SATELLITE EVOLUTION

March 2024
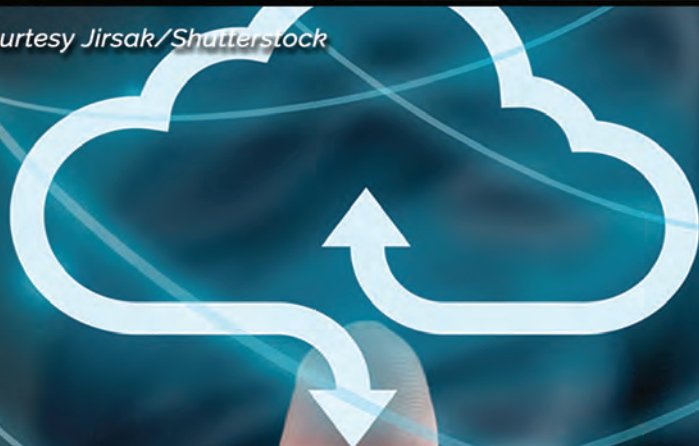
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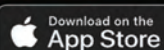
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Future-proofing the ground segment

Plus:

- Why laser is the future of defense communication
- Exploring the vital contribution of satellite IoT to environmental sustainability
- A global resurgence of HF communications

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Q&A ST Engineering iDirect - page 20...

Navigating to 5G NTN - page 28...

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Groundswell

If you go online and search for market reports on the global satellite ground station segment, you'll find several. One will say the satellite ground station market is projected to grow from US$61.5 billion in 2023 to US$115.4 billion by 2028, at a CAGR of 13.4 percent. Another will characterize the market size at US$58.70 billion in 2022 expected to reach US$178.94 billion by 2032, at a CAGR of 11.9 percent. Still another locks those numbers in as US$53.98 billion in 2022 growing to US$109.77 billion by 2032, at a CAGR of 7.3 percent while a fourth says the market was valued at US$143.9 billion in 2022 and is expected to generate US$213.8 billion by 2032, at a CAGR of 4.5 percent.

Crispin Littlehales, Executive Editor ●●●

Needless to say, each of these reports captures a somewhat different snapshot of the industry, citing a list of players that changes slightly from one report to the next along with a varied list of essential products. Market drivers, challenges, and expectations differ as well. Wading through all the discrepancies, I came up with two conclusions: this segment of our industry is destined to change dramatically and grow in value over the next decade. The who, what, where, and why is not entirely clear because these report writers are not on the front lines, and they are not intimately involved in the day-to-day workings of satellites or ground stations.

Even those of us who are actively involved in charting the future of the ground segment cannot accurately predict every nuance of what lies ahead. The connected world that we seek is dynamic and the road ahead will require a great deal of collaboration, cooperation, and partnering. Recognizing this, Satellite Evolution Group, along with TalkSatellite, is launching the first ever Strategies in Satellite Ground Segment Conference to be held on the 4th and 5th of September in London at the Park Plaza London Riverbank Hotel. With a focus on fostering collaboration and knowledge exchange, this intimate gathering will offer an opportunity to gain insights from leading experts and explore innovative solutions that are shaping the future of connectivity and bandwidth.

The way forward for the ground segment will doubtless be challenging. Standards must be set and adopted. Novel technologies must be created and utilized, and we will all need to work together to make it happen. We are at a vital inflection point and it would be wise to remember the words of the late martial arts master, Bruce Lee: "Knowing is not enough, we must apply. Willing is not enough, we must do."

In this month's issue of Satellite Evolution Global, we go deep with Ken Peterman, Comtech's President and CEO, who tells us all about the company's dramatic transformational journey and the positive effect it has had on new business development. We also sit down with Don Claussen, ST Engineering iDirect's CEO to discuss the company's efforts to revolutionize the ground segment and deliver a virtualized cloud-based network, based on standards. Greg Quiggle, Senior Vice President of Space Product Management at Kratos, writes about future-proofing the ground segment for an evolving future and Gilat's Gil Elizov, Vice President of Products, shows us how to navigate a smooth transition to 5G NTN. On the military side, Jean Francois Morizur, co-founder and CEO of Cailabs shares his thoughts on why laser is the future of defense communications and Dr. Misho Tkalcevic, CTO of TCI informs us about a global resurgence of HF communications to support national security. Finally, Alistair MacLeod, CEO of Ground Control, explores the vital contribution of Satellite IoT to environmental sustainability.

I want to take a moment to recognize Jill (Durfee) Alesi, who will be leaving us after four years of unrelenting effort and wonderful camaraderie. Jill has been in the often-grueling publishing business for three decades and is taking a well-deserved break to recharge her batteries. We will miss her vibrant wit, her winning smile, and her nurturing personality. We wish her a restorative sabbatical and hope to see her back in the fall.

Photo courtesy Shutterstock

Regulars

Features & Market Reports

Executive Q&A

Eutelsat OneWeb launches 'Land Mobility' connectivity services

EUROPE: Eutelsat Group has confirmed the launch of Eutelsat OneWeb's low Earth orbit (LEO) mobility services, bringing high-speed communications 'on the move' into reality for land-based customers.

The launch of Land Mobility services enables Eutelsat OneWeb's distribution partners to implement comms on the move solutions for customers around the world. The service activation opens up new revenue opportunities for rail connectivity, as well as services for emergency responders, the media, oil and gas industries, mining, government and NGO customers. The service is now available through more than 30 of Eutelsat OneWeb's existing distribution partners and leverages Kymeta Hawk TM u8 flat panel user terminal (UT) enabled for mobility, with a wider suite of terminals coming later this year.

This announcement means customers across North and South America, Europe and Australia are now able to access download speeds of up to 200mbps while travelling, or while mobile at work in industries such as agriculture, mining and governmental services. Coverage and availability will be extended as Eutelsat Group completes the roll-out of its ground segment to enable true global coverage.

These innovative low Earth orbit powered mobility services have been developed and extensively tested alongside leading industry partners, including the European Space Agency and the UK Space Agency. With land mobile and portable connectivity now available across the network, Eutelsat OneWeb will be offering these services to both existing and potential partners and markets.

Commenting, Stephen Beynon, Co-President of Connectivity at Eutelsat Group, said: "The launch of Eutelsat OneWeb's Land Mobility services brings high-speed, low-latency connectivity to under-served industries such as transport, first responders and the international aid sector. We are looking forward to meeting the huge demand for connectivity on the move services by working closely with our trusted distribution and technology partners." ●

Photo courtesy Eutelsat OneWeb ●●●

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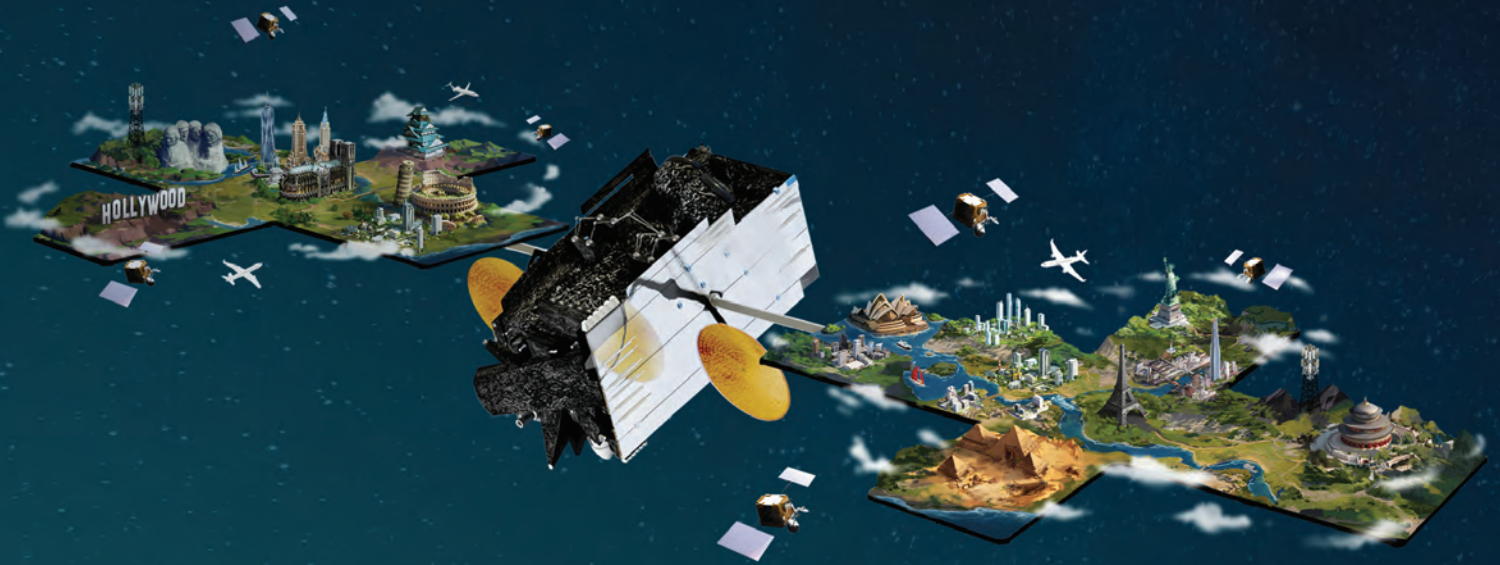
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Our engineering innovations deliver essential connectivity to families, communities, businesses and governments around the world — because making connections is what we're all about.

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Virgin Voyages powers fastest internet at sea with integrated MEO-LEO service from SES

EUROPE: Virgin Voyages will deploy a new level of "Pretty Fly for a Wi-Fi" connected experiences for thousands of its "sailors" (passengers) across its fleet; becoming the first cruise line to deploy SES Cruise mPOWERED + Starlink PRO service. The seamlessly integrated high-performance connectivity service with no data consumption limitations will power Virgin Voyages' high-end cruise offering of tech-savvy cabins, beautiful spas, and designer suites, plus award-winning entertainment, which all require superior connectivity. Launched in 2021, Virgin Voyages offers adult-only voyages on ships inspired by boutique hotels, sailing to 100+ ports globally.

With unlimited Wi-Fi access across multiple devices, passengers can share their cruise experiences live and in real-time via social media and video calls, while enjoying the incredible connected experiences that Virgin Voyages offers. In addition to meeting and exceeding guests' expectations, the unmatched connectivity delivered by SES Cruise mPOWERED + Starlink PRO service will maintain cutting-edge operation levels for its crew across the fleet.

"For cruise operators, being able to constantly innovate and unlock new, superior guest experiences for passengers is essential to stay ahead of the curve," said Simon Maher, Senior Vice President, Cruise at SES. "State-of-the-art connectivity is at the heart of this. This is why we expanded our offering to create a fully integrated end-to-end service that uses multiple orbits, from Geostationary to Medium and Low Earth, to optimise bandwidth and meet the needs of both passengers and crew, wherever in the world they are sailing. By doing so, we are proud to deliver this new level of enhanced operational efficiency coupled with the ultimate connectivity guest experience." ●

Hughes has announced that SES has selected the Auto-PACE Solution for DEUCSI programme

NORTH AMERICA: SES Space & Defense has awarded Hughes a contract to provide a flexible, software-defined, multi-orbit, auto-PACE solution and associated modems in support of SES Space & Defense's and the Air Force Research Laboratory's (AFRL) Defense Experimentation Using Commercial Space Internet (DEUCSI) program. The Hughes solution will enable resilient broadband connectivity using both Ku and Ka-band Geostationary (GEO), Medium Earth Orbit (MEO), and Low Earth Orbit (LEO) satellite constellations for various Comms on the Pause (COTP) and Comms on the Move (COTM) test scenario.

Virgin Voyages Scarlet Lady. Photo courtesy Virgin Voyages ●●●

Under this contract, Hughes will deliver its automated Network Management System (NMS), Enterprise Management and Control (EM&C) capabilities together with its Smart Network Edge software to be integrated by the SES Space & Defense team with Hughes next-generation, software-defined HM100 and HM400 satellite modems providing GEO and MEO connectivity. SES Space & Defense, which focuses exclusively on delivering satellite network solutions for governments, will integrate a LEO solution into the Hughes auto-PACE offering, adding further to the resilient nature of the ultimate program deliverable.

"Multi-orbit, flexible networks deliver real-time communications to meet mission requirements across the battlefield, said Rick Lober, Vice President/General Manager, Hughes Defense and Government Systems Division. "Whether users need connectivity on the ground or in the air, resilient communications must be available using the frequency band and satellite system that is most effective for the application and location. Hughes appreciates the opportunity to continue working with SES Space & Defense and others on this program as the need for multi-orbit communications accelerates." Hughes is a pioneer in SATCOM for government, defense, and enterprise use cases. With more than 50 years of experience in satellite communications, Hughes continues to advance the technologies and capabilities available to commercial and government customers. ●

ATLAS Space Operations provides ground support for VICTUS NOX mission

NORTH AMERICA: ATLAS Space Operations has been contracted by Millennium Space Systems to support Space Systems Command's VICTUS NOX program, demonstrating its rapid onboarding ability across a global network during the record-setting US Space Force Tactically Responsive Space mission.

ATLAS provided its global ground station network using its proprietary Freedom™ Software Platform to automate communications and enable near-real-time trouble shooting capabilities. VICTUS NOX required mission partners to maintain constant mission readiness to support launch and first contact followed by accelerated spacecraft commissioning within a condensed time frame.

"At ATLAS, we pride ourselves on our highly reliable network and adaptable software, and we demonstrated that with VICTUS NOX," said ATLAS Space Operations Chief Executive Officer, John Williams. "Without any compromises to support our existing government, civil, and commercial customers, we were able to fully support this record-breaking Space Force mission. ATLAS demonstrated how it works with our mission partners to deploy and operate communications solutions more quickly than ever before." ●

Why laser is the future of defense communication

The war in Sudan, the invasion of Ukraine, the conflict in the Middle East – in 2023, violent struggle around the world has thrown the need for defense into sharp relief. For the ancients, it was, "if you want peace, prepare for war".

Jean-Francois Morizur, co-founder and CEO of Cailabs

Jean-Francois Morizur, co-founder and CEO of Cailabs ●●●

In today's unsettled world, peace-loving countries need a strong military – as the rise in defense spending all across Europe shows. Dr John Chipman of the International Institute for Strategic Studies rightly states, "Russia's war in Ukraine has recast the security environment."

With advances in technology, conflict has changed radically. Now, the party with the best technology has the upper hand. Countries must therefore ensure not only that they invest adequately in defense, but also that they adopt the right technology and create conditions in which the tech of the future can be developed. At this moment in time, one key technological battleground is communication.

For a long time, communication has been synonymous with radio not just on the battlefield but everywhere. Radio is an established, tried-and-tested workhorse technology, used for its reliability. It can be depended on – and there are few places where that's more necessary than a war zone. But another technology has been advancing in recent years and now has a starring role to play.

HUGE ADVANTAGES

That technology is laser. Though lesser known, its advantages over radio are huge. It can transmit up to 100 times more data than radio. It's almost impossible both to detect this transmission and to intercept it. Laser is classified as having a low probability of detection and low probability of interception. Interference, too, is almost impossible. Jamming is also very difficult; though a cloud of smoke could jam a laser, you can see the cloud and where it originates. This is all to do with laser's properties: laser light propagates in a straight line.

Radio broadcast, in contrast, spreads out in waves (potentially overlapping with other broadcasts, which is why the International Telecommunication Union has to regulate the spectrum). This makes interception easier. Consider a broadcast from satellite to earth, which can be tens of kilometers wide. The detection zone is simply vast and made larger by so-called side lobes—the energy transmitted outside the main beam. Anyone within the radius can intercept the signal. It's easy to see why this could be lethal in a conflict zone.

Crucially, laser technology's Achilles' heel is on the way to being resolved. Though researchers have long known that, simply due to physics, laser could outdo radio in terms of safety and speed, atmospheric turbulence has made point-to-point laser communication over vast distances very difficult to achieve. Pointing accurately is difficult due to the narrowness of the beam. Advances in the field are addressing these, however, and laser now stands at the wings, ready to take the stage. Military professionals say use cases are emerging all the time, from radio-silent operational updates to drones that can't be immobilized.

TAKE NOTICE!

All countries should pay heed to these developments, but Europe in particular should notice. The continent is lagging behind China and the US in the new space race, which is essential to national security. Europe is dependent on foreign support to get its own satellites, without which space-to-ground laser comms is impossible, into space. Even the strategically important Galileo satellites, a European version of the US' Global Positioning System or China's Beidou, will be taken into space by Falcon 9 rockets made by Elon Musk's SpaceX. Unable to direct investment effectively or create the kind of conditions in which private space tech companies can thrive, Europe struggles to harness its enormous talent and innovation in the same way as the US, which has looked to the private sector to bolster its defense capabilities on the ground and beyond the atmosphere.

There are steps that Europe can take. Ending or suspending geographic return – the policy which states that countries are repaid what they invest in the European Space Agency in the form of industrial contracts – would be a good start. That would increase competition among ESA's tenders, driving down costs, reducing inefficiencies, increasing quality, inspiring entrepreneurs, and researchers, and keeping home-grown European businesses on the continent. That would soon strengthen Europe's space culture, with huge knock-on benefits for defense.

For now, what we know is that laser comms has matured. Space-to-ground, point-to-point communication promises large, concrete advantages on the battlefield to those who adopt it as a core technology. It offers much faster data transmission and at a level of security greater than ever before. The US are taking it seriously. China is as well. It's not just the future of defense communication, it's rapidly becoming the present. ●

● ● *Ken Peterman, President and CEO, Comtech*

Satellite Evolution Global

Q&A

A unified structure to deliver comprehensive solutions ● ●

Comtech has a nearly 60-year history of technology leadership with hundreds of patents and significant positions in hundreds of countries. The company has done remarkable things and led the way in delivering innovative SATCOM, space, terrestrial, and wireless solutions to global customers for over five decades. However, to keep up with the needs of today's fast-changing satellite communications ecosystem, Comtech embarked on a transformational journey about a year ago. Ken Peterman, Comtech's President and CEO, tells us how the company's rebirth as "One Comtech" has solidified its future.

Crispin Littlehales, Executive Editor, Satellite Evolution Group

Question: Tell us about One Comtech. What sparked the idea for this transformational journey and how has it affected the way you do business?

Ken Peterman: Over the last year, we brought 14 historically siloed businesses together. We instituted common practices and common tools across the enterprise so that we bring our disparate skills and capabilities together to deliver a more comprehensive value proposition to our customers. Along with that, we implemented our first ever comprehensive people strategy so that regardless of what geography or business unit our employees are in, they all have the same opportunity for professional development and promotion. Thus, they are free to pursue their passion and unleash their creativity.

With the One Comtech transformation, we also established EVOKE,

Comtech employees are free to pursue their passion and unleash their creativity. Photo courtesy metamorworks/Shutterstock ● ● ●

which is our innovation foundry. The initial purpose was so that we could bring our disparate technologies together into a common venue and, with all the tools and building blocks in one place, discover more comprehensive capabilities and solutions we can bring to market and offer to our customers. We also used EVOKE to bring in third parties so that we could augment our organic capabilities with cutting-edge technologies.

Finally, as we have disclosed publicly over the last few quarters, we have turned a corner. Clearly, what we are doing as One Comtech is bringing customers what they need while opening the aperture for significant growth across all our businesses.

Question: Comtech was recently awarded a contract of up to US$544 million to provide the US Army with onsite professional engineering services and market leading satellite and terrestrial networking communications technologies for Global Field Service Representative (GFSR) support. How is the project unfolding?

Ken Peterman: It represents one of the largest service contracts that has ever been awarded and demonstrates clear validation that our core value propositions, and transformational initiatives are working. The contract includes satellite communications, mobile networking, engineering, program management, logistics, support, and training.

What makes this win particularly valuable is that, in addition to the solutions we deploy to satisfy the next generation communication needs of the US Army and other services, our people are on the front lines with our equipment to directly engage and collaborate with US warfighters on the Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) bases around the globe. We can make a difference every day ensuring that not only our equipment is deployed properly, but we are also there to identify capability gaps and other opportunities where we can put our people and innovative culture to work and deliver next generation capabilities to the young men and women in uniform faster and more effectively than ever.

One of the challenges that I've found in my recent experience with the DoD is that the commercial technology is accelerating so fast and has such a steep trajectory that the user and procurement community loses sight of where the state of the art really is. This kind of contract enables Comtech to put cutting edge technology into action in ways likely to delight the DoD customers because they don't always see how fast the technology envelopes are moving. So, we are anxious to get started pending the go-ahead from our customer.

Question: On your website there is an intriguing statement: "We are building a future that sets ideas free—hybridized connectivity." Can you expand upon that?

Ken Peterman: When we launched our One Comtech transformation, we looked at our brand and our vision. We reinvented that along with the initiative that we have underway. We are, in fact, building a future that sets ideas free. We're also on a mission to bridge the digital divide

End users will be connected to LEO, MEO, and GEO satellite constellations simultaneously. Photo courtesy Andrey VP/Shutterstock ●●●

and democratize access to communication technologies on a global scale. That's important to me personally and to all of us at Comtech because there are still significant parts of the world that are unconnected.

Connectivity provides a lens through which people can see how others live. They can see the opportunities that others in the world have, whether that's access to education, economic markets, or medical assistance. Think of a grandmother in a disadvantaged area, growing up in an oppressive type of government or society, who has lived without much opportunity. When she is connected for the first time, her eyes are opened to things like professional development and economic advancement that may now be available for her daughters and granddaughters. That might create unrest, but it also drives much needed change and democratizes humanity on a global scale.

One of the only practical and affordable ways to connect the unconnected is through satellite communications. The convergence of communications infrastructures is key to democratizing access. We at Comtech are excited about putting that technology to work and leading the way in delivering blended, hybrid, smart, enabled services that empower a truly unified planet.

Traditionally we have had very disparate, isolated satellite communications ecosystems that operated independently. Going forward, we anticipate end users will be connected to LEO, MEO, and GEO satellite constellations simultaneously. In this hybrid connectivity environment, a decision engine in your device can automatically route the traffic over the network that provides the optimum user experience, just like your smartphone does. In some cases, there will be a convergence of geospatial constellations with communications because we don't need to get all the imagery down to Earth, we just need the insight that the imagery enables.

When we say "fluent in the future" we're talking about this type of hybrid connectivity that's unfolding right now. Businesses, government, and individuals around the world

Photo courtesy nmedia/Shutterstock ●●●

are demanding communication infrastructures to seamlessly provide information and insight that is trusted. What's more, they want it to be available in every imaginable situation. Comtech is laser focused on providing that.

Question: Last October, Comtech won a US$48.6 million contract from the US Army to design, develop, test, and deliver the next generation Enterprise Digital Intermediate Frequency Multi-Carrier (EDIM) modems. How do you see this effort tying in with the Space Force Enterprise SATCOM vision?
Ken Peterman: The Space Force enterprise vision for satellite communications is evolving but it initially called for five key attributes:

- Rapid, resilient, sustainable, and global access to satellite communications capabilities;
- Terminal and modem agility;
- Network agility;
- Cyber link and operational security; and
- Data interoperability with Joint Command and Control Systems.

Comtech's EDIM modems are designed to support all the unique US Army and Tri-services requirements.

We believe that EDIM modems are going to be deployed across installations around the world supporting multiple networks. It is contemplated largely as a drop-in replacement for existing modems. The prior EBEM legacy program delivered over 40,000 modems to the Army and the DoD. We are also proactively installing features and capabilities into our EDIM modem that go beyond the current specifications to make certain that it fully embraces the opportunities that this program offers.

Question: The ground infrastructure must change to accommodate multi-orbit capabilities and other breakthroughs in satellite technology. What is Comtech doing to help its customers take full advantage of both current and future advances in satellite communications?
Ken Peterman: The ground infrastructure for GEO satellites has typically been an afterthought planned by the entity doing the space segment or satellite design. They draw up the architecture and then reduce that specification to individual box specs. They then procure the modems, amplifiers, antennas, and the up down converters

separately on a technically compliant, lowest price basis. It has been a very hardware-centric approach because a GEO satellite has a life of 20 years, and one cannot effectively or materially change the performance envelope while the satellite is in orbit.

LEO satellites, which suffer significant gravitational pull, only have enough propellant and energy to stay in orbit for 3-5 years. That poses some challenges for the provider in terms of cost to replenish but it also offers a competitive advantage that they can exploit. Since providers are replacing entire constellations every four years on average, they can gather data on how their subscriber community is using the network; they can fold in new technologies; and they can increase cyber defenses. In short, they can alter their network to keep pace with or even anticipate those changing and evolving usage patterns.

Of course, they cannot procure their ground infrastructure the same way that GEO satellite operators did every 20 years. That would be a ball and chain on the leg of their space segment. At Comtech, we found we have a unique position to serve these LEO providers from a ground infrastructure perspective. We are a US sovereign company that builds all the elements that are needed and can therefore provide a comprehensive solution south of the antenna that is largely software centric, cloud native, and digitized. As we constantly evolve our ground segment, we can enable those providers to deliver a continuum of improved overall performance, thereby creating greater financial return for themselves and their shareholders.

We are seeing our One Comtech initiative play an extremely vital role as a ground infrastructure partner—a company that LEO providers can marry over the long term, and which can effectively create the blueprint of how their next generation space segment should be designed, built, and operated.

Question: Comtech had a strong fiscal year in 2023. To what do you attribute your success, and do you see that winning streak continuing in 2024?
Ken Peterman: We see these changing market dynamics and we're uniquely positioned to serve our customers. This growth requires us to hire more people and provide new capabilities such as data collection, data analytics, and security. Customers are asking us for network orchestration, network management and multi-network connectivity. These are all areas where they are driving us to expand even further. So, yes, we're seeing meaningful growth, which benefits both our customers and our stakeholders. ●

Forward-Looking Statements
Certain information in this article contains statements that are forward-looking in nature and involve certain significant risks and uncertainties. Actual results and performance could differ materially from such forward-looking information. The Company's Securities and Exchange Commission filings identify many such risks and uncertainties. Any forward-looking information in this article is qualified in its entirety by the risks and uncertainties described in such Securities and Exchange Commission filings.

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Private Data Center Suite

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Future-proofing the ground segment for an evolving future ● ●

From today's needs to tomorrow's, digital ground systems lay the path that will leverage AI, Multi-Cloud, 5G networks and more.

Greg Quiggle, Senior Vice President of Space Product Management, Kratos

Greg Quiggle, Senior Vice President of Space Product Management, Kratos ●●●

Space today doesn't look like it did five years ago, and it will look different again a few years from now. The satellite ecosystem is being remade with mega-constellations and software-defined satellites to serve a world that craves more connectivity anytime, anywhere.

Payloads that were once fixed for years can now be reconfigured in minutes, redirecting beams and bandwidth to support needs that shift throughout the day, the region, or by customer. If there was a path to that future, however, the traditional ground segment didn't support it.

That's kicked off a digital transformation, with a shift to virtualization, orchestration, and the cloud to enable more agile and dynamic operations. A digital ground system that can spin up processing and adjust ground settings as needed, works in tandem with the satellite as a real-time integrated system – a significant change indeed.

But if those are the ground capabilities that are unfolding today, what should we expect tomorrow, and in the next 3 to 5 years? For an industry that's changing rapidly, what innovations or disruptions will further transform the ground segment for the challenges ahead? Satellite operators, who buy satellites years before they're launched, need to project today what their networks might look like tomorrow in order to future proof their ground operations and investments.

CRYSTAL-BALLING THE DIGITAL PATH INTO THE FUTURE

It's safe to say that in orbit the trend to more satellites, capacity, and complexity will continue. NSR forecasts that 26,000 software-defined satellites will be ordered through 2031, and for good reason. Operators want more flexible and powerful satellites. They want to blend the best features of LEO, MEO and GEO for multi-orbit capability.

All of that leads us back to a ground segment that will need to become more scalable, automated, and intelligent. But the ground segment can't get to that future without being digitally transformed. Fortunately, it's beginning to, which will allow it take advantage of advances on the horizon that include AI and cognitive networking, multi-cloud architectures, and software-defined networks for 5G and beyond.

AI EVERYWHERE

AI is making inroads everywhere, and that will include making digital ground systems more intelligent and efficient. AI has been a hot topic in the telecommunications industry, much of it around how to better manage costs and scale. Satellite networks can go down for many reasons – from equipment failure or interference, to weather, configurations issues, or other satellites. By gathering as much data about the network as possible, AI can detect and diagnose anomalies and issues to reconfigure the network and fix problems at a speed and scale beyond a human.

Its ability to learn and adapt over time goes beyond rules and root cause analysis. As it receives more data, and experiences new and novel situations, of which there will be many, it can continuously improve its accuracy and effectiveness, while uncovering complex relationships and hidden causes that go unnoticed by traditional methods. As it identifies and learns patterns it can predict when they might occur next in order to tune the network to avoid outages. That might involve rerouting traffic around malfunctions or proactively maintaining equipment before a predicted failure. And, unlike human-based manual troubleshooting, it can scale to thousands of networks (and endpoints), not only reducing baseline costs, but preventing and minimizing downtime to improve user experience, service quality, and availability.

Networks built in software can also use AI to support hyper-responsive cognitive networking. Cognitive networks analyze traffic patterns and user demands to adjust resources and prioritize communications in real-time. As the satellite industry brings more bandwidth online and networks grow even larger, cognitive networks will go beyond present-state network optimization to dynamically respond to changes in bandwidth, power, and beamforming, making the business of managing networks simpler and faster, as well as driving better customer experience.

Ovzon

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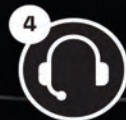
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PERFORMANCE, MOBILITY, RESILIENCY

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MOVING TO MULTI-CLOUD

A huge benefit of the digital ground is the ability to spin up virtual processes on generic infrastructure most anywhere. When those functions are containerized in software, using Kubernetes for instance, digital workloads can be spread out across a distributed environment that can include on-premise servers, private cloud, public cloud, and devices at the network edge.

Multi-cloud takes the concept of cloud to the next level. Instead of relying on a single public cloud provider, satellite operators can deploy their applications across different platforms such as private cloud, AWS, Microsoft Azure, and Google Cloud. They can choose which tasks to run on which cloud platform based on cost-effectiveness, performance, geographic reach or to access specific features and functionalities. They might want, for example, data processing to run on one provider, EO image analytics on another, or to choose geographically distributed cloud regions from different providers to optimize latency and performance for real-time applications like satcom and remote data transfer.

As they evolve their operations and business models, satellite operators can take advantage of different platforms to unlock the full potential of their satellite technologies and services. Multi-cloud also protects them from vendor lock-in, avoiding the dependence that comes with sole provider to give them greater negotiating power and choice when it comes to price hikes or service limitations.

THE RUNWAY TO 5G OR ANY FUTURE 'GENERATION' NETWORK

5G is a new type of high-speed, low-latency network designed to connect everyone and everything. 5G Non-Terrestrial Networks (NTN), a modification of the 3GPP standard designed to deliver 5G connectivity over satellites, promises to be a game-changer for the industry, unlocking new opportunities and addressing some longstanding challenges. 5G is specifically designed for scale and mobility, two things that the industry must solve as it transforms itself for the future. 5G NTN's integration with terrestrial networks to extend coverage and provide uninterrupted connectivity will help mainstream satellite. It will also open the door to a wide range of applications, including satellite broadband, mobile connectivity on land, sea, and air, real-time EO data transmission and more. For now, 5G NTN technology is still evolving and standardization efforts are ongoing, so satellite operators will understandably continue to rely on more established networks. But as we transition towards 5G NTN, ground systems will take on a crucial role to support 5G's advanced functionalities and demands.

Hardware-based ground systems have served their purpose well, but their dedicated physical components for functions like signal processing and routing are more fixed and limited. Their manual configurations make adapting to changing network demands or new functionalities slow and labor-intensive. Software-defined ground systems on the other hand, offer the scale and flexibility well-suited to the dynamic requirements of 5G NTN. They can quickly adapt to fluctuating traffic patterns and constellation changes, efficiently allocating resources for processing, power, and bandwidth. By operating in software, processes can be automated, simplifying and streamlining operations while minimizing manual intervention. When an operator is ready to take advantage of these next generation networks, with a digital ground system they can move to 5G with an upgrade through software, and continue to evolve its diverse applications, as opposed to hardware-based systems that offer no such migration path.

CUMULATIVE BENEFITS

As part of a digital infrastructure, AI, multi-cloud, and 5G are not stove-piped. They can work together to leverage their respective capabilities, extending operations and networks with more automation, intelligence, and reach. The cloud, for example, can serve as the central nervous system for 5G NTN, hosting core network functions, service platforms, and applications. That could include network management, orchestration, security, and content delivery services.

5G NTN in turn can extend cloud services to remote and underserved areas where terrestrial networks struggle. This allows wider distribution of cloud capabilities to empower people and industries in unconnected areas. Cloud resources can also be extended to the edge of the network, closer to satellite ground stations or users. That enables local processing of data, reducing latency for real-time applications.

Let's not overlook the fact that for AI to work its magic, it needs lots of data. Cloud platforms provide the infrastructure and tools for big data analytics and AI to optimize network performance, predict usage patterns, and personalize user experiences in 5G NTN deployments.

THE ROAD AHEAD

These advances may seem a leap into the future, at least for satellite, but not in the telecom and IT sectors. They are further ahead in digital transformation, and are actively pursuing AI, 5G, and multi-cloud, which provides somewhat of a roadmap. Telecom providers once operated in a world of stove-piped hardware, much like the satellite industry, but they have continued to evolve to more open, digital software-defined systems that are more capable…and future proof.

The digitally transformed ground segment represents a significant change from the past but offers substantial benefits. Operators can better serve their customers today in terms of speed, scale, and performance, while putting them on a path to adopt tomorrow's advances for their challenges ahead, whether that's five months or five years down the road. ●

●● *Don Claussen, CEO, ST Engineering iDirect*

Satellite Evolution Global

Q&A

Leading the way to standards-based networks ● ●

ST Engineering iDirect has been an industry leader for a long time and now the company is entering a new era where the goal is to revolutionize the ground and deliver a virtualized cloud-based network unfettered by the limitations of bespoke hardware and finite capacity. We spoke with Don Claussen, the company's CEO, to find out what's next.

Crispin Littlehales, Executive Editor, Satellite Evolution Group

Question: You took over as CEO for ST Engineering iDirect at the start of 2023 with the directive to enhance the company's global leadership and technological vision. What would you say are your biggest accomplishments to date and what is the next big thing on your leadership agenda?

Don Claussen: 2023 was focused on reorienting the business for the new market dynamics. We will be unveiling our next generation product at Satellite 2024 in March. What you'll see is a combination of the best of both the Newtec and iDirect legacy product lines—essentially the best of both worlds. This new product line addresses the core needs of the emerging market such as multi-orbit integration; easing satellite network deployment; and scalability. We've branded that product to make sense to the evolving market.

I have a holistic view of what we need to do as a company to successfully launch this new brand. As such we've been enhancing the leadership team and bringing on new people with different experience. Some have worked in the IoT and cellular markets, some have worked on the satellite operator side, and some have worked extensively in defense both in the United States and internationally.

We have been very successful doing things a certain way for 20 years.

There are many different initiatives, whether it's DIFI or 5G or 3GPP. The challenge is to find a way for it all to come together ●●●

INDUSTRY TRENDS

5G STIMULATING NEW USE CASES AND GROWTH:
• 3GPP standards with NTN
• Direct access
• 5G NR Waveform
• Virtualization, NFV/SDN, Orchestration

GLOBAL TELCO AND IT 5G

NEW GROUND

NEW SPACE — GEO MEO LEO HEO

• New LEO/MEO/HEO constellations
• Dynamic Space Segment
• Multi-orbit

• Generic hardware platforms
• Strong Security Requirements
• New business models

CLOUD DEPLOYMENT

ST Engineering
iDIRECT

Photo courtesy ST Engineering iDirect ●●●

We've enabled global and regional operators to expand their customer base across a wide variety of markets. The next big step is telling our next innovation story to the community—not just in our marketing materials, but in technology proofs of concepts. We are going to demonstrate our capabilities as we mature them so the market can understand what they can do and how to deploy them.

Question: Overall, what do you see as the main challenges the satellite industry faces and where do you think the biggest opportunities lie?

Don Claussen: The main challenge is something that we've been talking about for several years now. It's the adoption of industry standards. We have all been siloed since the beginning of time. There are many different initiatives, whether it's DIFI or 5G or 3GPP. The challenge for us as an industry is to find a way for all of us to come together and accept standards, whatever they are. The point is that we must decide as a group that we're going to do that.

At the same time there are always going to be those entities that vertically integrate. We must figure out how we are going to bring them into those standards-based networks because it is very clear that all our customers are going to operate in a multi-orbit environment. They are going to use GEO, MEO, and LEO and we who make the ground systems are going to bring the terrestrial network to create a unified environment and experience. I think ST Engineering iDirect is ahead of the curve on figuring that out.

At present, we have a lot of bandwidth and capability on orbit which is driving the cost down and increasing the total addressable market because we can bring more

people into the satellite space. It's faster, cheaper, and more efficient. The opportunity is collapsing on common standards; getting away from bespoke hardware so that commodity hardware can be used and providing that in a network that is scalable and easier to deploy.

Think of satellite radio 25 years ago. Everybody thought that would never upset terrestrial radio. These days nearly every car in North America has satellite radio capability. Once we achieve the aforementioned goals we can bring cars, trains, trucks, and all of the IoT targets into the network. That's one of the big opportunities.

Question: NGSO constellations are growing at an astonishing rate, and they promise to revolutionize our future by delivering more sophisticated communications capabilities including smart cities. What role is ST Engineering iDirect playing to convert hopes and dreams into reality?

Don Claussen: Part of our next generation platform strategy is to make sure we can bring those NGSO constellations into the network. We've traditionally enabled geostationary orbit operators and now we want to bring them all together. It's not just so they interoperate, it's designing a system that will support the scale that's going to come with that.

Thus far with satellite communications, we haven't had to manage the scale that cellular companies have had to manage but that's where we are headed as we connect all these devices. In any given region we are going to have 10 to 100 times the number of users in a network. NGSO is going to enable that by bringing high-speed bandwidth and low latency which can drive a scale that will create more advantageous costs points. Those capabilities are

Photo courtesy ST Engineering iDirect ●●●

creating an environment where we as traditional enablers of GEO operators have had to rethink what we do.

Question: I'm going to circle back to smart cities. The ST Engineering (your parent company) website has a whole area devoted to that segment. How is that unfolding?
Don Claussen: That's part of ST Engineering's DNA. There is a whole business that handles smart cities whether it is public transportation or badging systems or tolling systems. Smart cities are part of the whole IoT business case. Today, you can connect things that need to be remotely managed in a way that can be handled within your SATCOM network. For example, last year we worked with a large Latam provider to deliver IoT capability to control power plant electrical switches in remote areas. Whereas previously someone would have to use a truck, car, airplane, or boat to manage such things, we're enabling that to be done over a satellite network.

As I drive from New Jersey to Washington D.C. for work, there is no cellular connection for about one third of the trip. If I had the ability to extend it through a satellite network, I would have a much better experience. The same is true for trains. Enabling connectivity for commuters is part of IoT and smart cities.

As we continue to scale our networks, costs will come down and when we adhere to standards-based platforms where we can roam between networks, we'll see our total addressable market grow. I think we're going to see a lot of new SATCOM users.

Question: ST Engineering iDirect is a big proponent of industry standards. What do you see as the key advantages to having an industry united under a common set of standards and when, if ever, do you see that happening?

Don Claussen: Although I don't think we've decided how we are going to do it as an industry, I believe we all want to embrace standards and build them into our products. What we need to do, though, is look at what mobile cellular operators have done because they have already figured this out. They know how to run between networks and how to make them all interoperable. We should take that framework and apply it because I don't think we can do smart cities or IoT or anything of that scale without having interoperability.

I don't know how long it will take. We've been talking about this for a few years and ST Engineering iDirect is going to participate in driving those standards discussions forward. As we put our products out into the market, the plan is that both our customers and our competitors will embrace those standards so that we can all work together. If we don't work together, it's just not going to happen. Hopefully we can provide market leadership and through proofs of concept we will demonstrate that it is feasible to do it.

Question: We hear a lot about the government and military shifting towards the use of commercial off-the-shelf products to build out large scale networks more rapidly and cost-effectively. How is ST Engineering iDirect facilitating the use of its products without compromising the high level of cyber security and resiliency that is crucial to defense and disaster communications?
Don Claussen: We have a government business that focuses on the US Department of Defense (DoD) and a business that focuses on Ministries of Defence worldwide. We are tightly integrated from a go to market standpoint because what the US DoD does others want to emulate, and everyone needs that security. The military and defense industry is moving towards the adoption of commercial products because they can get them into the hands of users much faster than something that's developed specifically for military use.

Those bespoke products will always be there, but what we are doing is taking the lessons we've learned from our defense customers and applying some of those to our commercial product while making sure that the network complexity is taken out of it. For example, in the defense environment, iDirect's Evolution® Defense product is a market leader. A lot of large operators use iDirect's Velocity™ product and we've just released a software-defined mode on the newly announced 450mp, the first in 4-Series suite of SDR modems, that will enable people to switch from an Evolution® Defense network to a Velocity™ network' thereby providing the mechanism for our customers to move back and forth from their bespoke defense network to a commercial network without sacrificing the security they need.

Question: In the last year ST Engineering iDirect has forged strategic partnerships with Microsoft and Airbus. Can you provide a bit of detail about both endeavours and tell us why such partnerships are mission critical to the advancement of the company's technology?
Don Claussen: We started to collaborate with Microsoft

Azure Space to prove out the concept and develop the capability to virtualize the ground segment. This is very important because if we don't virtualize and run on commoditized platforms that have a much faster refresh rate, we are making it harder for our customers to upgrade or to scale when their networks grow. We did a proof of concept late in 2022 where we demonstrated the demodulation capability of an iDirect virtualized high-speed SCPC modem running as containerized software on a COTS server located on Azure. That was also the first time we showed how we could receive high-speed traffic via a digital interface instead of the traditional L-band interface, proving our commitment to the DIFI standard. In May of 2023, we showcased the virtualization of the modulator capability of the modem to run on Azure. So, we've now done both the transmit and receive in a virtualized environment. We are now in a PoC phase to virtualize the network processing functions of the hub running on Azure Cloud on COTS.

In June 2023, we entered into a strategic partnership with Airbus Defence and Space to enable a tighter integration between the ground segment and the space segment. This allows us to collaborate with those who build the spacecraft and the payload. If we work with a company like Airbus at the beginning to understand how they are going to handle the technology that's going into orbit and how it's going to work, we can enable the systems necessary to manage that.

We can optimize the interactions between ground and space as well as introducing capabilities over the course of time that allow that to happen automatically. For instance, as capacity moves around in a given beam or a region, our technology will enable the operator to take advantage of that without user intervention, based on what is going on with the network. You can't do that if you don't interact with the people making the payloads because once they are in orbit, they're already up there for whatever the lifespan is going to be and then the ground is behind the curve. What we want to do is to be able to introduce those capabilities before or as the satellites reach orbit.

Part of ST Engineering iDirect's realignment is enhancing the leadership team with people who have worked at operators and worked at other ground segment providers and therefore been users of the equipment. We are talking with our customers about not only what we can provide for their existing constellations, but what they want for their next generation satellites. That way, we can either build or provide the capability they seek or help them think through that capability in an alternative way. This means we will be able to deliver a more relevant product that is future proof because we are continually evolving our technology with our customers and our partners.

Question: I've read that ST Engineering iDirect is on a transformative journey, not only in terms of its identity but also in terms of product development. Can you

expand on how the journey is unfolding and what we can expect to see from the company in the next 1 to 5 years?
Don Claussen: Starting with the introduction of our new next generation product brand at Satellite 2024, we are going to demonstrate our story. Over the next 1 to 5 years, we are going to deliver a virtualized, cloud-based network that will evolve towards a standards-based approach. This will provide end-to-end orchestration of a network that's composed of multi-orbit, multi-access capabilities.

Our goal is to do demonstrations so that our customers can see the evolution of the technology as we come to major releases. People can come and see this in our labs. They can start to use it in their labs so that they can get used to the technology and understand what it means to them. This is all about creating a platform that evolves.

In the past, when we've progressed the technology, we've had to replace a lot of hardware. With a standards-based, virtualized approach we can move to a more software-based deployment which will allow our customers to upgrade at a more predictable rate and allow us to focus on delivering new capabilities and not worry about obsolete hardware. Think of the gateway which typically could only provide as much capacity as resided in that gateway. Once we digitize some of the capabilities that have thus far been analog, that flexibility starts to grow because a portion of the gateway resources reside in the cloud.

Because there is now so much on orbit capacity with multi-orbit solutions and very high throughput geostationary satellites, we want to make certain that we set up our customers to scale for continual growth. .

It's an exciting time for our industry. We have new entrants into the market. More and more people are consuming satellite communications. This company has been an industry leader for a very long time and now we are entering a new era—the next generation ST Engineering iDirect—and we are going to drive a lot of what the market is going to require. ●

Setting up customers to scale for continual growth. Photo courtesy sdecoret/Shutterstock ●●●
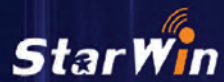
Navigating a smooth transition to 5G NTN ●●

The satellite communications industry stands on the brink of transformation with the impending shift to 5G Non-Terrestrial Networks (NTN). This evolution promises standard ubiquitous connectivity across terrestrial and non-terrestrial networks, a multi-vendor open ecosystem for the satcom industry, new revenue streams from new use cases, and reduced total cost of ownership (TCO) for satellite operators.

Gil Elizov, VP Products, Gilat Satellite Networks

5G NTN brings forth a wide range of advantages that contribute to the progression and enhancement of global satellite communication systems. Some of these advantages include:

- **Ubiquitous Connectivity:** 5G NTN can provide ubiquitous connectivity, extending text, voice, video, and broadband 5G services to remote and underserved areas globally. This contributes to bridging the digital divide and ensuring that people in diverse geographical locations have access to advanced communication services.
- **Service Monetization:** By moving to standard 5G NTN solution, satellite operators can adapt 5G terrestrial network monetization systems that allow them to on-board new customers and provide new services quickly and easily, as well as expand to new use-cases and revenue streams.
- **Operational Efficiency:** Satellite operators can adapt 5G terrestrial network functions and operation systems that allow them to reduce their current Opex and Capex, as well as increase customer experience.
- **High Reliability and Availability:** 5G NTN platforms, such as satellite constellations, can provide high reliability and availability, reducing the risk of service disruptions. This is crucial for mission-critical applications, emergency services, and other scenarios where uninterrupted connectivity is imperative.
- **Flexibility for Diverse Use Cases:** 5G NTN is designed to accommodate diverse use cases, ranging from direct-to-device and IoT to mobility, cellular backhaul, private networks, and military services. This flexibility makes it suitable for a wide array of applications, driving innovation across industries.
- **Future-Proof Design:** 5G NTN standards are developed with a forward-looking approach, allowing for easy integration of future technologies and standards. This ensures that the network remains relevant and adaptable to emerging trends and requirements.

However, as we embark on this exciting journey, it's crucial to focus on efficiency, adaptability, and strategic evolution. Here at Gilat, we have analyzed the key considerations for a seamless evolution to 5G NTN, ensuring a harmonious integration without sacrificing current investments and business continuity.

TRANSITIONING TO A VIRTUALIZED ALL-SOFTWARE PLATFORM

The foundation of a successful transition to 5G NTN is the adoption of a virtualized all-software platform that operates efficiently on standard, off-the-shelf hardware. This shift towards virtualization empowers network operators with flexibility, scalability, and cost-effectiveness. By decoupling software from dedicated hardware, operators can harness the power of commodity hardware, significantly reducing capital expenditures and operational costs.

A virtualized platform also facilitates the efficient allocation of resources, ensuring optimal performance based on demand. This approach not only enhances operational efficiency but also paves the way for a dynamic, software-defined network architecture that can easily adapt to evolving requirements and new technologies.

FUTURE-READY PLATFORM

To future-proof your infrastructure, it's essential to choose a platform designed to apply future standards, ensuring adaptability and integration across multiple waveforms.

The 5G NTN landscape is dynamic and characterized by new standards and technologies. A forward-thinking platform should be capable of seamlessly incorporating these changes without necessitating extensive hardware upgrades.

Flexibility is paramount, and a platform that supports various waveforms ensures compatibility with diverse satellite communication technologies. This adaptability is crucial as the industry continues to explore different frequency bands, modulation schemes, and satellite constellations to meet the growing demand for ubiquitous connectivity.

STRATEGIC EVOLUTION AND PHASED APPROACH

Evolution should be strategic, preserving current investments in technologies like DVB-S2X while maintaining business continuity. The transition to 5G NTN is not a one-size-fits-all process. A phased approach allows operators to incrementally upgrade their infrastructure, mitigating risks and ensuring a smooth transition without disrupting ongoing operations.

Preserving investments in current technologies is essential for a cost-effective transition. By strategically integrating 5G NTN elements (5G Core, gNBs, Terminals) alongside existing systems, operators can leverage the benefits of both technologies while minimizing disruptions to ongoing operations. This phased approach also allows for thorough testing and validation, ensuring that each stage of the transition is successful before moving to the next.

Photo courtesy Golden Dayz/Shutterstock ●●●

NETWORK MANAGEMENT SYSTEM (NMS) FOR BOTH CURRENT DVB-S2X AND 5G NTN PLATFORMS

The NMS serves as the central nervous system of your network, providing real-time monitoring, configuration, and optimization capabilities. Invest in a robust NMS designed to handle the intricacies of both current DVB-S2X and 5G NTN platforms.

A unified NMS that seamlessly integrates with both legacy and future platforms simplifies operations and reduces the learning curve for network administrators. This unified approach enhances overall efficiency, allowing operators to manage and monitor their entire hybrid network ecosystem from a single interface.

CONCLUSION

The transition to 5G NTN represents a significant leap forward for the satellite communications industry. By embracing a virtualized all-software platform, incorporating future standards, adopting a phased evolution strategy, supporting multi-orbit operation and VHTS, and investing in a versatile NMS, operators can ensure a smooth and future-ready transition.

As we navigate the complexities of this transformation, it's imperative to keep in mind that the journey to 5G NTN is not just about embracing the latest technologies but also about leveraging them strategically to enhance connectivity, efficiency, and business continuity. With careful planning and a forward-thinking approach, the industry is poised to unlock new possibilities and redefine the landscape of satellite communications. The successful implementation of these tips will not only position operators as leaders in the 5G NTN era but also ensure that they are well-prepared for the evolving demands of the digital age.

Since the invention of cellular networks, their focus has been only on terrestrial infrastructures. For the first time in history, 5G technology is about to expand to non-terrestrial networks, allowing the creation of ubiquitous coverage and connectivity around the world. ●

MULTI-ORBIT OPERATION AND VHTS

Ensure your platform supports multi-orbit operation and Very High Throughput Satellite (VHTS) capabilities with an architecture that enables steady evolution to the Cloud and 5G NTN. Multi-orbit operation is crucial for optimizing coverage and ensuring seamless connectivity across diverse geographical regions.

VHTS capabilities play a pivotal role in meeting the escalating demand for data-intensive applications. An architecture designed for steady evolution to the Cloud and 5G NTN ensures that your network remains agile and future ready. This forward-looking approach positions operators to harness the full potential of emerging technologies and market trends, providing a competitive edge in the rapidly evolving telecommunications landscape.
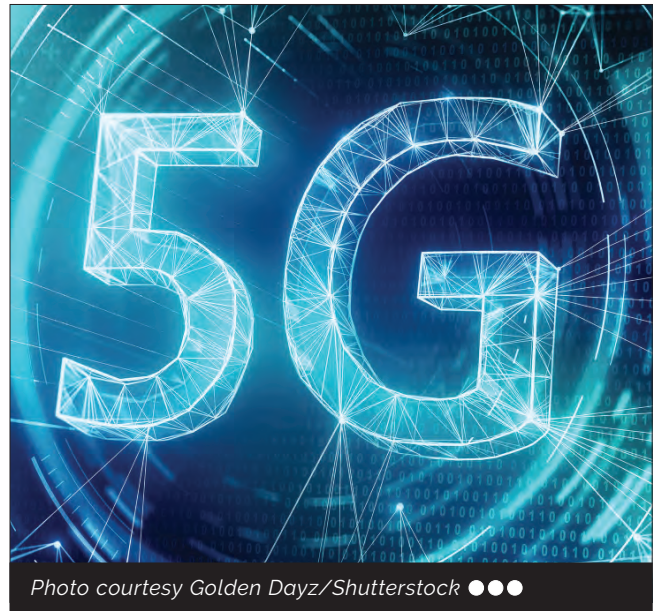
Photo courtesy buffaloboy/Shutterstock ●●●

Exploring the vital contribution of satellite IoT to environmental sustainability ● ●

As the world and its ecosystem faces unprecedented challenges, satellite IoT, a means of communicating with very remote assets and sensors, will play a pivotal role in the deployment of environmental monitoring systems. These technologies can be used to confront the challenges head-on and support sustainable practices.

Alastair MacLeod, CEO of Ground Control

The World Economic Forum's IoT Guidelines for Sustainability report reveals that 84 percent of IoT deployments either directly address or have the potential to contribute to the UN's Sustainable Development Goals. The remarkable capability of Satellite IoT to gather and transmit data, even in remote locations, holds significant promise for reshaping global sustainability initiatives. By facilitating intelligent communication between devices and leveraging real-time data, Satellite IoT's role in tackling environmental issues and developing sustainable practices, should not be underestimated.

EXPLORING THE PRACTICAL INTERSECTION OF SATELLITE IOT AND SUSTAINABILITY

One notable area where Satellite IoT is driving sustainability is in wildlife conservation and environmental monitoring. This approach presents an efficient and impactful means of collecting and transmitting essential data. A common strategy involves using a form of low-power wide area network (LPWAN) to network multiple sensors across expansive areas. The collected data is centralized in a gateway, optimized for satellite transmission. Long range wide area network (LoRaWAN), often paired with satellite technology, is gaining prominence due to its ability to establish a fully wireless communication network without relying on cellular infrastructure.

An outstanding feature of LoRaWAN is its capacity to cover vast areas with minimal infrastructure requirements. In contrast to traditional cellular networks, which often struggle to provide coverage in remote and challenging terrains like dense forests, mountains, or deserts—habitats crucial for numerous endangered species—LoRaWAN excels. It can connect hundreds of nodes up to 10 kilometres apart, with just a single base station or gateway, connected to satellites for data backhaul. This valuable data serves as a crucial resource for environmental agencies and policymakers.

Alternatively, sensors can be directly paired with a satellite transceiver to ensure data transmission in real-time. One such example of using Satellite IoT data to empower environmental conservation efforts can be seen in the "Digitalization of forest" where this technology is being integrated in forest environments. The aim of this initiative is to improve existing methods in monitoring, data acquisition, and research and development.

Notable technologies comprise the IoT: Wireless Sensor Networks, Internet of Trees, and Deep Learning. In this case, satellite-enabled sensors can be deployed in forests to detect signs of deforestation, monitor wildlife movement, and measure carbon dioxide levels. This data

"One notable area where Satellite IoT is driving sustainability is in wildlife conservation and environmental monitoring."

helps in making informed decisions for conservation efforts, preventing illegal activities, and preserving ecosystems. These sophisticated systems are designed for intelligent sensing, monitoring, and analysis— specifically targeting applications like forest fire detection, illegal logging, and poaching.

Similarly, satellite IoT connectivity is helping smart agriculture and precision farming, optimizing resource usage, and reducing environmental impact. Farmers now harness IoT sensors to oversee environmental factors, manage livestock, and enhance decision-making across all facets of agriculture, transforming it into a "smart" endeavour. Given the expansive nature of farm operations, LoRaWAN paired with a satellite enabled gateway emerges as an ideal technology to aid efficient IoT solutions within the agricultural sector. Effectively networked IoT sensors can monitor soil moisture levels, assess crop health, and provide farmers with actionable insights even if the farm is in an extremely remote location.

Satellite IoT, therefore, is crucial in areas lacking traditional, cellular connectivity. For example, Synnefa, which facilitates remote farming for smallholders in rural Kenya, provides cost-effective, reliable, and efficient data for farmers to make educated decisions about when to irrigate or fertilize their crops. Farmers can also use Synnefa's smart greenhouses and drip kits which will automatically fulfil these tasks based on sensor data.

The gains are spectacular: Farmers are saving water by over 50 percent, reducing fertilizer application rates by 41 percent, and increasing production by 30 percent when compared to yields prior to the use of their smart sensors.

Moreover, precision agriculture, a farming management strategy based on observing, measuring, and responding to temporal and spatial variability to improve agricultural production sustainability, holds the potential to significantly reduce the environmental impact of the agricultural industry, currently responsible for a quarter of global greenhouse gas emissions. Adopting precision agriculture technologies can increase crop production, reduce resource usage, and have positive economic impacts. The Association of Equipment Manufacturers estimates current precision agriculture usage at 10-60 percent, predicting that a 90 percent adoption rate could lead to substantial benefits. However, slow adoption is attributed to challenges, with connectivity being a prominent issue, especially in remote farm areas.

THE COMPLEX CHALLENGE OF CLIMATE CHANGE

Satellite IoT contributes to climate change mitigation by providing invaluable data for monitoring and understanding environmental changes. Remote sensors deliver accurate real-time data to help us understand how we affect the environment. These sensors can track changes in sea levels, measure atmospheric carbon concentrations, and monitor deforestation patterns. Their

Alastair MacLeod, CEO of Ground Control ●●●

data can be securely, reliably, and cost-effectively delivered over satellite. This data is crucial for climate scientists and policymakers in formulating evidence-based strategies to mitigate the impacts of climate change and adapt to evolving environmental conditions.

With climate change comes potential disasters and extreme weather. Satellite IoT supports disaster management, enhancing early warning systems and boosting response capabilities. Satellite-enabled sensors can monitor various natural disasters such as hurricanes, floods, and wildfires, supplying real-time data to emergency responders. This enables prompt evacuation, optimal resource allocation, and efficient post-disaster recovery efforts, helping to reduce the environmental and human impact of such events. Satellite-empowered technology means that disaster management crews can comprehend their available resources, allowing them to coordinate actions effectively. Asset trackers fixed to vehicles and equipment can provide precise GPS coordinates at varying frequencies, depending on the disaster's scale, offering a tailored level of insight for swift and efficient relief efforts.

While satellite IoT indeed offers numerous prospects for environmental sustainability, addressing challenges such as data security and high implementation costs is crucial. Ground Control delves deeper into this topic discussing how to overcome infrastructure obstacles and make the benefits of IoT available to all. The future trajectory of satellite technology, marked by the deployment of smaller, cost-effective satellites and advancements in machine learning for data analysis, holds the potential to overcome these challenges and further amplify the positive impact of Satellite IoT on environmental sustainability.

As technology continues its evolution, Satellite IoT is positioned to play an increasingly pivotal role in creating a balanced relationship between human activities and the environment. By harnessing the capabilities of Satellite IoT, we can actively contribute to building a more sustainable future. ●

A global resurgence of HF communications emphasizes need for HF signal intercept and direction finding to support national security ••

Recent changes in the global geopolitical and social environment, the rise of malicious actors, and greater sophistication in electronic warfare all mean countries worldwide are on higher alert and enhancing their security.

Dr. Misho Tkalcevic, CTO at TCI part of the SPX Communication Technologies platform

In peacetime, satellites provided fast, straightforward communications. By combining the vast network of satellites orbiting Earth, information is relayed to and from ground stations to deliver and exchange information at speed. However, satellite communication can fall short in today's uneasy, geopolitically cold environment. Satellites can easily be jammed, disrupted, or interfered with. Various bad actors are turning to different communication methods to drive their nefarious activity. These vulnerabilities can't be tolerated when transferring critical high-value data. That's where High Frequency (HF) comes into play.

High Frequency is an effective communication method requiring only a transmitter and receiver. Operating over long ranges, with no "middleman" (satellite) or third-party infrastructure, makes it incredibly hard for HF radio transmissions to be denied. First deployed in the 1930s, HF was a popular choice for safe, omnidirectional communication such as shore-to-shore, and ship-to-shore over huge distances – or beyond-the-line-of-sight (BLOS) – of around 500 to 5,000 kilometers. But countries soon were distracted with smart new internet technologies as they developed.

Today, the world is a different place. Countries still require beyond-the-line-of-sight and require greater security and basic data transfer. As a result, HF voice and data communications are experiencing a resurgence, offering significant benefits over other BLOS alternatives.

REIGNITING THE HF CAPABILITY

There are few countries around the world that currently don't have HF capabilities. Many adopted it early on and have been using it in a supporting role ever since because the technology is reliable, robust, and long-lasting for long-range communications. Now, HF is increasingly being used in an active role, and countries are looking to enhance their HF capabilities in line with technological advancements.

In the past, HF technology required specialist skills to operate. But modern-day automation has eliminated this need. HF has been optimized to apply the latest signal processing, providing advanced capabilities to ensure that the communications system is easy to operate.

Also, HF hardware and software solutions are optimized for modern-day scenarios. For instance, new capabilities can be delivered by combining HF with the latest radio technologies, such as software-defined radios (SDR) – which leverage software to generate signals as opposed to hardware components – for greater flexibility and accuracy.

Given the operating climate and technological advances, we're seeing a growing number of use cases where HF communication is reemerging as the transmission methodology of choice.

Due to its cross-sector usage and benefits, HF is considered a national asset, shared across services with a tactical and strategic purpose in support of transmitting critical national data. For example, other sectors outside of government and defense are beginning to recognize the benefits. For instance, in a finance context, HF allows high-speed financial trade communications in a fraction of the time it currently takes over fiber – and at a fraction of the cost. To illustrate, sending a signal from Chicago to London would take 15 milliseconds where HF can get there in half the time.

TCI 612 Receiving Loop Antennas. Photo courtesy TCI ●●●

OVERCOMING NEFARIOUS ACTIVITY

There are, however, downsides to these technological developments, as they allow our adversaries to operate in new ways – without utilizing satellite services.

The use of HF communications is no stranger to certain environments, for instance maritime defense where ships utilize BLOS to communicate over vast distances. But, today, adversaries are utilizing HF in similar ways to avoid detection on the ocean, where the desirable outcome for ships conducting smuggling activities is to have a low probability of being detected.

HF also suits difficult environments such as the jungle where signal processing allows reliable communications despite the dense trees and flora – areas where satellites would almost certainly fail. HF will beat almost any other technology in these pockets of the world.

In response, there's an urgent need for HF communication to be intercepted in order to counter the nefarious activity being enabled by its use. HF Direction Finding (DF) is increasingly being used as a critical tool providing the intercept and the location of the source transmission when being used as an alternative to BLOS satellite communications. Modern signal processing supports improved interception. This provides advanced capabilities to identify and intercept HF transmission, this can also lead to DF when multiple nodes home in on signals of interest. Once identified, a specific signal can be monitored, recorded, and analyzed to understand the level of activity from the source and provide a vital piece of the strategic intelligence picture.

ADAPTING TO PRESENT-DAY NEEDS

Since 1968, TCI – part of the SPX Communication Technologies platform – has been designing and manufacturing HFDF solutions, providing omnidirectional high-gain wide-band transmitting antennas covering the short-wave band (2-30 MHz).

In the coming years the geopolitical climate is likely to increase the interest in HF due to its secure transmission capabilities.
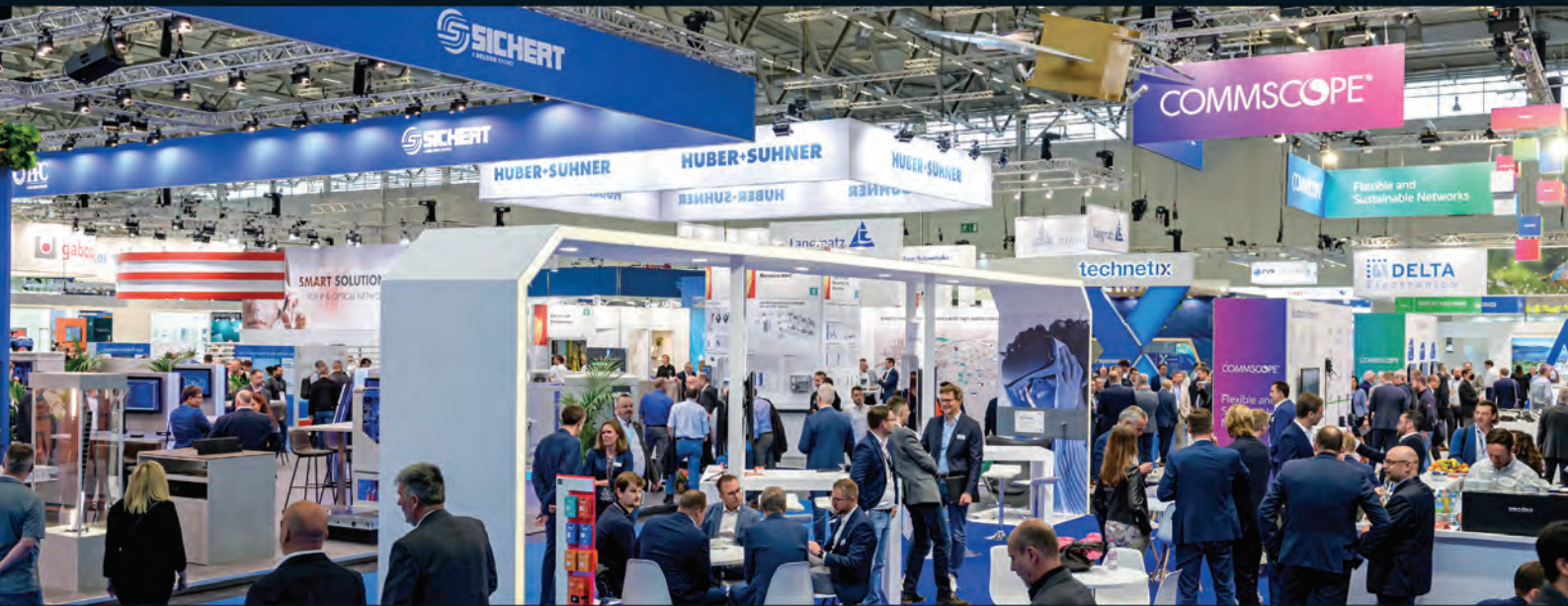
From Europe to Asia, HF will serve not just as a back-up, but in an active role. TCI has the ability to provide the optimum solution to meet the challenges of modern-day HF communications and HFDF strategic capabilities. ●

TCI HF DF system. Photo courtesy TCI ●●●

Quadsat welcomes Karina Bergstrøm Larsen as new Chairman to drive commercial growth

Quadsat has appointed Karina Bergstrøm Larsen as its new Chairman of the Board.

Karina joins Quadsat with a rich and proven background in the satellite industry, having founded and scaled her own successful company, before orchestrating a triumphant exit to Honeywell Aerospace. Karina is now an independent consultant for satellite and aerospace, as well as putting her time into mentoring and encouraging girls to follow a career in STEM.

Karina's appointment comes as Torben Frigaard Rasmussen transitions from his role as Chairman, following his instrumental role in securing a significant Series A funding round of •9 million for Quadsat last year. His leadership has been pivotal in setting the stage for Quadsat's expansion and technological advancements. Torben continues to stay closely related to Quadsat as shareholder and trusted advisor.

Commenting on the transition, Torben Frigaard Rasmussen remarked: "I am immensely proud of the progress Quadsat has made under my stewardship. Karina's appointment marks an exciting new chapter for the company, and I have full confidence in her ability to lead Quadsat to even greater success."

Karina Bergstrøm Larsen added: "Quadsat has developed a game-changing technology for the satcoms industry and has already gained a lot of interest and traction. Having known the team at Quadsat for a number of years, I know we have a shared passion and dedication to innovation and excellence. I am looking forward to working with the team to ramp up the commercial growth."

Quadsat's unique testing solution is democratizing accurate test and optimization, enabling network owners to ensure world-class performance for their customers at all times. This cost-effective, scalable, and precise method is simplifying antenna testing, while making it globally available.

Joakim Espeland, CEO and Founder of Quadsat, said: "I want to express my heartfelt gratitude to Torben for his leadership and dedication to Quadsat. His guidance has been instrumental in our growth. As we move onto the next stage, I am excited to be working with Karina. I know that her leadership and strategic acumen will put us in a strong position to capitalize on emerging opportunities and spearhead advancements in satellite testing solutions." ●

Karina Bergstrøm Larsen ●●●

NASA Administrator names new Head of Small Business Programs

NASA Administrator Bill Nelson has announced that Dwight Deneal will serve as the new assistant administrator for the Office of Small Business Programs (OSBP) at the agency's headquarters in Washington, effective immediately.

In this role, Deneal provides executive leadership, policy direction, and management for programs that help ensure all small businesses are given a fair chance to work with NASA. He succeeds Glenn Delgado, who retired from the agency in December 2023.

"Dwight brings a wealth of experience and knowledge to NASA's Office of Small Business Programs," said Nelson. "Small businesses play a critical role in propelling our country forward with new technologies and scientific discoveries to maintain American leadership in space and benefit all humanity. I am confident his leadership will help NASA continue to promote and integrate America's small businesses into every aspect of our missions."

Prior to his NASA appointment, Deneal served as the director for the Defense Logistics Agency's Office of Small Business Programs, supervising all small business programs and contracting activities that equated to more than $45 billion of annual contract spending and $18 billion in small business spending. He also was responsible for maintaining strategic partnerships that attract small businesses into the defense supply chain, helping grow the national defense industrial base.

Deneal also previously served as the director for the Small Business and Industry Liaison Programs at the US Coast Guard, part of the US Department of Homeland Security. In this capacity, he led all small business and socio-economic related guidelines, policies, regulations and was the authority for planning and carrying out acquisition activities in support of small business programs.

From 2013 to 2017, Deneal served as a team lead small business specialist at the Department of Health and Human Services. His experience also includes supporting the Department of Education and US Department of Navy as a contract specialist.

In addition to his NASA role, Deneal also serves as the vice chairman of the Federal Interagency Office of Small and Disadvantaged Business Utilization Directors Council. This organization of federal small business program officials that meets regularly to exchange and discuss information on small business methods, issues, and strategies. ●

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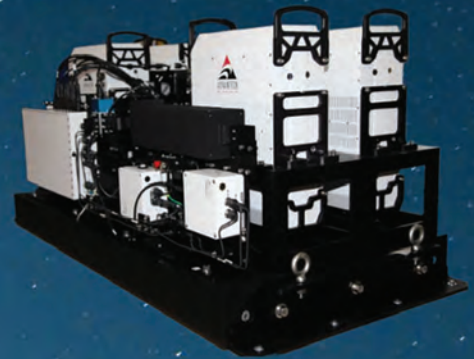
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