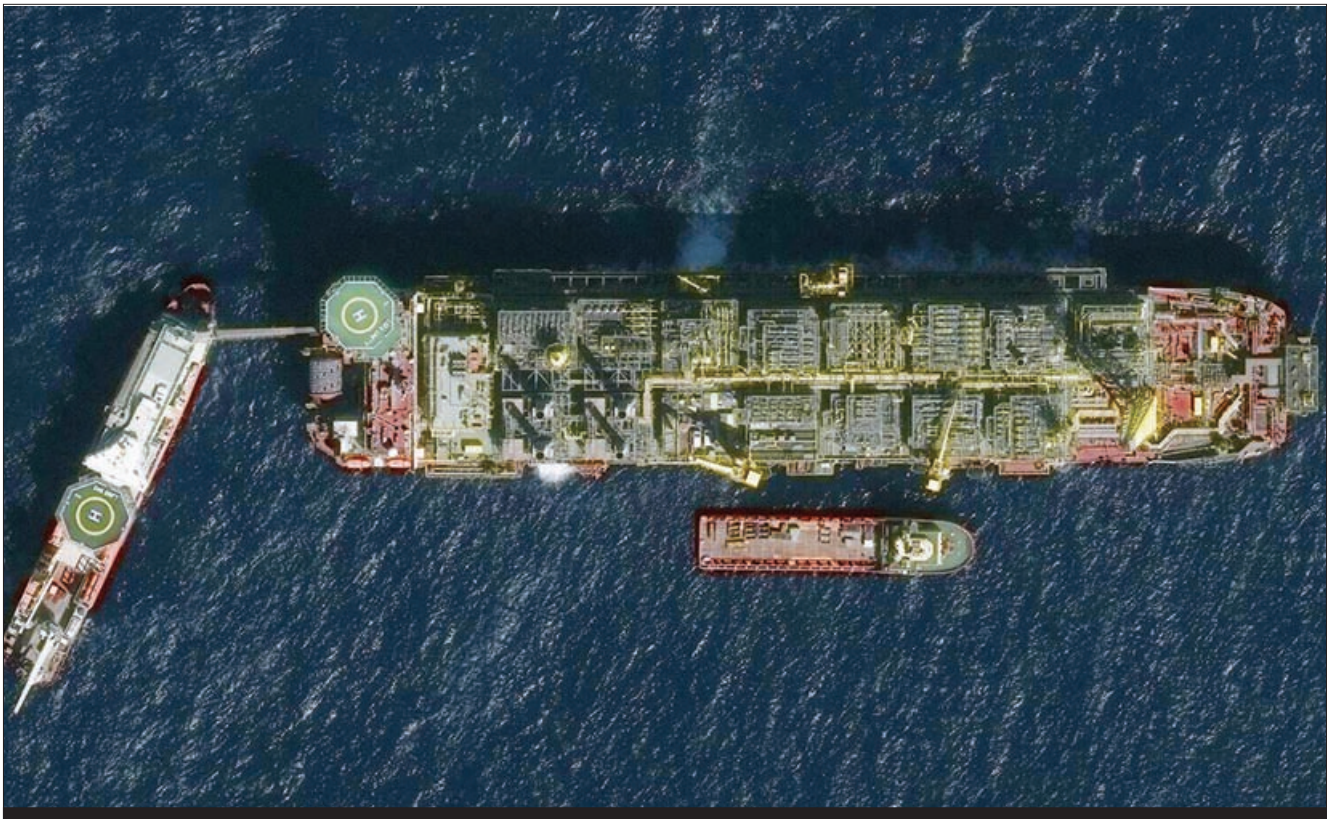
Guyana's economy has grown significantly as a result of the influx of capital from newly discovered offshore oil and gas resources, and Maxar's monitoring capabilities will help Guyana's EPA ensure the resource is sustainably managed, environmentally safe and able to be extracted for years to come.

Also included in the agreement, the Guyana Forestry Commission will combine several Maxar capabilities to track illegal deforestation, protect mangroves and safeguard the country's biodiversity. Products that will support this work include:

- SecureWatch: This cloud-based platform provides on-demand access to Maxar's high-accuracy, high-resolution satellite imagery and analytics.
- Persistent Change Monitoring (PCM): PCM highlights human changes in an area and displays persistent change accessibly as a color-coded geospatial data layer.
- Imagery tasking capabilities.

"Maxar's geospatial data and analytics will help MNR protect the environment for future generations while also sustainably developing the extraction of Guyana's natural resources for long-term economic gains," said Hon. Vickram Bharrat, M.P, Guyana's Minister of Natural Resources.

"Maxar is the only company that can offer these diverse environmental monitoring technologies under a single contract," said Tony Frazier, Maxar's Executive Vice



This Maxar WorldView-3 image, collected January 15, 2022, shows offshore petroleum activity in the Guyanese Exclusive Economic Zone (EEZ). Photo courtesy Maxar Technologies ●●●

President and General Manager of Public Sector Earth Intelligence. "We applaud Guyana's Ministry of Natural Resources for applying our industry-leading technology to help meet its environmental goals."

Gilat enables TIM Brasil to be first network operator with coverage to 100 percent of Brazilian cities

SOUTH AMERICA: Gilat Satellite Networks has enabled TIM Brasil, a Tier-1 Mobile Network Operator (MNO), to be the first MNO to provide mobile coverage to all 5,570 cities in Brazil.

TIM Brasil's coverage of 12 million hectares for the agrobusiness is largely possible due to Gilat's cellular backhaul over satellite solution. The successful execution included timely remote installations by the Gilat team to ensure that 100 percent of Brazil's cities have mobile network access provided by TIM Brasil, mostly being 4G, and thus turning the company into the largest mobile network in the country.

"TIM Brasil is the only MNO in the nation to cover all of Brazil's municipalities. We are extremely proud of this achievement, a major step forward in digital inclusion and in fostering economic and human development," said Marco Di Costanzo, Network Director at TIM Brasil." Reaching this goal wouldn't have been possible without the strong and continuous support of the entire Gilat team, working closely with us to connect sites in the most remote regions of the country."

"We are very happy to support TIM Brasil in accomplishing this impressive objective, which represents a great start to 2023," said Michal Aharonov, Chief Commercial Officer at Gilat. "Gilat's industry-leading technology enables TIM to extend their presence from urban centres to the countryside. We are proud to partner with TIM in this important journey to bridge the digital divide with 4G access across the country."

Vyoma and EnduroSat join forces to enhance Space Sustainability

EUROPE: Vyoma has partnered with EnduroSat, leading provider of software-defined nanosatellites and space services, to help improve the safety of satellites in orbit. A Memorandum of Understanding has been agreed upon, outlining how the two companies will support each other to improve sustainability of space activities.

Vyoma's solutions and services will give EnduroSat access to accurate real-time tracking data from a network of ground-based sensors located across the globe. This network will be extended to include space-based sensors in the near future, enabling Vyoma to make highly accurate trajectory predictions. Vyoma's service provides improved insights and warnings of close approaches, empowering satellite operators to efficiently determine when maneuvers are necessary. This ensures satellite fleets remain safe and operational while avoiding costly maneuvers when they are not required.

These services complement EnduroSat's Space as a Service, which offers the easiest way to deploy various types of payloads to orbit. There is no need to re-engineer satellite hardware, as EnduroSat's unique software-defined

architecture allows multiple sensors to operate together reliably on a single platform, resulting in fewer satellites in orbit, used with much higher efficiency, shared as a common resource in space.

Stefan Frey, CEO, Vyoma, commented: "Ensuring space remains safe and sustainable is a shared responsibility, but to adhere to their duty, operators need better tools at their disposal. The data and services we provide enable EnduroSat to improve the safety of its satellites and the efficiency of its operations. We look forward to working together and further developing our solutions and services to help to make space sustainable."

Raycho Raychev, Founder & CEO, EnduroSat, added: "I am really proud of Vyoma and our constant team efforts to improve sustainability in orbit. As the space industry is maturing, we need to have coherent and open ways to operate safely and to protect the safety of others. Looking forward to the next steps of the program!"

As part of its ongoing mission to improve space safety, Vyoma will launch space-based telescopes that track space debris from 2024. This enables the company to further improve the accuracy of debris trajectories and reduce the visibility threshold to as low as 1cm-sized objects, dramatically reducing the collision risk with satellites.

Telemar secures maintenance and service contract from MINSHIP Ship management

EUROPE: Marlink subsidiary Telemar has signed a maintenance and service agreement for eight bulk carriers operated by MINSHIP Shipmanagement.

The contract will see Telemar provide global service co-ordination for Bavaria-based MINSHIP. It includes the provision of the latest Telemar World Service (TWS), a web-based tool for managing scheduled and predictive service appointments for the entire MINSHIP fleet, increasing visibility on service intervals, and optimizing vessel availability.

MINSHIP provides long-term management and logistics solutions for both its vessel owners and cargo trading clients. In 2021, the company integrated Hamburg-based technical manager Auerbach Marine, extending its operational expertise to a fleet of MPP vessels. Based in southern Germany, MINSHIP has been a Telemar on-call customer for years. Following the merger with Auerbach, which was already a contract customer, MINSHIP has become a full Telemar partner, reflecting management's satisfaction with the company's performance.

Using a planned maintenance strategy will give MINSHIP the ability to create better predictability in its vessel operations. The equipment included in the contract supports both navigational safety and efficient shipping and higher uptime means performance data can be shared on a close to real-time basis if required.

The contract includes a shore-based maintenance contract including annual radio survey, exchange and check of EPIRB and SART, VDR APT and CoC, annual gyro compass and radar overhaul and exchange of X- and S-band radar magnetrons.

"MINSHIP prides itself on being a transparent and co-operative service provider; our commitment to responding individually to customer wishes requires a fleet designed for highly reliable operations," says Markus Hiltl, Managing Director, MINSHIP. "The importance of properly planned and executed maintenance to our vessel operations is paramount and makes Telemar the natural choice for a closer relationship."

"Telemar is delighted to start the new year by strengthening our co-operation with MINSHIP, a customer with whom we've enjoyed a strong working partnership for many years," said Mike Bauwens, Chief Executive

Telemar will provide the latest version of Telemar World Service, a web-based tool for managing scheduled and predictive service appointments for the entire MINSHIP fleet

Officer, Telemar Group. "Winning the trust of clients with consistent performance is key to demonstrating that we support their business strategies and can help them run safer and more efficient ships."

Sidus Space announces multi-million dollar agreement with Netherlands for laser comms satellite

EUROPE: Sidus Space has been awarded a multi-million dollar agreement with The Netherlands Organization for Applied Scientific Research (TNO) to deploy and test TNO's laser communications technology aboard a Sidus' LizzieSat™ satellite.

As part of the $2.5 Million agreement, TNO will design and deliver HemiCAT, a high-efficiency miniature communications laser terminal, which Sidus will integrate into its hybrid 3D printed satellite, LizzieSat™. Sidus will manage all aspects of integration, deployment, and operations, including procuring a launch and operating HemiCAT in orbit. The in-orbit demonstration mission for laser satellite communication is part of a study of Dutch defense technology.

"We are honored to be selected by TNO as its mission partner for the HemiCAT technology," said Carol Craig, Sidus Space Founder and CEO. "This partnership will allow us to demonstrate further versatility of our LizzieSat™ platform and advance our mission of 'Bringing Space Down to Earth' while continuing to expand our reach into the international satellite market."

"This HemiCat is an important new technology, and we look forward to working with Sidus to launch and test HemiCAT as a pathfinder for future laser satellite communication systems," Michiel Ringers, TNO Business Development Manager stated. "The Sidus team offered the best turnkey solution, designing, building, and deploying flight heritage hardware for demanding applications — the perfect combination of expertise and capabilities we look for in a partner."

Arabsat signs a strategic partnership with Kinéis to launch LEO IOT services

MIDDLE EAST: Arabsat and Kineis have signed a joint cooperation agreement during LEAP 2023, which is an annual global platform and unique event held in Riyadh, Saudi Arabia for futuristic and disruptive technologies bringing together top professionals from around the world.

Eng. Alhamedi Al-Anezi, President &, CEO of Arabsat, said that this agreement gives Arabsat the grounds to discuss distribution rights as the regional distributor in the Middle East and North Africa of Kineis' Satellite IoT services.

Mr. Al-Anezi assured that the strategic cooperation between Arabsat and Kineis will include further agreements in near future related to terrestrial networks and space infrastructure targeting several countries, including Saudi Arabia, Egypt, Algeria, and Mauritania, in addition to other MENA countries where Arabsat has operational capabilities.

Mr. Alexandre Tisserant, CEO of KINEIS, said that KINEIS will become the sole provider for connecting the innovative Nano satellite IoT to Arabsat in the Middle East and Africa. He pointed out that providing satellite data information to become accessible to everyone will facilitate and multiply its uses for experts and individuals alike.

Proceed with caution

Although the recent Virgin Orbit launch failure is by no means the end of the UK's sovereign space ambitions, it is a reminder that the satellite and space industries are fraught with risk. Still, the NewSpace economy offers plenty of upside potential if you're willing to play the long game.

Andy Chambers, Director of Industrials, Edison

Andy Chambers, Director of Industrials, Edison ●●●

The satellite and space sector are very important to most economies these days. We've seen substantial increases in numbers of launches and deployments of satellites. A growing number of countries are initiating their own space programs and satellite constellations in LEO are providing services that are helping to address some of humanity's biggest challenges such as climate change, resource management, optimization of agriculture, and disaster response. Satellites also are playing key roles in data acquisition and analysis as well helping to close the digital divide.

With revenues of approximately US$400 billion in 2022 the global space industry (three quarters of which relates to the satellite segment) is predicted to treble in size by 2040. Clearly, there is substantial opportunity for investors, but picking the winners is by no means an easy task when there are thousands of NewSpace companies touting complex technologies and ambitious business models in an arena where the capital expenditure is high, and mistakes can prove fatal.

SETBACK NOT SHOWSTOPPER

Although Virgin Orbit's first orbital satellite launch from Space Cornwall experienced a systems failure which prevented the mission from reaching its goal, this disappointment is but a setback and we are likely to see another horizontal launch using the Virgin Orbit system in the not-too-distant future. While the UK is not the only country in Europe with launch site ambitions—Sweden just opened Spaceport Esrange last month—it has several sites that will soon be operational.

In addition to Spaceport Cornwall which has horizonal launch capabilities, there are a two more spaceports under development that will support vertical launches. SaxaVord Spaceport in the Shetland Islands recently partnered with launch service provider Rocket Factory Augsburg AG (RFA). The RFA pad is the first for vertical orbital rocket launches in the UK and mainland Europe. British rocket startup Orbex signed a 50-year lease with Space Hub Sutherland and plans to launch the first vertical rocket from UK soil later this year. Clearly, the UK remains fully committed to being a leader in the space economy. The country has a long heritage of space involvement having built commercial and military satellites for over fifty years. According to BryceTech's report, *The Size and Health of the UK Space Industry*, employment in the field was nearly 47,000 in 2019/20 with an annual growth rate of six percent. What's more, the industry contributed £6.9 billion of direct gross value added (GVA) and £15.8 billion total GVA across the supply chain.

The UK's national space strategy which was announced in 2021 brings both commercial and defence operations into an integrated environment with clear planning and delivery responsibilities. This includes the development of a dedicated small satellite launch capability with the claim they can get to a 30 percent market share. The whole point of this capability is to stimulate economic development of space activity in the UK and grow the 1300 or so companies that exist in the UK today to double that amount. It is a high tech, high value, professional industry with 85 percent of the employees at graduate level or above.

A COMPLEX PATH TO MATURITY

Although interest in the global space industry has grown steadily in the last few years, investment slowed down in 2022, due in great measure to the economic environment. According to the fourth quarter report released by Space Capital, investment was down 58 percent from the previous year. Of the 14 space-related companies that went public between 2019 and 2022, all but one has seen stock prices plunge precipitously from when they first entered the market (See chart: Updated SPAC table as of close 2/2/23)

This is not to say that all these newly minted public companies are not credible, but many are still struggling to prove their business models. Generating the self-financing capability that will determine where those valuations ultimately lie will likely take years and any hiccups along the way will be costly. Take Virgin Orbit, for example. They took a big hit on the stock market even though their shares were already very depressed. There is so much riding on these companies and everything they do requires technological perfection and a good deal of money.

GROWTH TRAJECTORY: LEO VS GEO

Historically it took at least five years and millions of dollars to build a single large satellite which would then operate

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Updated SPAC table as of close 2/2/23

Exhibit 2: Recent space related SPAC deals

Company	Ticker	SPAC partner	Listed	Share Price ($)	Mkt Cap ($bn)	Segment
Virgin Galactic	(NYS: SPCE)	Social Capital Hedosophia	25-Oct-19	6.34	1.74	Launch & Transportation
AST SpaceMobile	(NAS: ASTS)	New Providence Acquisition Corp.	06-Apr-21	5.87	1.17	Space infrastructure
Astra	(NAS: ASTR)	Holicity, Inc.	30-Jun-21	0.66	0.18	Launch & Transportation
Momentus	(NAS: MNTS)	Stable Road Acquisition Corp.	12-Aug-21	1.03	0.09	Launch & Transportation
Spire	(NYS: SPIR)	NavSight Holdings, Inc.	16-Aug-21	1.22	0.19	Space infrastructure
Rocket Lab	(NAS: RKLB)	Vector Acquisition Corporation	25-Aug-21	5.24	2.48	Launch & Transportation
Redwire	(NYS: RDW)	Genesis Park Acquisition Corp.	02-Sep-21	2.65	0.17	Space infrastructure
Arqit	(NAS: ARQQ)	Centricus Acquisition Corp.	03-Sep-21	2.46	0.30	Infromation Technology
BlackSky	(NYS: BKSY)	Osprey Technology Acquisition Corp.	09-Sep-21	1.94	0.24	Space infrastructure
Planet Labs	(NYS: PL)	dMY Technology Group, Inc. IV	07-Dec-21	5.04	1.37	Space infrastructure
Virgin Orbit	(NAS: VORB)	NextGen Acquisition Corp. II	28-Dec-21	1.75	0.59	Launch & Transportation
Satellogic	(NAS: SATL)	CF Acquisition Corp. V	26-Jan-22	3.76	0.34	Space infrastructure
Terran Orbital	(NYS: LLAP)	Tailwind Two Acquisition Corp.	28-Mar-22	2.02	0.29	Space infrastructure

Source: Refinitiv, Edison Investment research

D-Orbit removed as SPAC proposal cancelled for now

Updated quoted space companies as of close 2/2/23

Exhibit 3: Selected listed space companies

Company	Ticker	Market	Description	CCY	Share Price	MKT Cap	MKT Cap
					Local CCY	Local CCY m	US$m
AAC Clyde Space	AAC	Nasdaq FirstNorth Stockholm	Smallsat and system manufacturer and data services	SEK	1.56	309	30
Avio Spa	AVIO	EuroNext STAR Milan	Launch - propulsion	EUR	10.08	264	242
Creotech	CRI	Warsaw New Connect	Smallsat and system manufacturer and data services	PLN	133.00	264	62
Gomspace	GOMX	Nasdaq FirstNorth Stockholm	Smallsat and system manufacturer and data services	SEK	3.51	220	21
Mynaric	M0YN	Xetra, Nasdaq	Optical inter-satellite communication links	EUR	15.70	82	75
OHB SE	OHB	Xetra	Satellite manufacture and data services	EUR	33.25	576	528

Source: Company reports, Edison Investment Research

in GEO for at least fifteen years. Now it takes six months to build a small satellite, but that still means getting it successfully deployed and creating a business model enables the satellite operator or the data processor to get data or information to people at a price that makes it a profitable proposition.

It's complicated, but the lower cost of entry and the 5-to-6-year lifecycle of small satellites in LEO allows for spiral development of technology. The pace of innovation of microelectronics has spawned sophisticated data sensors and communications systems along with supporting control, navigation, processing power, and propulsion units. These more capable payloads can generate increasing amounts of high-quality actionable data. The advent of LEO constellations has also led to rapid technology developments in solar arrays, batteries, optical satellite links, antennas, and more. It takes 40-70 LEO satellites to provide continuous global coverage and many more to ensure constant connectivity and the consistent deliver of high-quality real-time data.

The sheer number of satellites translates into a crowded market but that stimulates competitiveness which gives the evolution of technology a strong push. These constellations also need to be replenished continuously which means a recurring revenue stream is built into the equation.

WORTH THE WAIT

Typically, investors look about 18 moths into the future, not five years. Right now, many space-related companies are either in an experimental phase or at the very early stages of their business model so not having the revenue and cash flow generation to show sustainability and value has proven to be an issue. But that will unwind over time.

For investors it's just a question of being able to pick and choose what you're going to look at and then apply a comprehensive and rather complex analytical approach to identify the winners.

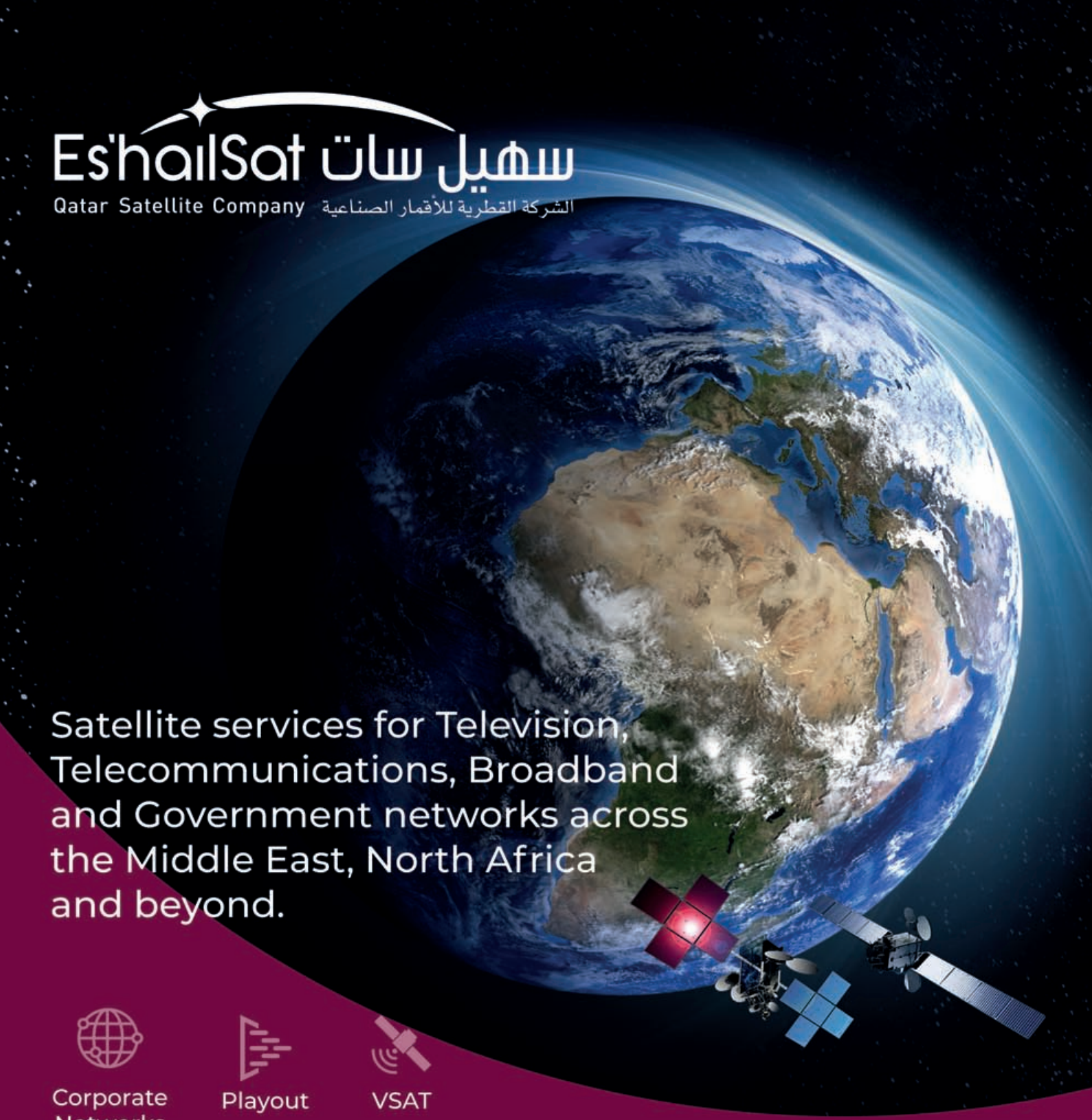
It's important to be certain that the requirement for what a company is doing is actually there. You also need to be certain that the company's management is competent and has the vision to actually deliver sustainability of the business model (See chart: Updated quotes space companies as of close 2/2/23).

Will there be a payoff? Absolutely. The world will rely more and more heavily on the transfer of data and information; on the Internet of Things; on broadband communication; and on Earth observation, not to mention global security.

In a decade or so we are likely to see some enormously interesting ambitions realized like manufacturing in space, in-orbit servicing, space tourism, and even the mining of asteroids.

Es'hailSat سهيل سات

Qatar Satellite Company الشركة القطرية للأقمار الصناعية



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Ken Peterman, Comtech, Chair, President, and CEO

Satellite Evolution Global

Q&A

Delivering the future

Comtech recently entered an exciting new phase in its evolution complete with a fresh logo, a compelling message—Fluent in the Future—and a Renaissance Man at the helm. We sat down with Ken Peterman, Chair, President, and CEO to discuss key initiatives and the creation of EVOKE, an Innovation Foundry that is expected to keep Comtech on the bleeding edge.

Crispin Littlehales, Executive Editor, Satellite Evolution Group

Question: Comtech recently rebranded itself with a new logo and new messaging. Can you elaborate on the company's new emphasis and share some of your key initiatives as CEO?

Ken Peterman: When I took the role of CEO in August, I was really impressed with the enormous potential of both our people and our 50 year history of technology leadership across multiple global market segments. Yet I saw an incredible untapped opportunity for Comtech to collaborate more effectively within our own walls, as well as with our customers and our partners. We have been undergoing a transformational change. As a company, we're embracing our unique culture of innovation. We're improving and expanding on employee empowerment and we're collaborating better with our customers and partners. That, in turn, is improving the speed and agility with which we transform our business practices, policies, and structure.

We're bringing the organization together with common platforms and common tools so that we can operate as one company. By bringing all the pieces of Comtech together we can deliver a more comprehensive value proposition to our customers and solve their challenges in innovative ways.

Chandler Technology Center. Photo courtesy Cushman & Wakefield

Question: Does that mean that customers come to Comtech with their problems and Comtech cobbles together solutions?

Ken Peterman: It's different than that. Let me explain. When I got my first flip phone, I was happy. I had a mobile device, and I was connected most of the time. When the Blackberry came out, I was even more thrilled. I had email and voice in a single device and I couldn't imagine needing anything else. So I didn't know to ask for a smartphone, because I didn't understand the art of the possible from a technology perspective. When I discovered there were apps to download, I couldn't see myself using them. Then, somewhere along the way, there were apps to do online banking, make restaurant reservations, download boarding passes, and navigate directions while driving. I didn't ask for those things as a customer because I didn't know it was in the art of the possible. But the technologists understood my world, understood how I lived, understood my problems to be solved better than I did.

I think when we come together as One Comtech it's not about just listening to our customers, it's about understanding with intimacy the customers' world and life and the challenges they deal with every day. Then we have to put technology to work in an entrepreneurial way and solve the challenge in an innovative way. One way to sum it up is to say, "let's not give the customer what they're asking for, let's give them what they really need."

We must see past the challenge they are trying to solve. When Henry Ford's customers came to him saying that they needed faster horses, Ford's response was not to breed speedier steeds, it was to invent the automobile.

Our tagline, "Fluent in the Future" reinforces our customer centric focus as well as our culture of innovation. We are very strong in the space and satellite communications market. We are very strong in terrestrial wireless networking. We are very strong in location-based services. When we put these capabilities together it allows us to move aggressively along this convergence and deliver the technologies and services that will positively impact lives and connect the world.

Question: Last year Comtech introduced the ELEVATE VSAT platform. How has the platform performed in the market thus far and what are the key areas in which it is being used?

Ken Peterman: ELEVATE is one of the tools in Comtech's toolbox. We launched the product in early 2022. It has attracted a lot of interest primarily because it has extraordinarily high performance relative to the competitors and it is affordable. We've won a number of contracts in a variety of market segments. For instance, we delivered the ELEVATE solution in Latin America to providers of cellular backhaul services as well as to the governments, and we are serving a top utility company in Asia, supporting their requirements for telemetry and video connectivity. We also have established a partnership with a very innovative global LEO satellite constellation operator, and we are working with them to adapt the ELEVATE technology to meet their use case trajectory.

ELEVATE's software-designed architecture is uniquely scalable which makes it readily adaptable to the evolving applications of different operators. It supports network capacity and connectivity in a multiple orbit context—ideal for future hybrid networks. It is designed to operate over LEO, GEO and MEO which is important since the typical user subscriber has multiple apps running at the same time, each requiring something different. For example, if you're gaming, you want low latency, so LEO satellite or terrestrial connectivity work best. Streaming video, though, is better supported through a high-capacity geosynchronous satellite. So, just like there is an embedded decision engine in your cell phone that knows which apps to route over Bluetooth and which to route over Wi-Fi, there needs to be a smart decision engine in your home to select the right traffic routes for gaming, streaming, and all the rest.

Hybrid networks make sense because they support in a blended fashion the diverse use cases that are simultaneously operating at any point in time. Traditionally, those have been separate and distinct market segments but now we are seeing the convergence of devices that

Comtech T350SX post installation. Photo courtesy Comtech ●●●

are connected terrestrially over Bluetooth, Wi-Fi, or cellular also being linked to satellite. As the world moves to the Internet of Things (IoT), Comtech is positioned to anticipate and serve this convergence in a way that most other companies are not.

Question: Tell us a bit about EVOKE and the role that your new technology partner, Sirqul will play.

Ken Peterman: EVOKE is Comtech's Innovation Foundry which is led by the company's Chief Growth Officer, Anirban Chakraborty. It has two purposes. The first is to bring all our indigenous Comtech capabilities together into a common venue so that we can see for ourselves and also show our customers what we are able to create. Secondly, it enables us as we explore how to solve our customers' most difficult challenges.

We are bringing onboard technology partners who augment what we ourselves do. That might be in data processing and data analytics; machine learning (ML) and artificial intelligence (AI); laser communications; blockchain encryption; distributed ledger and security technologies, and more.

Sirqul is a fantastic first partner because they are focused on smart cities and smart operations. Robert Frederick is the founder of Sirqul. He came out of M.I.T.'s Media Center and he was part of the team that invented Bluetooth. He also was part of the Amazon Everywhere initiative. He has been at the forefront of this emerging Internet of Things (IoT) tech sector for the last 20 years. We can work together to bring robust mobile web, IoT, digital twin offerings and other technologies to market globally. Sirqul has an innovative mindset and culture that is a perfect fit with ours. Together we are assimilating innovative minds to internally and externally develop ideas, build successful ventures, and collaborate at a fast pace so that we can lead the way in bringing value to this new era of connectivity.

We will be announcing additional technology partners over the next few months, and I think EVOKE will feed on itself. When you get innovative minds together, they start to imagine the art of the possible and the engineering follows. We are trying to establish the kind of environment where creative energy abounds—a culture of innovation and employee empowerment.

Question: You have an impressive background in the government and defense arena. How does that play into your new role as CEO of Comtech?

Ken Peterman: When I graduated from engineering school, the defense sector was inventing things that had never been done before such as satellite communications, mobile networking, cybersecurity, and global positioning systems (GPS). They were inventing things that had to work in the harshest environments and on the battlefield where you had a sophisticated adversary doing everything in their power to disrupt those capabilities which were put in place to protect our sons and daughters who took on the responsibility to serve our nation. Those capabilities were also there to help them be better informed and make better decisions so that they could perform their missions more effectively.

For the first 20 years of my career, I was part of that invention of the technologies that were born out of the defense sector and during the second 20 years, I watched the private sector embrace these technologies and put them to work in a commercial context.

Mobile by design, and the smallest of Comtech's Family of Troposcatter Systems, Comtech's Compact Over-the-Horizon Transportable Terminal (COMET™) is the world's smallest and lightest modular, man-packable troposcatter system. COMET was developed to provide resilient communications in contested environments addressing a wide range of tactical mission needs. Photo courtesy Comtech ●●●

Although Comtech is a largely commercial company, we also serve the Department of Defense (DoD) because our technology is superior. But we are moving faster than the defense industrial base can move because of the budgeting and acquisition processes. Indeed, the DoD is now better served to work with commercial companies using flexible business models that embrace the speed and trajectory in which these technologies move. Today, the DoD must embrace policies, practices and a culture that is predicated on a process of adoption rather than invention. They need to migrate to an acquisition process that is based on assessing and adopting and doing that in a flexible way so that the provider can upgrade the capability using cloud native technologies, digitization, virtualization, less hardware, and more software.

This approach will enable the DoD to drive those technology improvements in near real time so they can keep pace with the evolving use cases and also stay ahead of evolving threat vectors. That is one reason why Comtech is increasingly serving the defense market with these flexible business models.

Another reason is that our young men and women have grown up in a connected world. Their decision calculus is predicated and depends on cloud connectivity and to take that away from them in a stressful environment is just wrong. Our sons and daughters on the battlefield need to accelerate decision-making using the same kind of access to information that they have at home.

That's another area where the convergence of satellite and terrestrial networks is so important because there are billions of people who are still unconnected. Comtech is on a mission to bridge the digital divide and provide access to data, information, and insight to everyone. When you are connected, you have increased access to healthcare, education, and other critical services. Access to ubiquitous connectivity democratizes almost everything so that everyone in the world is empowered with new tools, and has equal access to the critical services communications technologies provide.

Question: Where do you see Comtech heading in the next five years?

Ken Peterman: Roughly 60 percent of all 911 emergency calls in the United States are handled by one or more Comtech solutions. We already provide location-based services across the globe. Our satellite equipment operates globally as well. And we do business in over 150 countries. In the future, I see us becoming much more sophisticated in the way we apply the tools in our toolbox to solve customers' challenges in ways they cannot imagine. We will not just be giving customers what they ask of us, we will deliver something significantly more powerful—what they really need.

In our culture of innovation, we will thrive in that kind of market. What's more, some of these companies in our EVOKE Innovation Foundry will partner with us over the long term and some may decide that they need to be vertically integrated. There may be merger and acquisition opportunities that stem from that. Through EVOKE, we will improve and accelerate our talent pipeline by partnering with universities and that will inspire students to work for Comtech. All these things will make Comtech a very exciting, vibrant place to work. The culture of innovation is gong to elevate our people to be empowered to imagine and then engineer technology enabled capabilities to change the world. That's the path that we are on. ●

Preventing downtime in an unpredictable climate

We are living in an era of changing weather patterns that are extreme and unpredictable. Pummeling winds, sub-zero freezes, record snowfalls, flash floods, and unrelenting heat have become the norm. Suffering through these meteorological assaults is bad enough, but what if communications go down as well? For the last 43 years, Walton De-Ice has devised an array of solutions to protect ground station antennas, no matter what kind of weather happens.

Ray Powers, Director of Sales and Marketing for Walton De-Ice

In the last few years, we have witnessed an increase in extreme weather patterns around the globe. One study, recently published in the journal, *Science*, has linked Arctic warming to a chain of processes called a stratospheric polar vortex disruption. This, researchers say, is what may be causing the extreme cold in areas like the Midwest, the East Coast, Texas and parts of Asia. Another disturbing weather pattern, noted by the authors of a paper published in the *Journal of Geophysical Research* last September is called "weather whiplash". This term is used to describe abrupt swings in weather conditions from one extreme to another as was exemplified by the 340,000 acre wildfire that was followed by torrential monsoons in New Mexico last summer.

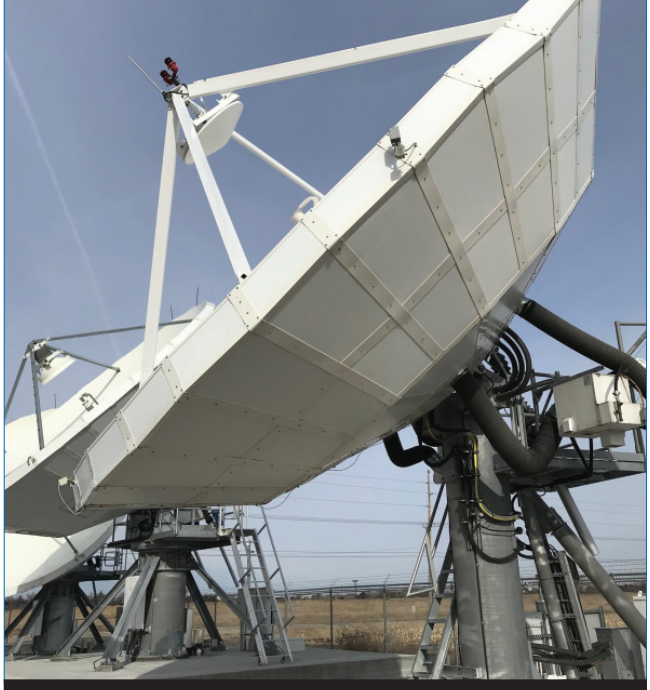

Photo courtesy Walton De-Ice

Startling headlines about the weather seem to be daily fodder regardless of geographic location—tornados, dust clouds, downpours, record-breaking temperatures, and widespread drought. It's clear that these weather patterns can wreak havoc on just about every aspect of our daily lives, including satellite-based communications. What's not so clear is how not to be caught off guard.

AVOIDING DISRUPTION AND DOWNTIME

Most teleports and ground stations are very well thought out, but bad weather can cause physical damage to sub reflectors and feeds. Heavy winds can send projectiles flying into reflectors and terminals. There are all sorts of ways that the elements can cause disruption to service

COST AND ENERGY SAVINGS OF USING THE WALTON ICE QUAKE SYSTEM

Annual Snow & Freezing Rain Fall in Hours	Cents per Kilowatt Hour Commercial Charges	2.4 to 3.0 meter Antennas Full Reflector De-Icing Systems Annual costs shown below		3.2 to 4.2 meter Antennas Full Reflector De-Icing Systems Annual costs shown below		4.3 to 4.8 meter Antennas Full Reflector De-Icing Systems Annual costs shown below		5.0 to 6.3 meter Antennas Full Reflector De-Icing Systems Annual costs shown below	
		Electric Heat 4000 watts	IQ System 45 watts	Electric Heat 6000 watts	IQ System 90 watts	Electric Heat 12000 watts	IQ System 90 watts	Electric Heat 45000 watts	IQ System 200 watts
450	$0.147 7	$265.86	$2.99	$398.79	$5.98	$797.40	$5.98	$2,990.93	$13.29
350	$0.147 7	$206.78	$2.31	$310.17	$4.65	$620.20	$4.65	$2,326.28	$10.34
250	$0.147 7	$147.70	$1.50	$221.55	$3.32	$443.00	$3.32	$1,661.63	$ 7.39
150	$0.147 7	$88.62	$0.90	$132.93	$1.99	$265.80	$1.99	$996.98	$ 4.43
50	$0.147 7	$29.54	$0.30	$44.31	$0.66	$88.60	$0.66	$332.33	$ 1.48

The chart above is for comparison only and the costs may vary depending on location. The chart shows the costs savings of using the Walton Ice Quake System over the conventional electric heater pad or heat tape systems. Shipping, installation, and maintenance would be another cost saving factor when using the Ice Quake System

Photo courtesy Walton De-Ice

and that, ultimately, can lead to financial loss and angry end users.

Down time is not only inconvenient for customers and audiences, but it can also be catastrophic for business. One broadcast company with whom we work has redundant systems and backups. If they lose communications on one antenna, they can simply move to another terminal with just a second or two of interruption. However, if the reflector is not protected from the elements, the presence of ice and snow can disrupt the signal for a significant period of time. For a company that has lots of channels and advertisers, that can cost upwards of US$1.2 million a minute.

There have been some pretty harsh winters in areas that often go a whole season without ice or snow. For example, last year a ground station in Athens, Greece experienced an unusual cold snap that caused a complete loss of communications because ice developed on the reflectors of the antennas, and they weren't prepared for it. Now they are looking at long range protection where they may not need a De-Ice system for two or three years, but these days, you never know. At least with a system in place, they're ready, come what may.

PROTECT AGAINST ANY EXTREME

Walton De-Ice products include passive and heated systems for a wide variety of requirements and antenna systems, from small to large.

The Walton De-Ice Plenum System has a unique hot air enclosure (the plenum) that mounts behind antennas ranging from 3.7 to 32 meters. Unlike electric pad or heat tape anti-ice systems, our offering provides uniform

Photo courtesy Walton De-Ice

surface heating that minimizes distortion losses. There are several options for heating—gas heaters with their economical operation advantages or the low maintenance stainless steel electric heaters. Over the years, we've refined our systems to make them easier to install and operate. In addition to automatic heat and moisture monitoring and control, our systems are field-proven for Ka-band.

With Ka-band, it's imperative that the entire reflector surface maintain an even balance of the temperature of that reflector. Even in mid-summer, there can be issues just from solar reflection. The benefit of having the plenum, even in areas that are not susceptible to snow and ice, is that we can use what is called a temperature balance control inside the plenum that automatically measures the rate of change from one area of the reflector to other areas. If it measures anything from 2 to 15 degrees Fahrenheit the system is activated automatically to circulate that air and balance the temperature so that it is always within a variable of 8 to 10 degrees at any point on the reflector, day or night.

Our Snow Shield Cover is designed for antennas ranging from 0.6 to 6.3 meters in diameter (including Ka-Band). It consists of coated material stretched over the satellite antenna (either the PTFE with a usable life of 20 years, the Kynar® coating, or the Tedlar® coating, both of which will last 10-15 years) which is virtually invisible to RF. What's more, there is no need to remove the covers during warmer months.

Snow Shields can be upgraded with the addition of an electric or gas heater or our Ice Quake, Rain Quake, or Solar Cover systems at a later date. The Ice Quake system enhances the reliability of a passive Snow Shield Cover by enabling the de-icing of a 4.5 meter antenna with only 150 watts of power and a 2.4 meter antenna with only 50 watts of power, thereby greatly reducing costs. (see Chart entitled, "Cost and Energy Savings of Using the Walton Ice Quake System"). The Rain Quake System can also be used with the Snow Shield. This activates during a rainstorm to keep water from sheeting on the reflective surface of the antenna. A Solar Cover system can be added as well to keep the temperature within the cavity the same as the outside temperature.

To keep those using Coms-on-the-Pause (COTP) and Coms-on-the-Move (COTM) one step ahead of bad weather, we created the Walton Portable Radome with optional de-icing. Designed to protect satellite terminals used by military personnel, first responders, vehicular and similar VSAT and smaller Earth station sites, the Radome can withstand all kinds of extreme weather including sandstorms and heavy winds. In very hot climates, it can be cooled using a forced air/HVAC system to protect equipment and prevent damage. Made of RF transparent hydrophobic architectural fabric to maximize protection and minimize antenna G/T reduction, the Radome takes less than one hour to install.

WE'VE GOT YOU COVERED

Turnkey integration, installation, maintenance services and 24/7 tech support are offered for every single system we manufacture. Our highly trained Field Technicians know our products inside and out. Not every customer takes advantage of our technical services. Some have their own on-site personnel and we offer training to those individuals so that they can maintain our equipment properly. There are those cases where customers are trying to save a nickel and maintenance goes by the wayside. Wear and tear takes its toll, but no repairs are made.

This happened not long ago to a broadcast company that handed the upkeep of our systems over to a subcontractor. It was college bowl season and a huge storm hit the area. Ice began to form on the feeds, disrupting the signal. With another storm about to roll in, the customer called us and we rushed in, handled the repairs and prevented further downtime. Of course, the moral of that cautionary tale is let Walton keep you up and running. ●

Plenum enclosure where gas heaters are installed. Photo courtesy Walton De-Ice ●●●

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Michael Nebel, ND SATCOM, Head of Product Management

Satellite Evolution Global

Q&A

Hubless ingenuity – ND Satcom decentralizes connectivity for more agile communications

Since 2000, ND SATCOM has been serving the communications market and has remained an innovative player through its customer-focused approach. As policy direction has continued to shift toward decentralization, hybridization, and frictionless integration, ND Satcom has stayed on the same page. We spoke to Michael Nebel, Head of Product Management about their strategy.

Laurence Russell, Associate Editor, The Satellite Evolution Group

Question: Late last year ND SATCOM announced the release of SKYWAN 5G patch 2.2, powering and protecting VSAT networks.

Michael Nebel: With SKYWAN Release 2.2 ND SATCOM continues its long history of providing secure, resilient, and reliable satellite communications solutions. The highlight is the integration of X.509 certificates - a safeguard against malicious network impersonators as each network node is authenticated by a certificate authority. In addition, SKYWAN R2.2 further enhances services in the Network Management System and makes it easier for operators to use.

The GRE service now provides a holistic method for the setup, with

MFT 1500 Terminal. Photo courtesy ND SATCOM

both endpoints combined into a single view. Furthermore, a bandwidth management extension is giving more control over the committed and maximum information rate (CIR, MIR) per station.

Question: In an era of critical sensitivity to cyberthreat, transmission security has never been a more paramount concern for procurers. How does ND SATCOM approach that capability?

Michael Nebel: Transmission security is certainly becoming more and more important. As SKYWAN has a long history of providing this feature set, it is a perfect fit and an answer to the challenges of cyber security. In addition to communication security through encryption, the most important TRANSEC features are the before mentioned X.509 authentication, non-transmission of metadata such as GPS coordinates of terminals and also traffic obfuscation within the TDMA network.

Question: What contemporary cyber attack tactics have you seen growing in popularity? What defences do you aspire to provide with your technologies that other developers aren't taking seriously enough?

Michael Nebel: Apart from TRANSEC, we see a major advantage in the ability to operate SKYWAN as a fully meshed network without the need for a gateway or a hub. On the one hand, this makes the network resilient against any problems or outages of the central infrastructure. On the other hand, it makes it very hard to intercept, as no hub-based outbound signal is used – but only proprietary waveforms in its mesh TDMA carriers.

Coming back to your question – in addition to protecting our clients against interception, we of course put lots of effort into securing the network against cyberattacks. This, for example, means following strict rules in how to develop secure software. As you know, recent incidents show that secure firmware is a key asset to ensure that the network is resistant to malware attacks.

SKYWAN implements a highly secure management plan and again, X.509 certificates prevent the network from being intruded upon by subjects not entitled to do so. We are convinced that this combination of TRANSEC measures, encryption, intelligent mesh topology and high-class software is unique in the market and brings additional value to our customers.

Question: In September 2022, you received a follow-up order delivering manpacks for the Polish MoD. What made you their developer of choice?

Michael Nebel: Together with our Polish partner company GISS, we have been a supplier for the Polish Ministry of Defence MoD for many years. The manpacks from GISS are robust and very powerful, but at the same time, very lightweight and easy to set up. They are perfect for fast deployment in rapidly developing situations. For this, SKYWAN is the perfect match as it provides reliable broadband connectivity without depending on terrestrial infrastructure – using a full-meshed hubless approach. This unique solution is what often convinces our customers to choose us.

Question: In 2022 You also presented a new solution Airborne Satcom system, a product for helicopter communications that addresses rotor blade impedance. How has the product performed, and how do you think it will perform in 2023?

Michael Nebel: Together with a partner, we have developed a SATCOM solution for helicopters that

SKYWAN the new dimension in airborne satellite communication. Photo courtesy ND SATCOM

combines the advantages of SKYWAN with easy installation and calibration in the helicopter. For example, the solution is compatible with any kind of helicopter from any vendor. Unlike other solutions on the market, we provide broadband connectivity with up to 10 MBit/s from the helicopter to the ground without the need for a second antenna or complicated calibration.

In 2022, we reached a milestone by successfully demonstrating the solution to customers in the field. This year, the focus will be on integration and certification in a customer helicopter. The timeline for this product is certainly long, but we follow the path step-by-step.

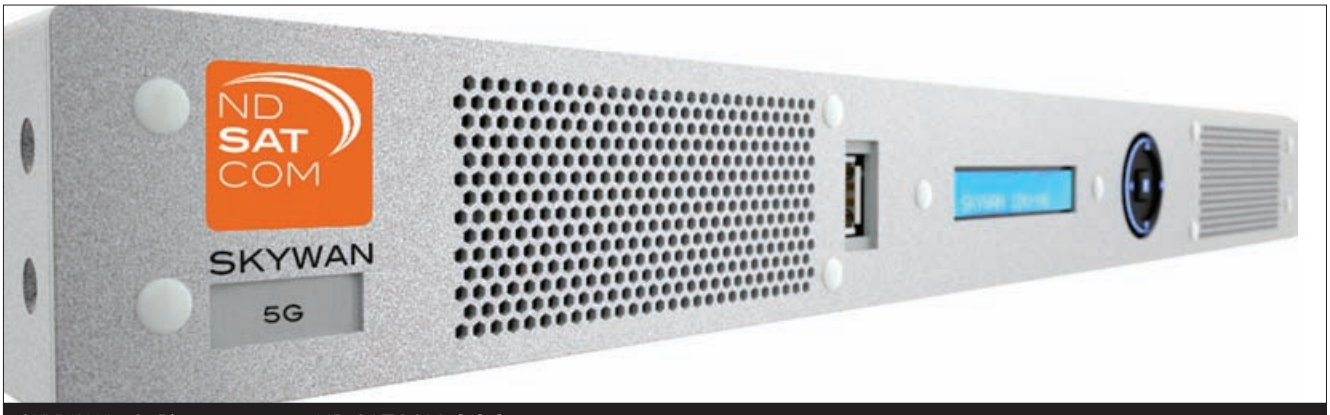
Question: The New Ground movement is a line of thought aspiring to the acceleration of technological sophistication to the standard of the high-value NewSpace industry. What strategic investments and breakthroughs do you think would rapidly evolve the ground segment?

Michael Nebel: We see two major trends that will disrupt the ground segment in the future: terrestrial 5G/6G communications will increasingly converge with satellite communications – it will become a part of one composite communications infrastructure. Second, the vision of multi-orbit communications, including MEO and LEO, will become a reality very soon. Both trends bring lots of new opportunities as well as challenges. In addition to IP-based communications over all physical media, moving a big portion of today's signal processing to a cloud-based infrastructure is certain to be a technological breakthrough that will transform the ground segment to a big extent.

Question: As a veteran developer of ground station equipment, what are your long-term goals in the industry? What problems do you hope to solve in the years ahead?

Michael Nebel: In contrast to most ground equipment providers, we build our infrastructure using a hubless approach. This means that the hub itself does not possess the same importance as it does for others. That is doubtless one reason why a cloud-based approach is not our first priority.

In the coming years, we will focus on strengthening our portfolio, especially for our customers in the government and defence market. In this increasingly complex and unsafe world, relying on a resilient and secure infrastructure is becoming more and more important. In addition, we will of course adapt to the upcoming MEO and LEO opportunities and include the necessary technology in our products.



SKYWAN 5G. Photo courtesy ND SATCOM

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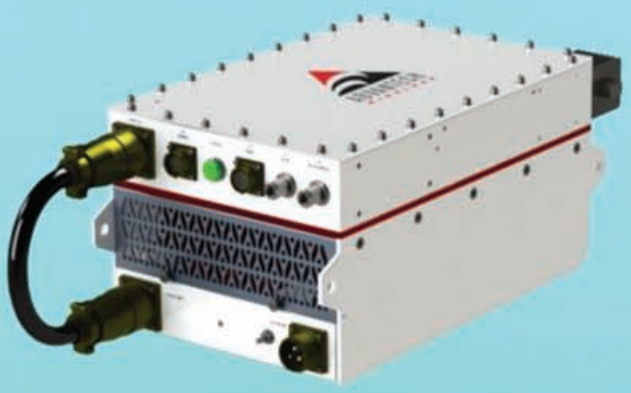
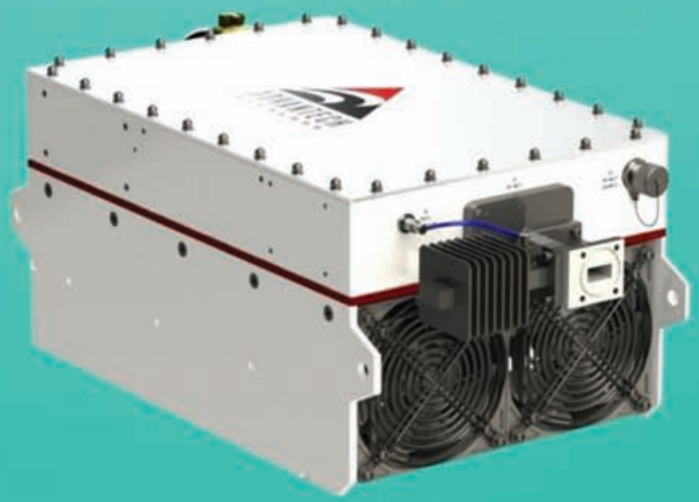


Introducing ***GENESIS*** - the new series of Ku-band SSPAs and BUCs from Advantech Wireless Technologies.

GENESIS epitomizes the latest in hardware and software technologies, making it the most feature-rich satcom SSPA in the industry. Initially available in 200W, and 250W variants, GENESIS delivers a host of high-end features, including some that are unique to the ***GENESIS*** family:

· Secure SNMPv3 interface
· Modular construction – fast production & simple serviceability
· Full M&C capability with embedded Webserver
· Field-removable power supply and fans
· Forward and reflected power monitoring & true RMS power detection
· Device-level monitoring for detailed fault analysis and diagnostics
· Embedded logic to manage multi-amplifier redundant and phase-combined systems, negating the need for any external controllers.

Additional frequency bands and higher power levels based on the ***GENESIS*** platform will become available in the coming months.



The success of satcom's redefinition lies in the ground segment

The satellite industry is evolving within a wider telecoms ecosystem that is advancing at a rapid pace. Applications across every industry and end users globally are demanding more as technology advances and networks become more capable.

Frederik Simoens, CTO at ST Engineering iDirect

Satellite was once treated as a network option for the last mile in cases where terrestrial networks were too expensive or physically not feasible. The industry has come a long way and satellite is on the cusp of establishing itself as a more than capable alternative or complementary technology to terrestrial.

To take this leap, two ecosystems and their transformations need to be acknowledged. As an industry, we need to understand the changes that are occurring with respect to 5G and NewSpace to accelerate and facilitate a successful transition and to ensure that satellite takes its place as an integral part of the new connectivity landscape.

CRITICAL ENABLERS: VIRTUALIZATION, ORCHESTRATION, AND STANDARDIZATION

NewSpace, specifically, is the evolution from GEO satellites to a hybrid mix of GEO, LEO and MEO orbits. This shift means the development of constellations of small satellites that are software defined and dynamic, offering new possibilities and greater flexibility.

At the same time, the telco industry also is adopting critical advances in virtualization and cloudification to improve the speed, scale, cost, and flexibility of service delivery. It's crucial that the satellite industry acknowledges and understands the implications of these changes and the importance of embracing them in the context of unlocking the potential of NewSpace.

Virtualization and the cloud can reduce the operational complexities, make integration easier, and empower satellite networks with the ability to deal with increasing demands from end users by providing scalability and flexibility. In order to shift the infrastructure to the cloud, the ground segment needs to embrace virtualization and standardization technologies to move satcom processes away from the hardware dependencies to better integrate with the terrestrial 5G networks. The cloudification of the ground network will add degrees of flexibility so that it can scale up and down, just like the satellites, and have the capability to move bandwidth around as required.

Frederik Simoens, CTO at ST Engineering iDirect

That network must then be able to integrate with the overall ecosystem, end-to-end. The use of standards will allow service providers to integrate satellite communication systems into an existing terrestrial environment that can be easily managed as one, further aligning the operations. This will come through adoption of the same telco 3GPP and MEF standards and utilizing service orchestration standards. Orchestration, and embracing Artificial Intelligence (AI) and Machine Learning (ML), can help networks automate functions and tasks for complex enterprise networks. Networking and orchestration technologies need to work in unison across multi-orbit satellite, terrestrial and mobile networks to enable a truly seamless service offering. Orchestration can achieve exactly that as it matches software-defined satellite constellations with software-defined networks.

Thanks to seamless integration alongside terrestrial networks, satellite can play a more prominent role in hybrid networks and address additional use cases which translates to new revenue streams and business growth.

COLLABORATION AND PARTNERSHIPS WILL BE KEY

This new connectivity landscape, the network of the future, will not be achieved without collaboration within and outside of the satellite industry itself. Involvement with industry standards groups to ensure that new technological concepts and developments align and that each are educated on the nuances of the different environments is an important step that should not be underestimated.

The New Ground initiative serves to highlight the key role that the ground segment will play in the industry transformation. This will only be achieved though unique ideas, transformative technologies and impactful industry collaboration. This is far bigger than any one company and will take dedication and participation between the satellite industry, Telco entities, and terrestrial standards organizations such as 5G MAG, MEF, and 3GPP to make it happen. Securing a place at the table with these groups is essential to drive home the importance of satellite in future connectivity networks.

Converging Ecosystems. Photo courtesy ST Engineering iDirect

Over the last few years several consortiums have formed with the aim of validating satellite's integration into a 5G core network such as Sat5G, Satis5 and Osmosis. ST Engineering iDirect has been working with these consortia and participating directly in the 3GPP standards initiative ensuring that, as our industry adopts the standards defined by 5G, it is optimized for satellite communications.

TECHNOLOGY MILESTONES

As previously mentioned, the critical first step to the integration of satellite technology into the new connectivity landscape lies in the virtualization of hardware, something that is currently being embraced at ST Engineering iDirect. We are shifting from ground segment-based hub hardware towards infrastructure virtualization and the cloud to ultimately allow our customers to scale faster without the need for additional cap-ex investments.

We have entered into a partnership with Microsoft Azure Space to develop virtualized modem capabilities and have been working towards the first phase in the development of a virtualized modem that can be deployed on a Microsoft Azure-based cloud solution. A successful demonstration of the demodulation of an iDirect virtualized high-speed modem running as software on a server located in the Azure Cloud has already been achieved. Now, instead of satellite communications relying on physical hardware stored at the ground level, it can utilize software that is stored in the cloud to transmit data.

The satellite industry can work in unison with cloud Service Providers and embrace virtualization technologies to carry out the modulation and processing of the satcom infrastructure. Steps to achieve that include the abstraction of the software functionality from the hardware and the adoption of standardized interfaces for easier interoperability of virtualized components in the cloud.

To that end we jointly started an open collaboration with ecosystem partners through the Digital IF Interoperability Consortium (DIFI) to define the Digitized Interface between modulator/ demodulator, modem, and RF components as a standard. Here, we have played a major role within the consortium which comprises ground segment players seeking to establish an open standard for the SATCOM industry. The consortium made good progress in 2022 and released an updated version of its interoperability standard in August. This improved the maturity of the specification and was part of the group's goals for 2022 after it released version 1.0 last year. In 2023, it will continue to seek further adoption and incremental improvement of the standard.

In 2022 we already showcased the adoption of the DIFI standard in a virtualized SCPC modem in the Microsoft Azure Cloud. In this demonstration we showed how our virtualized modem used a digital IF interface instead of the analog L-Band interface. In 2023 we are demonstrating the ability to incorporate the DIFI standard into our baseband technology connecting our modem and hub baseband with the RF equipment.

Digitizing the interface between modem and RF components using the new open standard, allows us to leverage the latest virtualization, cloud computing and network function virtualization technologies as well as greatly improve the performance and scale of satellite hub, gateway, and modem equipment.

FOR THE BETTERMENT OF THE OVERALL CONNECTIVITY LANDSCAPE

It's clear that the pace of innovation in space and on the ground will need to work in parallel. This is not only for the benefit of the satellite industry, but also for the betterment of the overall connectivity landscape. Satellite has unique qualities that mean it can accelerate the availability of quality networks to users with the help of virtualization, standards and cloudification.

As ground segment providers, we have to play the role of unifiers – the ones who will enable the changes that we are seeing in space and with the advent of 5G. This change is not going to happen overnight and will require the innovation, collaboration, and work of the whole industry. But we are on the path to transformation, driving this change for our customers to enable agile, flexible connectivity anywhere.

Kevin Steen, CEO of OneWeb Technologies

Satellite Evolution Global

Q&A

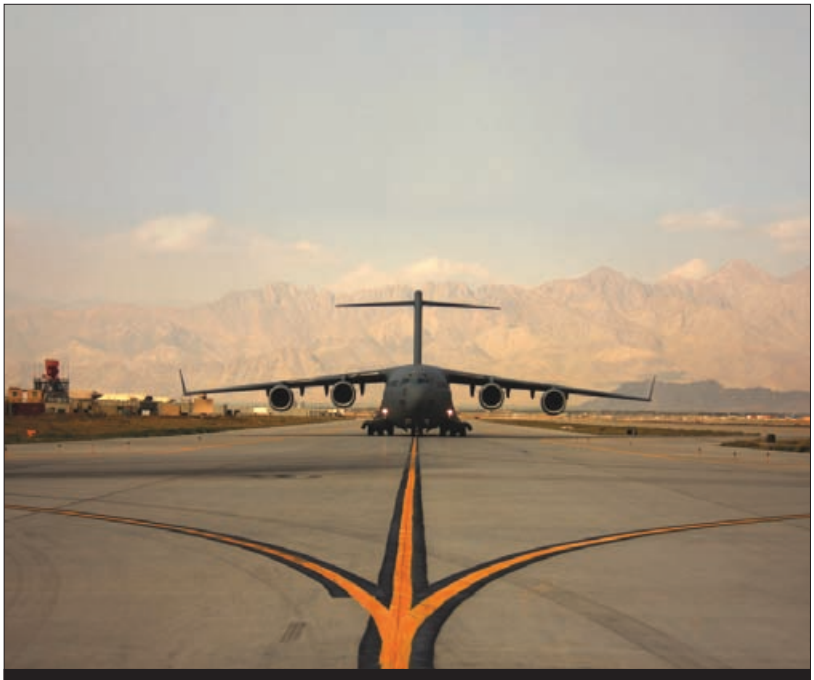
Cementing LEO agility for government customers in North America

Satellite operators run a truly global business case, which demands a plurality that some businesses find tricky. The growing LEO empire of OneWeb requires disseminated expertise around the world, which is where regional proxies like OneWeb Technologies (formerly TrustComm), come in. As the United States branch, it's up to OneWeb Technologies to forge a path forward for LEO in North America, where the market boom began and soon saturated. We spoke to Kevin Steen, CEO of OneWeb Technologies to hear their strategy going forward.

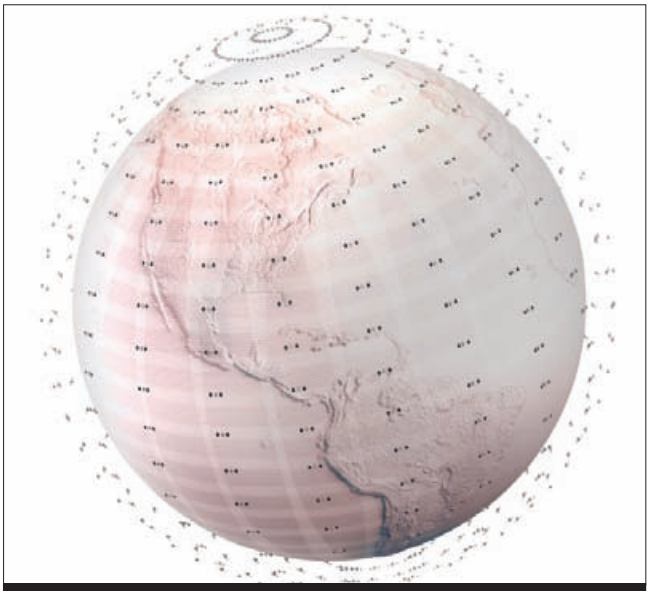
Laurence Russell, Associate Editor, Satellite Evolution Group

Question: In 2022, you became the CEO of OneWeb Technologies, the US proxy of OneWeb where you have been setting the strategic direction of the company. What will be your area of focus in 2023, and what objectives have been set aside?

Kevin Steen: Correct, I'm still very excited about the promise and all the opportunity that OneWeb Technologies offers to create a real impact on the world - particularly when you think about the LEO technology with which we are working and the greater societal benefits it can bring.



OneWeb Technologies offers high-speed, low latency, secure, multi-orbit, satellite network solutions. Photo courtesy OneWeb Technologies



Parent company OneWeb's LEO system of 648 satellites. Photo courtesy OneWeb Technologies ●●●

As the US proxy company of OneWeb, our LEO approach allows us to do some amazing things for our customer base, including connecting the unconnected and improving telemedicine at the corporate level. At OneWeb Technologies we will provide solutions that can help keep our troops safe, keep them connected with loved ones, and enable valuable communications in times of emergency by connecting those providing disaster relief, shelter, or food.

In 2023 and beyond, you will start to see OneWeb Technologies leverage the expanded OneWeb global footprint and global service once it launches with capabilities that are targeted for US government needs. We will continue our investment in expanding our secure interconnects for the US government, collaborating on unique solutions tailored to meet those unique requirements.

As OneWeb's next-generation constellation roadmap becomes more refined, you will see OneWeb Technologies introduce incredible new solutions and offerings to support the strategy and mission of our customers, be it different branches of the US government agencies, military, or federally and state-funded programs.

Question: As the company's US presence, OneWeb Technologies stands face-to-face with SpaceX's Starlink US military offering, as well as the traditionally poor connectivity of middle America and Alaska. How will OneWeb target these demographics?

Kevin Steen: OneWeb's network and OneWeb Technologies' approach to meeting defense needs is to offer committed data rates, guaranteed service, and user terminal equipment specifically tailored to the intended use. We also offer "cradle-to-grave" support that relies upon a hand-in-glove bond with our clients.

Granted, there is a need for least-common-denominator commodity service, especially in the domain of rural connectivity solutions that overlap with cellular network rollout. However, we are committed to the idea that the exceptional demands of defense, security, and emergency response require dedicated and allocated bandwidth for all elements, tailored solutions, and the exceptional service offering that OneWeb Technologies is positioned to provide.

Question: In recent months, OneWeb Technologies has seen success on contracts with the US Government as well as defense partners. What made you the best choice for such mission-critical procurers?

Kevin Steen: For starters, OneWeb Technologies' focus is 100 percent on the government market and supporting our partners. The investments we are making to advance our LEO technologies will benefit governments greatly, providing them access to secure, robust, and resilient new connectivity capabilities faster than they can do themselves.

Government and commercial collaboration are certainly not new in the satellite industry, but it is clear that OneWeb Technologies makes offering these solutions in a secure and trusted manner a matter of priority. We view ourselves as a partner of the government and are invested in making their objectives ours.

We're also looking at ways to offer hybrid satellite services (GEO and LEO) so that our customers can benefit from the best of both worlds. This makes OneWeb Technologies highly attractive for mission-critical applications, be it for connecting warfighters, or enabling broadband and IoT connectivity to manned and unmanned platforms.

Question: OneWeb Technologies says it can provide secure and discreet communications over satellite with a strong promise of continuity of service. What technologies and solutions unlock these capabilities?

Kevin Steen: OneWeb Technologies evaluates the unique requirements of our customers and, when coupled with the capabilities of our LEO constellation, builds them a solution that fits their needs by integrating the technologies of our partners. We consult with our customers regarding their specific needs, beyond purely communications, but also operational and support expectations.

We also look to support a broad range of wireless and satellite communication applications, which are adaptable to our customer's unique requirements. Often a requirement is "discreet communications" so that the warfighter, for example, can be assured connectivity wherever they may be. Underpinning our ability to deliver customer-focused solutions, OneWeb Technologies deploys a secure access network that meets the ever-increasing demands of the US government for resilience/redundancy and cyber defense and is committed to delivering a CMMC/IA-Pre compliant capability.

Question: How has the US military's approach to leveraging satellite communications changed in recent times?

Kevin Steen: Government demand for satellite broadband continues to increase as satellite communications become an even more critical element of the US military's strategy. The type of satcom needed by the US military is also changing; it is shifting to more robust, resilient, and lower latency systems to support autonomy and faster decision cycles.

Government demand for satellite broadband is global, including the polar regions since contingencies and natural disasters occur globally. OneWeb and OneWeb

OneWeb Technologies focus is on the US government and the Five Eyes (FVYS) . Photo courtesy OneWeb Technologies

Technologies are responding with a global coverage LEO system that is secure and incorporates government requirements. Our offerings are responsive to specific individual government needs and all the way to fully managed "turnkey" services. This is an exciting time for OneWeb and OneWeb Technologies as our LEO satellite constellation becomes fully operational by the end of this year.

Question: Across OneWeb, you support "responsible space", an interest in bringing a standard of Ethical, Social, and corporate Governance (ESG) to the NewSpace industry, a business direction infamously mocked by Elon Musk, could you explain how responsible space translates to policy at OneWeb Technologies?

Kevin Steen: Our parent company's approach towards ESG was one of many things that attracted me to OneWeb Technologies. Besides internal initiatives with an environmentally friendly focus, OneWeb is implementing programs and executing plans directly related to Sustainable Space. Space debris mitigation and debris remediation - not generating more debris and cleaning up large, derelict objects already circling the globe - are central to the space environment management (SEM) task ahead, and key in collision avoidance (which translates to less debris), deorbiting, and passivation plans.

I have always believed that the best companies are those that run with a mindset of working with integrity, building trust, and utilizing technology in a responsible manner. This approach is not only applied to space assets but also to the entire corporate and operational infrastructure, which also translates to OneWeb Technologies.

Global space-based communications are important to our everyday way of life here on Earth, and we view practicing "responsible space" as an essential part of our strategy. We see space as a natural resource that should be protected for generations to come.

Question: What can we expect from OneWeb Technologies in the years ahead?

Kevin Steen: The beauty of the industry is that there are always opportunities to solve problems, and OneWeb Technologies will be ready to help solve them. We will see continued adoption of LEO capacity in addition to hybrid networks, where terrestrial networks combine with satellite-based networks.

In the years ahead, I predict an application boom as new technologies on our network become available and are combined with applications and technologies that have historically been restricted to the terrestrial domain. Capabilities that have only worked in terrestrial networks will now be available to satellite networks. This will unlock new use cases to improve productivity and enhance our lives as individuals and as communities. We're going to see incredible adoption for applications that we might not even predict now as the coverage and capabilities expand. It's a truly exciting time, and I am so excited to be a part of it.

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Andrew Bond, ETL Systems, Sales & Marketing Director

Satellite Evolution Global

Q&A

Growth at home and at large

As a standout veteran provider of the industry, ETL Systems has seen the industry grow and evolve over decades of innovation and economic tumult. Following the opening of a new production facility in the UK, the company aims to retain the pole position for the development of the next era in reliable mission-critical communications. We spoke to Andrew Bond, Sales & Marketing Director about the reasons behind their recent moves, and how they plan to forge forward.

Laurence Russell, Associate Editor, Satellite Evolution Group

Question: Late last year you announced the opening of a NEW multi-million-pound production facility in Herefordshire off the back of strong growth. Could you summarize the thinking that led to that investment?
Andrew Bond: As you may know ETL Systems has been at the forefront of RF design and manufacturing for over 35 years. ETL designs and builds essential elements of critical satellite communications infrastructure. The company's culture of innovation and its solutioneering approach have made it a market leader in the field, with revenue growing 30x since the mantle of leadership was taken up by Ian Hilditch and Dr Esen Bayar in 2003.

In 2019, ETL expanded its range to include instrumentation and measurement equipment for the set-up and testing of RF chains through its acquisition of Atlantic Microwave, a British company with over 20 years of heritage in RF and microwave engineering. Today, the company offers a full suite of solutions between the antenna and the modem for both the uplink and downlink chains.

In 2020, ETL Systems received significant investment from CBPE

ETL Harrier 128x128 RF Switch Matrix. Photo courtesy ETL Systems

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ETL Systems' new C4 production building. Photo courtesy ETL Systems

Capital, enabling the management team to drive its ambitious growth plan forward. This ambition saw the company achieve a continued growth trajectory, even during the Covid-19 pandemic disruption.

The new facility is the fifth building to be constructed at ETL's Herefordshire headquarters and is outfitted with the latest manufacturing technology to support and drive the next stage of the company's development.

Question: You're planning to launch your newest product, Digital IF (Intermediate Frequency), which saw its first orders as early as September, at Satellite 2023 in Washington D.C. Which markets and demographics do you expect the product to address?

Andrew Bond: ETL expects the first adopters to be defence and government customers across the industrialized nations. This is driven partly by the operational flexibility and continuity of operations that are required for mission success, and partly by practicality; most commercial entities don't have the same level of resourcing available as state-run organizations and - as with all new technologies - the initial integrations are likely to be resource heavy.

Question: Last year you joined DIFI to enable hardware standardization in the industry. With so many incompatible proprietary solutions in the market, what are the best ways to ensure an effective standard?

Andrew Bond: The DIFI organization now has more than 50 members from across the industry. The key is cooperation. It is a trend that's been growing in the space-tech side of the industry, between satellite manufacturers and launch companies, or between satcoms providers and MNOs for example.

We need to bring that same level of discussion, consolidation, and consideration into the ground segment to enable those same conversations.

That's one of the reasons the DIFI Working Group was formed – to bring all parties involved including commercial bodies, governments, and manufacturers, to one table to open the channels of communication. Since its creation 2 years ago, DIFI has already released the v1.1 of the IEEE-ISTO 2900-2021 inter-operability standard and is working on v1.2.

Question: The policy direction of NATO defence procurement has been increasingly favouring sophisticated digitized communications which integrate across domains effectively. How has that influenced ETL's development priorities?

Andrew Bond: This is not just a NATO, or even a satcoms phenomenon – the world is changing, and digital technology is undeniably the next stage of its evolution. One of ETL's hallmarks is its ability and willingness to innovate, so tackling the challenge of integrating digital technology into the ground segment was too much temptation to ignore! Advances in ADC/DAC/FPGA chip technology have now made this development possible, and as always, we are keen to be trailblazers in the industry.

Several major satellite operators and modem manufacturers are now working with the world's leading cloud service providers to move towards the virtualized ground segment. Eventually, this will be realized. As an example, the ground segment of the future will include virtualized digital modems and waveforms that can be easily spun up or down in the virtual world. The interface between the analogue world of old and the digital world of the future is, of course, digital IF.

The challenge is in how that integration is going to happen – there are hundreds of thousands of dollars' worth of analogue RF equipment already in place in ground stations around the world, and for both commercial and operational reasons, that technology is not going to be replaced overnight.

As a longstanding leader in the design and manufacture of RF equipment for the ground segment, we were well situated to explore and realize this challenge, and we are working alongside the European Space Agency to do so.

Question: What can we expect from ETL in the years ahead?

Andrew Bond: With the arrival of Kevin Dunne, our new CEO in 2023, ETL's RF manufacturing focus will continue to be about developing our portfolio to meet the changing needs of the modern satellite world. Whether that is responding to the new LEO satellite constellations by providing fast switching ground station equipment or moving into the Digital IF domain, ETL will always innovate and adapt when delivering reliable RF signals.

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RF technology specialist increases its frontline business development team

To continue its growth into the space and defence industries, RF-to-mmWave designer and manufacturer Filtronic has expanded its team of business development experts. The company has appointed Mark Whetton and Keith Scivier as business development directors to support its offering in existing sectors and increase capability for upcoming projects in 2023 and beyond.

Filtronic has a rich history of innovation and a 45-year track record of designing and manufacturing high-performance, customised solutions for complex sectors such as telecommunications infrastructure, aerospace and defence, space, test & measurement, and critical communications.

During his career, Whetton has occupied principal roles in the aerospace and defence sector and boasts credentials from companies such as Teledyne, e2v and BAE Systems, where he started his career. Scivier possesses a broad international military and civil aircraft background, with experience ranging from sales manager at BAE Systems to interim CEO of Ultra Electronics Chinese Joint Venture. In their new roles, Whetton and Scivier will be responsible for key programmes within the aerospace and defence, and space sectors, as the company looks to grow its market share within these dynamic growth sectors.

"Filtronic is going through a decisive expansion into new technologies and industries," said Whetton. "Our experience within aerospace and defence primes, combined with our understanding of RF technologies and the various routes to market puts us in a great position to showcase Filtronic's extensive capabilities to customers old and new."

"We expect to drive growth and attract new quality customers," added Scivier. "In the past year, Filtronic has opened a new design centre in Manchester to support the existing sites in Sedgefield and Leeds, strengthening our engineering technical capacity. With Filtronic's continued investment in innovative UK manufacturing capabilities, we are looking forward to exploring and building new relationships with defence and space primes."

Walter Magiera, Chief Commercial Officer of Filtronic added, "Over the past year we've invested in the workforce, which has been pivotal in maintaining our leadership in RF and microwave technology that is designed, made, and delivered in the UK. Mark and Keith's vast expertise will reinforce Filtronic's position, driving growth and creating strong relationships with new and existing key strategic clients."

The company has appointed Mark Whetton and Keith Scivier as Business Development Directors

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Intelsat appoints Gaurav Kharod as the Regional Vice President of Asia Pacific

Intelsat, operator of one of the world's largest integrated satellite and terrestrial networks and leading provider of inflight connectivity (IFC), has announced the appointment of Gaurav Kharod as the regional vice president for its Asia Pacific (APAC) region. Kharod comes from Intelsat's India office, where he served as the managing sales director of South Asia and India.

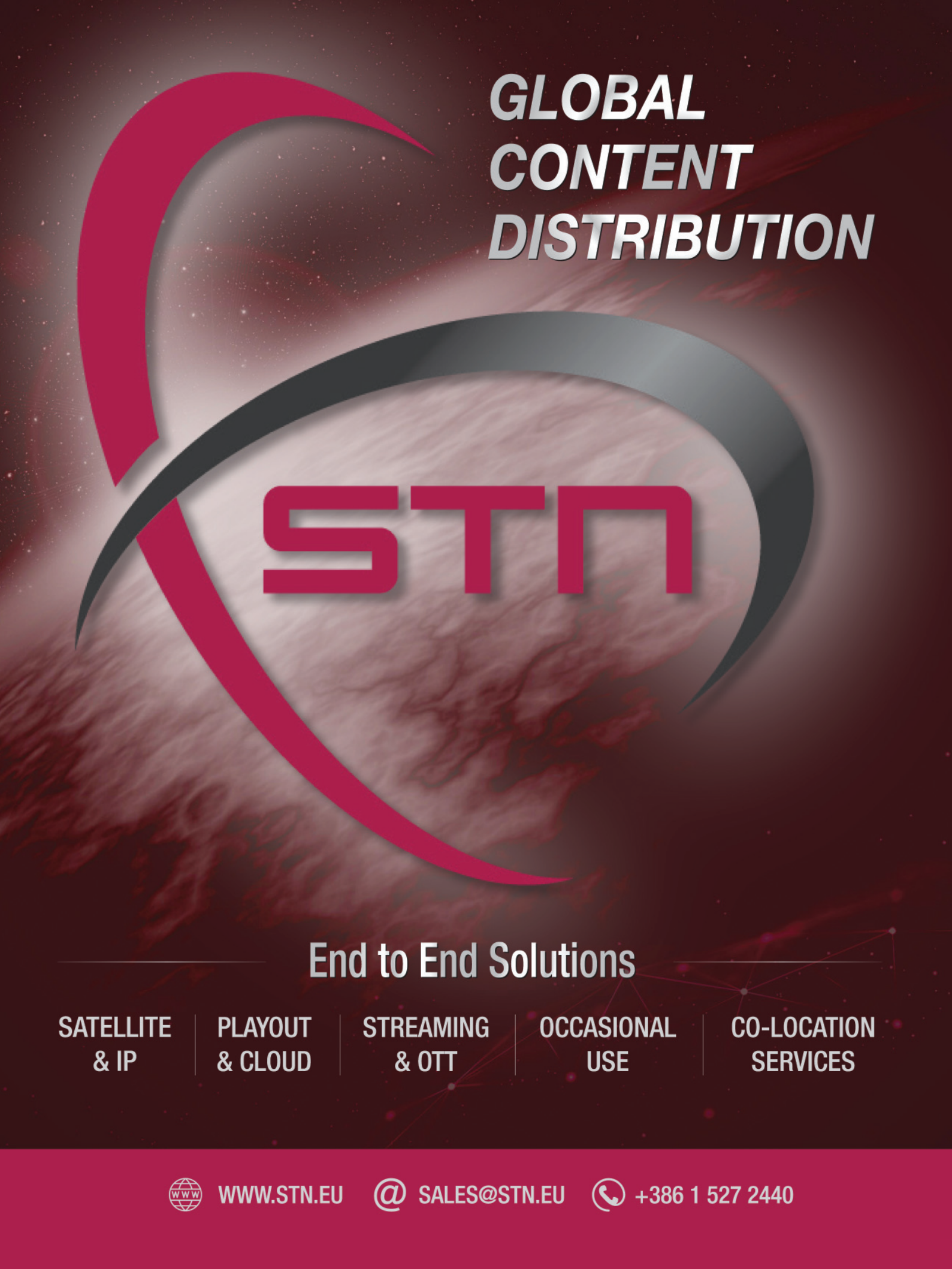
Kharod will assume the responsibilities from Terry Bleakley, who previously led the APAC team. Bleakley will transition on April 1 to a part-time senior advisory role at Intelsat and will continue to support key growth opportunities in the region.

"Intelsat is on an ambitious growth trajectory in the APAC market, and Gaurav brings with him the expertise that will help us achieve these goals," said Senior Vice President, Global Sales, Network and Media, Jean-Philippe Gillet. "I look forward to achieving many milestones under Gaurav's leadership in the region."

In Kharod's last assignment, he led the Media business sales team, driving the organization's strategy in the region. Kharod also implemented a successful entry strategy for Intelsat's high throughput satellite (HTS) IS-33e in the Indian market. This created a roadmap for the growth of all the different business verticals of Intelsat, including Media, Networks, FlexMaritime, and Commercial Aviation, to be fully represented in the Indian and South Asia markets.

Before joining Intelsat, Kharod held leadership roles at Hughes India and Viasat Inc. in the satellite domain, along with a stint at Conax AS in the media industry. He brings a mix of expertise across sales, product management, business development, regulatory and policy affairs.

Kharod holds an MBA and a bachelor's degree in electronics engineering as part of his college education in Gujarat, India.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