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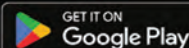
SATELLITE EVOLUTION

December 2023

GLOBAL

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REGULATION

Regulatory challenges and opportunities in the age of emerging satellite technologies

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- Satellites at the center - accelerating with AI and edge
- Kratos and Kacific: Partnering to connect the unconnected in Asia Pacific
- How to get more from your MSS satellites and spectrum

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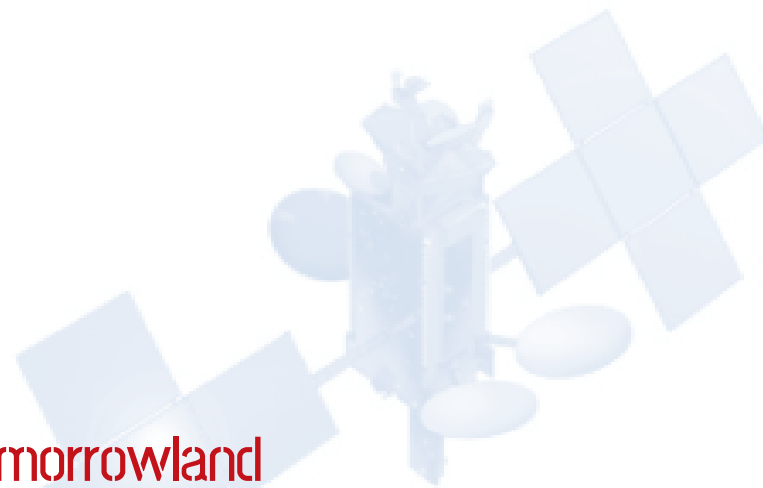
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Crispin Littlehales, Executive Editor ●●●

Defining the “space economy” is akin to pinning down a moving target. Some see it as the day-to-day progress of constructing ever more capable and cost-effective satellites; building rockets that can carry larger payloads using “greener” fuels; and improving communications in space using infrared lasers. Others are looking farther out to cislunar economic development where we have settlements on the Moon that serve as the gateway to deep space exploration. This is a mammoth undertaking rife with technological complexity but, to quote Buzz Aldrin, “I know the sky is not the limit, because there are footprints on the Moon.”

Of course, footprints are one thing and sustained lunar habitation is another. That said, there are more than just hopes and dreams afoot. The US, the European Union, Japan, UAE, India, Saudi Arabia, and China, among other countries, are already investing in a lunar economy. The most visible and coordinated effort is NASA's Artemis program which aims to fly the SLS/Orion with a live human crew around the Moon with a return trajectory back to Earth next year. Following that, Artemis 3 will land a four-person crew on the Moon's surface where they will remain for six and a half days. NASA's Artemis 4 is slated to dock with the Lunar Gateway in 2028 and in 2029, Artemis 5 will launch with the European Space Agency's Esprit refueling and communications module.

Meanwhile, a growing number of commercial companies are concentrating efforts to make a lunar outpost possible. The Swedish Space Corporation, which manages five ground stations that form part of NASA's Near Space Network, has plans in place to manage communications in cislunar space. Redwire, a US-based space infrastructure technology company, is part of a team which will enable the delivery of a NASA payload designed to support terrain navigation on the lunar surface with a weak-signal GNSS receiver and antenna. Redwire is also developing a heat treatment process that is similar to a microwave oven which may be able to transform lunar regolith into a solid surface. Another US company, ICON, is developing construction technologies for manifesting landing pads, roads, and habitats.

Those are just a few of the companies focusing on in-situ resource utilization (ISRU) of the wealth of materials on the Moon that can potentially be extracted to create oxygen, water, fuel, and building materials—all in support of sustainable habitation. Thomas Matula, Professor of Business Administration at Sul Ross State University in Texas, recently theorized that SpaceX's future fleet of Starship mega-rockets might one day be used not only to land humans and deploy full-size mining and construction equipment, but also be modified to create permanent facilities for habitation.

These are but a handful of examples. In the next 15-30 years we will see one mind-blowing innovation after another build a staircase to the Moon and beyond. Buckle up and stay tuned.

In this last issue for 2023, Matthew Evans and Alexis Martin of River Advisors share insight regarding the regulatory challenges in these times of emerging satellite technologies. We also speak with Karl Fuchs, Senior Vice President of iDirect Government about the ongoing battle against electronic warfare threats. In addition, Kratos and Kacific share the story of how they were able to connect the unconnected in the Asia Pacific region known as the “Ring of Fire”. Lewis Davies, Satellite and Space Systems Architect of TTP plc explains how to get more from MSS satellites and spectrum and Deloitte's Space Economy Acceleration Leader, Elizebeth Varghese, explains how automation, AI, and edge computing will exponentially improve the utility and efficiency of satellites.

Photo courtesy NASA



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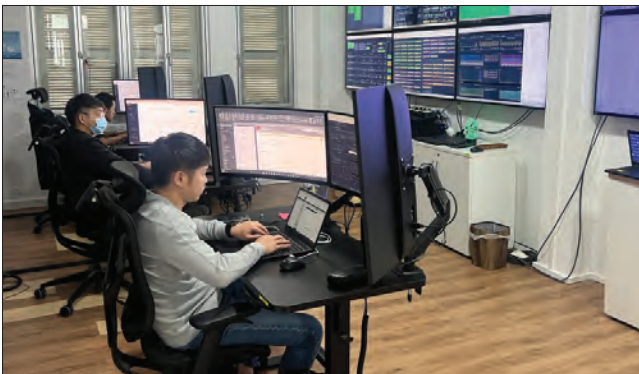
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British and European companies on the fast track of digital transformation in 2023

EUROPE: During 2023, over half of European firms have taken significant steps towards digitalization, focusing on enhancing their digital presence, according to the latest report *"Digitalization in Europe 2022-2023"* by the European Investment Bank. In a remarkable response to the COVID-19 pandemic, 53 percent of companies in Europe have expanded their online services, closing the technological gap with the United States. In addition, 69 percent of EU firms implemented advanced digital technologies in 2022, in contrast to 71 percent in the US.

However, the report also highlights a disparity in digital adoption across the EU, with only 30 percent of micro enterprises prioritizing digitalization compared to 62 percent of larger firms, underlining the need for inclusive digital strategies to encompass businesses of all sizes.

The European Union's commitment to digital transformation is evident in its allocation of over euro165 billion towards the Digital Decade objectives. This investment, particularly through the Recovery and Resilience Facility (RRF), is a testament to the EU's dedication to supporting digitalization in both the public sector and businesses. Different levels of digital transformation and funding allocation are observed across

EU member states, which have received a significant share of the Digital Decade budget.

In 2023, UK businesses have heavily invested in digital transformation, demonstrating resilience and adaptability in the face of economic challenges. According to a report by Boston Consulting Group, as referenced in Consultancy.uk, a significant number of executives from large companies are planning to increase their spending on digital initiatives. This surge in investment is driven by the need to adapt business models and capitalize on new revenue growth opportunities, even as a global recession looms. Key technologies such as artificial intelligence, blockchain, and the Internet of Things (IoT) are garnering substantial interest, with executives convinced of their crucial role in business success.

However, the path to digital transformation is fraught with challenges for UK companies. A study highlighted in Grand View Research reveals that many large UK businesses are struggling with a shortage of technical skills and the challenge of integrating new technologies with legacy IT systems. This situation is a significant barrier, potentially delaying the transformation process. Additionally, the healthcare sector in the UK is expected to witness substantial growth in digital transformation. This growth is primarily driven by the need for enhanced quality of care and the ability to respond effectively to changing health scenarios, as indicated by the increased adoption of technologies like Electronic Health Records (EHR) during the COVID-19 pandemic.

In this digital evolution, digital identity solutions, encompassing identity document verification, electronic IDs, identity proofing or authentication based on biometrics, access to identity data sources, and electronic signatures, among others, play a crucial role when it comes to digitization. Digital identity technologies not only streamline

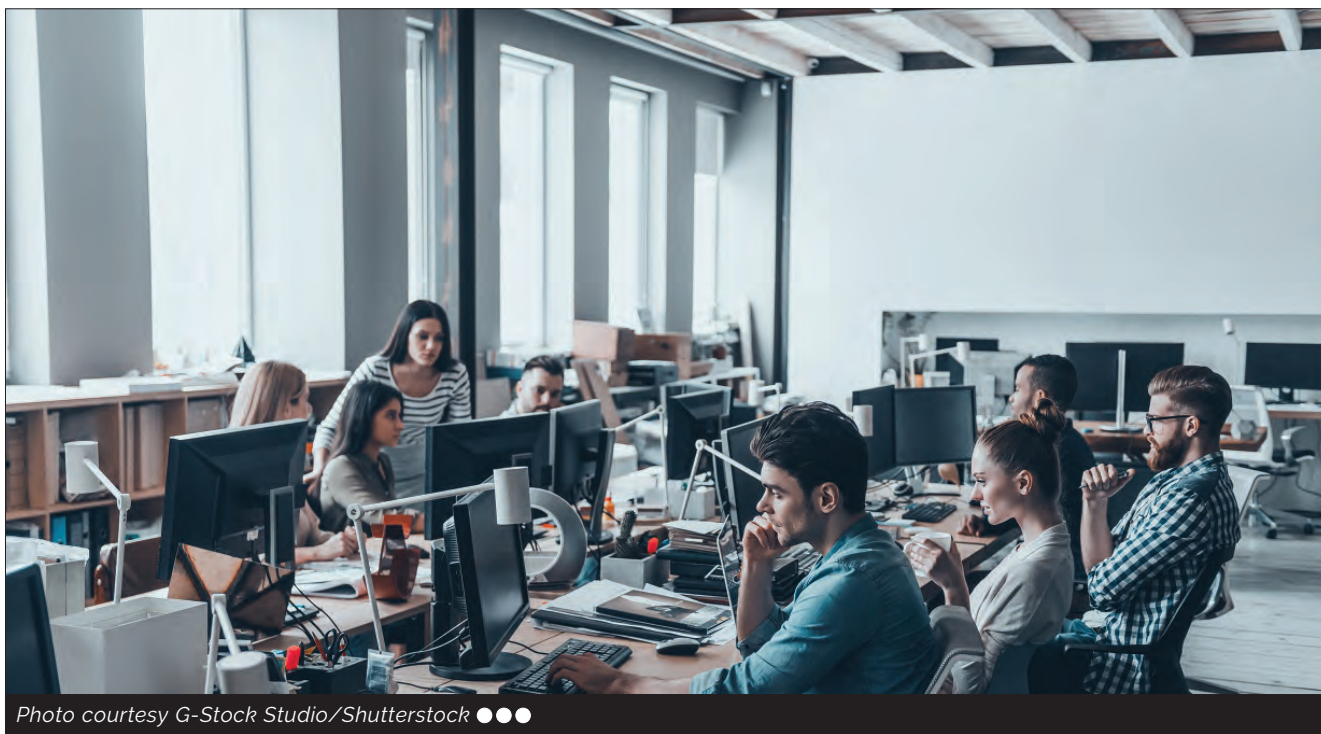


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business processes but also strengthen security, leading to significant time and cost savings.

A very simple and clear example of how digital identity solutions are key for companies of any size and sector to digitize their processes is electronic signatures. Signicat, the pan-European leader in Digital Identity, recently released a study commissioned from Forrester Consulting on the Total Economic Impact™ (TEI) of Signicat and, found that companies saved on costs and processes through the use of the digitalization of signatures as well as avoiding more than 1.1 million printed pages, after the first year of implementation of their solutions.

On the other hand, the study found that Digital Identity solutions could improve the operational efficiencies of a company from an automated identity verification process resulting in 40,000 hours per year saved in identity verification.

These findings not only underscore a growing opportunity for businesses in the digital identity sector but also for the private and public sectors: as European companies continue to embrace digital transformation, the demand for robust digital identity solutions is expected to rise, offering a promising market for innovation and growth.

While businesses and governments in Europe are on the right track toward their digitization, there is still a lot of work to be done, especially with the arrival of the eagerly awaited EU Wallets. A key element in Europe that will once again test the ability of both public administrations and private companies to offer 100 percent digital access to their services, this time through a single point of access: their national digital identifications. ●

GSOA welcomes India new Telecom Bill

INDIA: The Global Satellite Operators Association (GSOA), has welcomed the introduction of the Telecom Bill in the Indian Parliament. In particular, the chapter on spectrum assignment for space-based services is a major step forward in recognizing and leveraging the full potential of satellite communications to foster innovation, bring increased connectivity to India's citizens and advance the country's digital transformation.

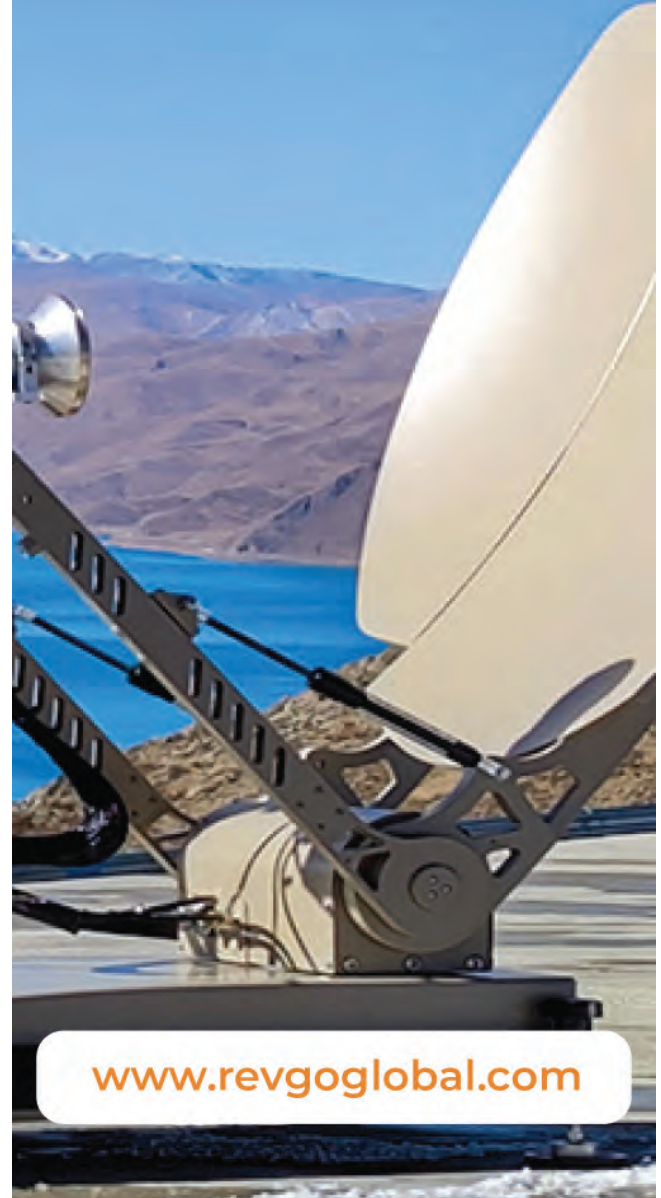
The Telecoms Bill's approach on administrative assignment of spectrum for a range of telecommunications services, including many satellite-based services and in-flight and maritime connectivity, is a forward-looking initiative toward aligning India's satellite industry with long-standing global standards & best practices. This approach not only ensures appropriate distribution of satellite-based services, but also enables the industry to continue innovating, investing, and working towards universal connectivity, while fostering a level playing field for all players.

"Satellite is one of the most exciting and dynamic industry sectors, with an increasingly innovative landscape", said Isabelle Mauro, Director General of GSOA. "We are very appreciative of the Ministry's dialogue with industry and efforts to understanding and incorporating



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industry's perspectives in the new Bill. We look forward to continuing our dialogue with the government to ensure that the power of satellite communications is fully leveraged, to bring a connected future that delivers growth and prosperity to the entire population of India." She added.

Ensuring that the spectrum assignment for satellite-based services is executed in a manner that maximizes the potential of satellite technology is crucial for the development of India and for extending connectivity and the benefits of digital inclusion to all Indian citizens, including those in rural and other difficult-to-serve areas.

Having the right policy and spectrum assignment process in place will not only open up investment opportunities in India, but will also enable satellite communication services to effectively ensure connectivity in far-flung villages, bridging the digital divide and supporting the implementation of government's programs such as Digital India. ●

Hughes launches new JUPITER-powered satellite internet plans for consumers

NORTH AMERICA: Hughes Network Systems has introduced new Hughesnet® high-speed satellite internet plans that allow customers to connect, stream and play wherever they live. The plans leverage capacity from the new Hughes JUPITER™ 3 satellite to offer faster speeds

and unlimited data, as well as feature low-latency Hughesnet Fusion® and Whole Home Wi-Fi.

Bringing unprecedented capacity for internet connectivity to the Americas, the Hughes JUPITER 3 is the world's largest commercial communications satellite. This ultra-high-density satellite features more than 300 spot beams that alleviate congestion and deliver a faster experience. The state-of-the-art ground system for JUPITER 3 has a new dedicated fiber backbone to reduce latency and artificial intelligence (AI) that automatically reroutes traffic around congestion. The JUPITER-powered Hughesnet plans feature download speeds up to 100 Mbps.

The Hughesnet Fusion plan allows customers to enjoy gaming and playing online like never before. Introduced to the market last year as the first consumer-ready multipath technology, Hughesnet Fusion seamlessly blends satellite and wireless technologies into a low-latency, more responsive internet experience—now with unlimited data and faster speeds. The Whole Home Wi-Fi lets users connect, stream and play anywhere in their home.

"Customers expect to be able to stream, videoconference and play games online," said Peter Gulla, Senior Vice President, Hughes. "The new Hughesnet is designed to enable these applications with fast speeds, unlimited data and new low-latency Fusion plans. Since inventing satellite internet in the 1990s, Hughes has been dedicated to constantly innovating our service to meet the needs of customers beyond the reach of cable and fiber connectivity."



Photo courtesy metamorworks/Shutterstock ●●●

The new Hughesnet is a fundamental reinvention of what satellite internet can be."

Rural customers will also have access to new Hughesnet for Business plans optimized to support the online applications they need to expand and grow. All Hughesnet for Business plans include commercial installation, Express Repair Premium and 24/7 business-class phone support. Plus, businesses leveraging Fusion plans will have expanded capabilities for common cloud-based collaboration tools.

Hughesnet was named the Best Satellite Internet Provider of 2023 and Best Internet Provider for Rural Areas of 2023 by US News & Report 360 Reviews. CNET has also named Hughesnet as the best satellite internet provider for reliable speeds. ●

Equatorial Space inaugurates new HQ in Singapore

SINGAPORE: Singapore's launcher startup, Equatorial Space, has revealed a new, 12,000 square foot headquarters and production facility in the Tuas area of the island-state at an opening ceremony attended by 40 representatives from Singapore's government agencies and fellow industry players.

The facility features a 40ft-container-accessible production floor, and a 420 square foot avionics & payload processing room being fitted to ISO 8 standards to support its suborbital launch services starting 2024, and orbital launches beginning in 2026.

"Over the last six years we had 100 reasons to close down, and just one to carry on. We chose the latter," says Simon Gwozd, CEO of Equatorial Space.

"Our new facility is a testimony of our resilience – almost four times the size of all our previous facilities combined and providing space for our sounding rocket and microlauncher development programs," he added.

Jonathan Hung, the Executive Director of Singapore's Office for Space Technologies and Industry (OSTIn) was the Guest of Honour at the ceremony.

"This is not only a celebration of a Singapore startup expanding, it is also a celebration of achievements that ESS has secured to realize its vision of making spaceflight more affordable, accessible and perhaps most importantly – sustainable," said Mr Hung during his opening remarks

"I have visited many rocket factories – and it is truly a feat to be in one in Singapore," he summed up.

Equatorial Space is a Techstars-backed, Singapore-headquartered rocket propulsion and launcher company started in 2017.

With its proprietary propulsion technologies, Equatorial Space builds game changing, eco-friendly, low-cost and explosives-free rockets to foster the future of space exploration. In 2020, Equatorial Space became the first company in Southeast Asia to test launch a commercially developed rocket prototype, testing its core technologies. It will begin orbital launch services in 2026. ●

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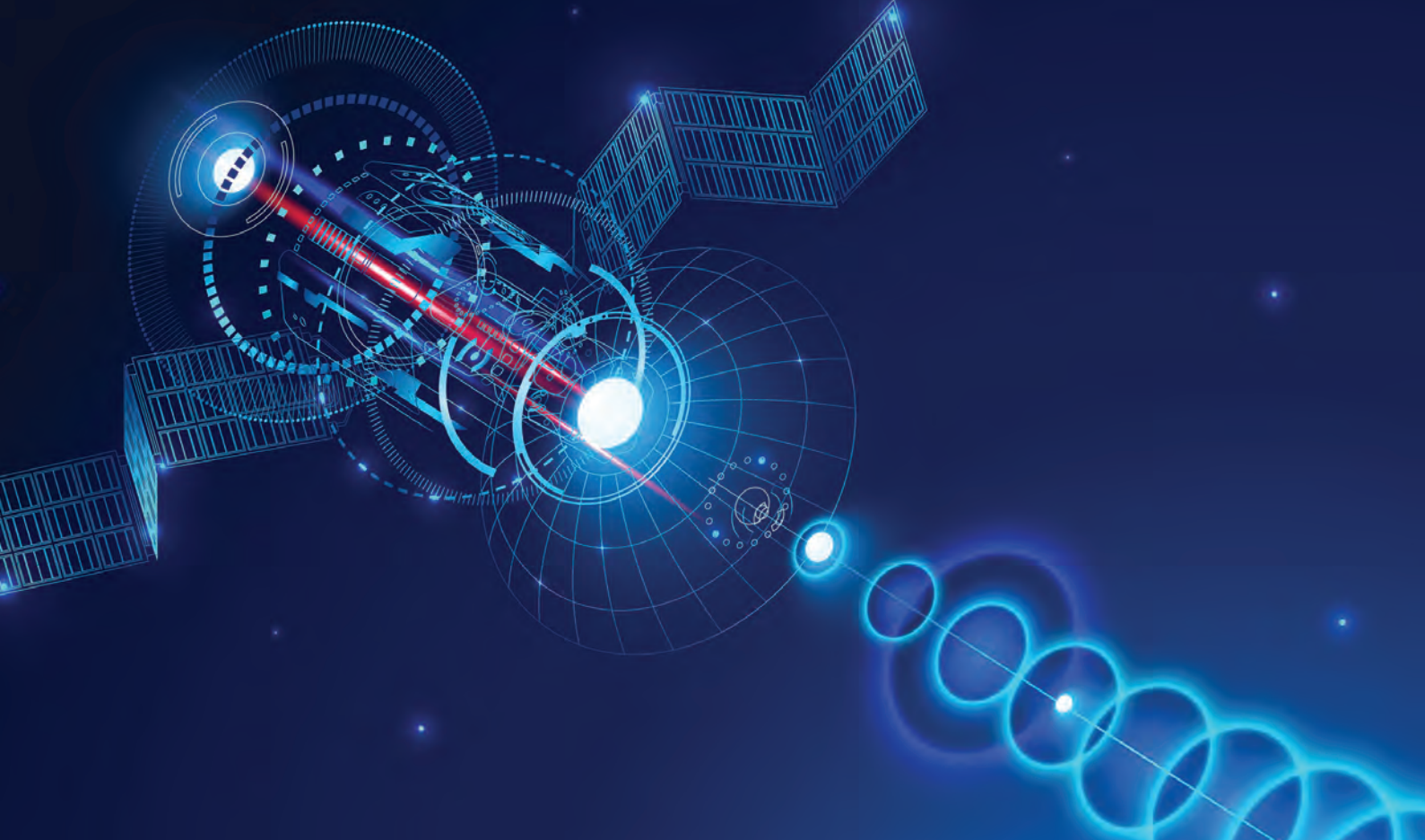


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Satellites at the center—accelerating with AI and edge ●●

With the era of the spacefaring economy upon us, the evolution of satellites has the potential to make life better for everyone on Earth and in space. Satellites are already aiding in the conservation of Earth's resources. The application of automation, artificial intelligence (AI), and edge computing will exponentially improve the utility and efficiency of satellites.

Elizebeth Varghese, Partner/Principal. Space Economy Acceleration Leader at Deloitte

Sacrifice, perils, opportunities—we are embarking upon one of the most exciting moments in human history, what I term “Stellar Singularity.” This shift represents the time and age where we see a robust spacefaring economy, a moment where technology, life, and business all operate together across the cosmic landscape.

SATELLITES AT THE FRONTLINES

The use of data obtained from Earth observation has exploded.

In addition to hardware, machines, and processes, countless software applications are used in space for the betterment of the earthbound. For example, collecting information about adverse weather conditions that might impact not only homes but also crops—or the ability to foresee potential droughts or floods, which we can track

using remote sensing satellite data—is a game-changer. We’re obtaining more critical data daily on whether preventative actions to slow climate change are working and to what extent. Just imagine the possibilities as our technology advances.

There is a tremendous increase in the number of satellites, constellations, and Earth observation satellites. They’re able to capture more data, more comprehensive data sets, and also at a much higher level of fidelity. While this creates opportunity, it also inherently creates the problem of data ingestion, transmission, and processing, especially across distances in space.

MOVING TO THE CENTER WITH AI

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Elizebeth Varghese, Partner/Principal, Space Economy Acceleration Leader at Deloitte ●●●

with orbit prediction, object detection, control satellite navigation, movement, and logistics. AI can estimate the location of a satellite and Residual Space Objects (RSOs)—commonly called space debris—and give satellites the ability to respond with onboard sensors without waiting for communications from terrestrial operators or terrestrial technology.

2. **Operator Support** - AI can assist human operators who monitor satellite performance, manage large constellations, and hand off all the low-value activities to AI so that operators can focus on tasks with higher cognitive load. For example, we can use AI algorithms to automatically respond to data coming from multiple sensors and determine the most efficient route for uplinks and downlinks across all the terrestrial nodes and networks.
3. **Ongoing Updates** - AI can be enabled with containerized apps, which can be uploaded even after launching a satellite. One example of a use case is where we use AI to enhance the quality of an image or a photograph, which a prior-generation sensor or camera may have taken and produced a lower-quality image.
4. **Cybersecurity Enhancement** - AI can analyze test data much faster, identify heuristic patterns, and predict and detect anomalies, which can also improve cybersecurity resilience on board when there are automatic threats.
5. **Analysis of Disparate Data** - AI can ingest telemetry data from satellites and consolidate datasets from different sources. For example, companies are using AI to analyze satellite data that may include information on harvested trees, vehicle loads, and transportation routes to detect what is happening within the supply chain.

TO THE EDGE AND BEYOND

Instant communication. Instant data. That's what is possible. Edge computing can improve a wide range of applications

that have become central to our work and life. For example, it can process satellite imagery onboard the satellite rather than transmitting it back to Earth for processing. This can significantly reduce latency and enable real-time applications such as disaster monitoring and tracking ship movements¹. Similarly, it can process satellite navigation signals onboard the satellite rather than transmit them back to Earth for processing, improving the accuracy and reliability of satellite navigation systems². It can be used to run autonomous control algorithms onboard spacecraft, enabling decisions and actions without human intervention³. Instead of being forced to make a split-second life or death situation, edge computing allows for spacecraft autonomy⁴.

OPTIMAL ACCELERATION

For AI to best assist satellites, the continuation of investing in research is necessary. There needs to be an ecosystem dedicated to establishing data and knowledge-sharing mechanisms, developing standards, and training the workforce. This approach will improve our AI algorithms while simultaneously teaching AI what is considered critical information and how to send it.

The satellite industry can harness the power of AI to improve operations, problem-solving, and innovation by working together and investing in AI research and development, establishing data and knowledge-sharing mechanisms and partnerships. We need an ecosystem where agencies, private companies, and research institutions exchange the latest and greatest thinking across AI. When this information exchange is activated, we can share how to improve our AI algorithms and models and teach AI to send critical information across this exchange.

Advocating for data sharing through organizations like Low Earth Orbit Science and Technology Interagency Working Group of the National Science and Technology Council (NSTC) and the National Artificial Intelligence Advisory Committee (NAIAC) will further enable AI utility.

OUR JOURNEY TO STELLAR SINGULARITY

The world is changing, but this new journey doesn't have to be frightening, and we don't have to be passive observers. Spacefaring speaks to our nature as curious, sentient beings equipped with the potential to work together toward a better future for ourselves. Satellite evolution is the answer to better understanding the world around us and how to navigate it. If used properly, AI and automation could be the tools to unlock this potential. As all of our lives are woven into this fabric of exploration, the future of data at the edge is limitless. ●

¹ *Real-time satellite imagery processing with edge computing* by Exo-Space (2023)

² *Edge computing for satellite navigation: A new paradigm for positioning and timing* by Kayhan Space (2023)

³ *Edge computing for spacecraft autonomy: A new approach to mission control* by SpaceChain (2023)

⁴ *IBID*

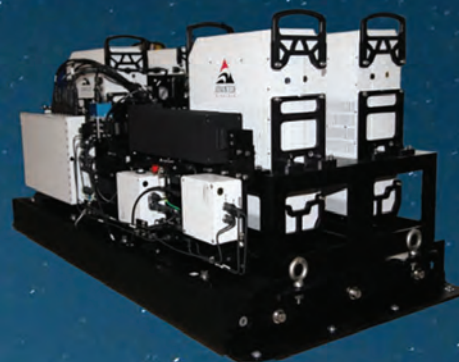
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Regulatory challenges and opportunities in the age of emerging satellite technologies

Regulators from across the globe are having to change the way they operate to keep up with the ongoing evolution of the industry. Skillful licensing and regulatory initiatives are now being devised to align with the rapid changes and are likely to form the benchmark for other markets and regions in the future.

Matthew Evans, Director of Regulatory Affairs and Alexis Martin, Chief Consulting Officer for River Advisers

The satellite sector continues to grow in size and dynamism, driven by a rapid increase in new firms and the continued growth of Non-Geostationary Orbit (NGSO) mega constellations. At the same time, major technological advancements in areas like satellite and terrestrial 5G convergence, satellite launchers, manufacturing, and terminal devices have rapidly increased complexity, leaving regulators to grapple with "regulatory blind-spots". Why does this matter? Because when technology outpaces regulation, uncertainty abounds, potentially creating barriers to innovation and new satellite services.

THE NEED FOR REGULATORY FLEXIBILITY

We are seeing a general global shift away from the more prescriptive model, which enables regulators to distinguish between types of licenses according to limited, pre-defined and often outdated satellite and terrestrial

technology types. These are being increasingly cast aside in favor of "technology and service neutral models", in which regulators can set out a general envelope of conditions in a more flexible and tailored manner. This results in applicants for various types of service or technology benefitting from a degree of tailoring to their specific licensing terms to ensure greater compliance.

Moreover, many regulators are employing a new and dynamic mechanism, the "regulatory sandbox" which lets regulators closely monitor and evaluate the testing and development of new technologies in-country. This facilitates customization of licensing exemptions and conditions of market access. This trend, which has become prevalent within the Middle East region, where the Telecommunications Regulatory Authority (TRA) of Oman and the Communications, Space, and Technology Commission (CST) of Saudi Arabia have both adopted this approach. Most remarkably, India, one of the most highly regulated and strict telecoms markets, announced its own sandbox in the field of digital communications via a consultation paper issued in June 2023. This adoption in India alone, illustrates the significance of this step-change.

EMBRACING IOT DEVELOPMENTS

It has been forecast that the global retail market for satellite Internet of Things (IoT) products will reach close to US\$2 billion by 2030. As a result, IoT has recently been a growing area of focus as governments and regulators recognize the rapid growth and importance of satellite platforms as "connectivity enablers" for multi-sectoral, remote, and often mission-critical applications.

The development and utilization of IoT technologies



Matthew Evans, Director of Regulatory Affairs, River Advisers ●●●

ties into the broader policy goals specified in digital transformation programs in both advanced and developing economies. This has led national regulators to introduce and adapt new licensing regulations, spectrum assignments, and technical conditions to enable low data rate satellite IoT platforms and services. Recent examples of such countries include Australia and Egypt, with more regulators expected to follow suit. With many programs aiming for demonstrable results within the next ten years, the heat is on for regulators to put these steps into place and give stakeholders further opportunities to influence and shape national frameworks.

OVERCOMING REGULATORY HURDLES FOR D2D

Last year also saw several satellite players break cover in the race to plug the coverage gaps for mobile cellular device users and their mobile operators. Known as direct to device (D2D) connectivity, this holds the potential to be the largest single market opportunity in the history of the satellite industry. However, the operators' prize of seizing this market is heavily dependent on the many unresolved regulatory and technical issues, which will undoubtedly play out extensively and intensively over the coming years.

The operators pursuing terrestrial mobile-allocated spectrum for their satellite connectivity under Mobile Network Operator (MNO) partnership models, are likely to feel the most pressure. Clear regulatory consensus has yet to be reached on this scenario, where interference risks and related coordination concerns are well-known. Satellite services by their very nature transcend national borders, and continents such as Europe may require precise coordination with multiple countries if operators are to guarantee services and protect other spectrum users within the same satellite footprint. To achieve success, regulators must now evaluate their frequency assignment rules and the International Telecommunication Union (ITU) radio regulations when licensing such use and the arrangements for doing so.

In February 2023 - while not excluding the possibility to license future satellite use - the German regulator, Bundesnetzagentur (BNetzA), raised severe interference concerns regarding plans to re-use terrestrial spectrum over the region for satellite services. During the same month, the Federal Communications Commission (FCC) of the United States also published a Note of Proposed Rulemaking (NPRM) on new regulations for enabling direct-to-cell satellite networks. Known as *Supplemental*

Coverage from Space, the proposed framework would allow interested satellite operators to modify their Part 25 authorizations and operate in terrestrial "flexible use" spectrum (without primary, federal, or non-federal satellite allocations), in partnership with terrestrial licensees.

The D2D topic will also be addressed at the upcoming WRC-23 with the view to include it in the Agenda for WRC-27. While there is no consensus yet on the frequency bands, there are proposals being discussed, and national regulators acknowledge that this topic cannot be ignored and requires further study. These include Ofcom and the National Frequency Agency (ANFR) of France. This will remain a topic of interest as long as stakeholders are having to pioneer licensing solutions and local regulatory arrangements on a country-by-country basis.

UTILIZING INDUSTRY EXPERIENCE

The new and dynamic environment we now find ourselves in necessitates ever closer cooperation and problem-solving between industry, international bodies, governments, and regulators alike. It is also clear that to survive and deliver new services and technologies successfully on a global scale, stakeholders must adopt an agile, strategic, and creative approach to tackling the regulatory ambiguities. Only then will the barriers to innovation be truly removed.

One way of achieving this is utilizing the services of companies like River Advisers who provide critical consulting for international spectrum regulation, market access, and wrap-around support for ambitious emerging technologies within the space and satellite sector. River Advisers, formerly known as ManSat, offers experience and knowledge gained from being at the forefront of these issues. Working with both regulators and stakeholders, the expertise provided through consultancy offerings is key to delivering solutions capable of supporting new and existing satellite services and give emerging technologies the chance to thrive around the world. ●



Alexis Martin, Chief Consulting Officer, River Advisers ●●●

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● ● Karl Fuchs, Senior Vice President of iDirect Government

Satellite Evolution Global

Q&A

The ongoing battle against electronic warfare threats ● ●

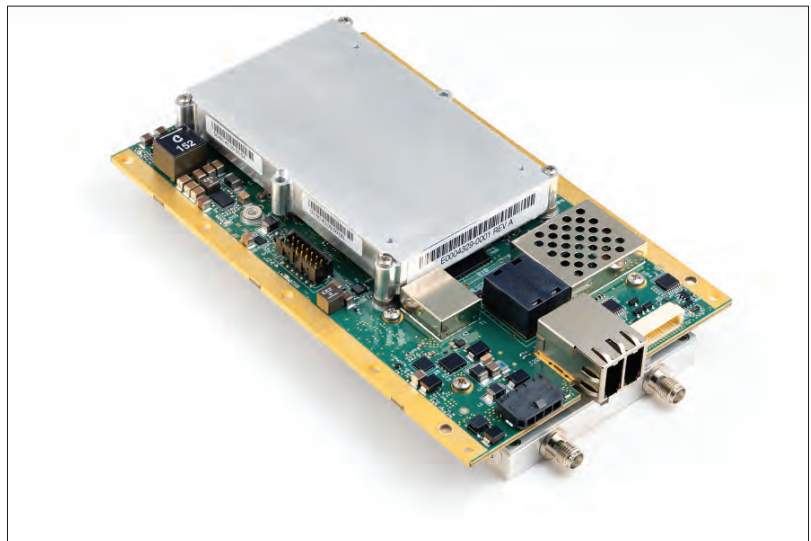
Electronic warfare threats are not only increasing in number, but they are also increasing in terms of sophistication. The only way to stay a step ahead of the enemy is to make sure your satellite modem can stand up to myriad cyber and EW threats while withstanding the rigors of the tactical edge. Karl Fuchs, Senior Vice President of iDirect Government, explains how his company is combining technological acumen and a wealth of experience to enable secure MilSatCom, even in the heat of battle.

Crispin Littlehales, Executive Editor, Satellite Evolution Group

Question: Electronic warfare is on the rise, not only in Ukraine but all around the world. What is being done right now to mitigate EW attacks and is it enough to stay one step ahead?

Karl Fuchs: Electronic warfare (EW) attacks take many different forms, and there's never going to be just one silver bullet to take care of all the threats. Quite often, people think of EW as simply jamming which can itself take on several different forms, but some electronic attacks are much more sophisticated. You may remember a few years back, there was an American stealth drone that was safely landed in Iran by means of an electronic warfare attack. This wasn't simply jamming; the adversary was able to spoof the GPS signals and convince the drone that it was someplace that it really wasn't. This is just one example of how EW attacks can take many different shapes and sizes.

It is almost impossible to stay ahead of these attacks. Just as in the world of cybersecurity, we must be right a million times, and they only need be right once. It is a never-ending struggle. At iDirect Government, we are investing a lot of resources, as well as research and development,



All photos courtesy iDirect Government ● ● ●



into mitigating EW attacks. Indeed, we are introducing a new set of capabilities, including an anti-jam technology called Communication Signal Interference Removal (CSIR™).

Question: How does Communications Signal Interference Removal technology work?

Karl Fuchs: CSIR™ is a branch of anti-jam technology known as signal excision. Anti-jam technology typically involves spread spectrum and requires an enormous amount of bandwidth. CSIR™, however, is unique in a couple of ways. First, it uses a set of digital signal processing (DSP) filters that can remove interferers without having any previous knowledge of the types. In addition, it requires no additional bandwidth.

iDirect Government is the only company bringing this tool to market in an integrated satellite communication package. We offer it in a couple of different form factors. One is a standalone box which can be utilized with pretty much any other radio frequency technology. Recently, we have integrated it with our Evolution Defense product line and is available on both our g-Series remotes DLC-R and the 450mp multi-waveform, multi-orbit SDR modem. It provides protection on all channels and can be inserted into any receive chain and mitigate unknown interference in a variety of scenarios with zero added complexity for users.

Question: We hear a lot about the US DoD's new policies when it comes to partnering with commercial companies and embracing off-the-shelf technology. How does this approach translate into the delivery of more effective cybersecurity?

Karl Fuchs: This new path that the DoD is taking is all about leveraging off-the-shelf technology and with good reason. That direction has the potential to bring features, functions, and capabilities to the warfighter more quickly than building something specifically for a DoD defense use case. Still, I see that approach as a double-edged sword. When it comes to cybersecurity, there are several concerns. Off-the-shelf technologies quite often use code that is sourced from many different locations. Often, they'll leverage open-source technology, and you have to be careful with that. You may remember that in 2020, there was an attack through Solar Winds, a major US software company that

provides system management tools for network and infrastructure monitoring. Off-the-shelf technology was leveraged, and there was malicious code within it. It was installed to the detriment of the US Government.

When you are dealing with zero trust architecture, everything on the outside of the firewall is seen as potentially bad, and everything within the firewall is trusted. Using a product built around open-source software has too many vulnerabilities. The nightmare within the DoD is that some sort of malicious code makes it into either the communication or computing networks. If something of that nature happens, it could trigger the loss of communications and computer processing. So, while it is good to embrace off-the-shelf technology, the government and vendors need to be extremely cautious about software provenance and make certain that all the elements making up the software are verifiable and trustworthy.

Question: What benefits do partnerships between the DoD and commercial players yield?

Karl Fuchs: I believe it is vital for industry to partner with the DoD. To give you an example of what industry has to offer, especially in the world of security features and functions that are using the wireless systems that don't really exist in terrestrial communication, there is something known as transactional transmission security. With regular communications security, you simply encrypt the data traveling from point A to point B, but in the world of radio frequency communication, adversaries can see essentially who is talking to whom and how many remotes are in a network. When they take that sort of information and combine it with other intelligence, it can cause problems for the good guys. The job of transactional transmission security is to obfuscate all that information from the adversaries.

iDirect Government has developed a version of this technology based on several generations of transmission security for geosynchronous satellites, and we are now looking to partner with the DoD to work on transmission security for the new MEO and LEO satellite constellations. I believe that when industry and the DoD work together as a team, it is possible to develop a protocol as valuable and feature rich as transmission security.

Question: How difficult is it for warfighters to use this technology on the battlefield?

Karl Fuchs: While the systems are difficult to develop, a lot of the hard work that we do at iDirect Government is specifically designed to make the user's interface and experience as simple and easy as possible. We've thought through exactly what's happening in the heat of battle. Warfighters cannot be worried about passwords and key exchanges. Our offerings that meet the DoD's transmission security (TRANSEC) requirements handle all that complexity transparently in the background. We've found ways and have systems in place to establish what is known as the chain of trust in the remote before it is deployed to the network. Updates happen transparently over the course of time. We've managed to do that in a very secure fashion which has been approved not only by the DoD but

also by the National Institute of Standards and Technology (NIST) and the National Security Agency (NSA).

Question: The physical architecture of SATCOM modems needs to accommodate SWaP and industry requirements. How can that be accomplished?

Karl Fuchs: SWaP is extremely important. In fact, it is almost everything on the remote side, and it's very important on the hub side for satellite communications. We partnered with a company called Xilinx, which manufactures some excellent Field Programmable Gate Array (FPGA) chips. These are at the heart of our digital system. What we've been able to do in cooperation with Xilinx and others is to develop a new type of hardware—a single FPGA in which normal waveform processing can happen simultaneously on a single chip and is separate from the encryption domain of that chip.

What that means to the end users and to the industry in general is that we can have an encryption done inside a single piece of silicon and that encryption can be certified by NIST or other organizations for things such as the Federal Information Processing Standard (FIPS) 140-3. On that same piece of silicon, you can run all the waveform processing and make updates to the waveform processing firmware as needed—all without impacting the FIPS certification of the encryption module itself. To achieve that previously, we had to have two separate chips: One for encryption, and one for waveform processing. Now, with this integration, we can do it on a single chip, so the size, weight, and power (SWaP) are dramatically improved.

Question: How does iDirect Government keep its finger on the pulse of what's needed in the battlefield when it comes to secure communications?

Karl Fuchs: Our company is focused and organized to do exactly that. First, a significant portion of our personnel have government and military backgrounds. We have people in our development engineering group and our Technical Assistance Center who were former users of iDirect equipment in the battlefield. We have PSE (professional services engineers) use sales engineers who are embedded with people from organizations such as the US Special Operations Command (SOCOM) and the Defense Information Systems Agency (DISA). They fully understand what the warfighter in the field is going through, and they talk to people who are using this equipment daily. That gives our staff a good idea not just how an individual uses our systems today but also what requirements they will have 18 months to 24 months in the future.

Question: What is a Defense-in-Depth approach and how can that help to keep MilSatCom secure?

Karl Fuchs: When you are building a piece of hardware or software for the US military, you must be able to design it from the bottom up with security and defense in mind. At the very base level, we now have a piece of hardware that can do on chip encryption. This is something that's important to a military organization. Then, we layer on top of that all the other components that are part of zero trust architecture, which is a segment of what's referred to as

the Root of Trust. Then, there is the software provenance layered on top of that. Each layer is as important as the next. We do this Defense-in-Depth all the way up to the protocol stack, everywhere from the base physical level to the user experience and authentication.

Question: What plans does iDirect Government have to improve MilSatCom security in the next 1 to 5 years?

Karl Fuchs: What is driving our roadmap are security and resiliency. In terms of resiliency, we are actively working on building very robust anti-jam systems. Part of the basis of that is the CSIR™ technology with spread spectrum capabilities and low probability of intercept (LPI) as well as multi-orbit capabilities. If an adversary tries EW to jam the system, these elements are in place to protect it. Should an entire LEO constellation be taken out, our solution would make it possible to resiliently jump to a MEO constellation, giving an unparalleled level of resiliency for the network.

As for the security aspects, in addition to all we are doing to enhance zero trust architecture, we employ the Security Content Automation Protocol (SCAP), which is essentially penetration testing on operating systems and other pieces of software that is conducted by the DoD and NSA in the United States.

They report to us and to others any vulnerabilities that exist. iDirect has an entire team of specialists who are dedicated to making sure that we address and close all those vulnerabilities with the appropriate patches in a timely manner. We use these tools to ensure that adversaries cannot implement malicious software or firmware into our system. Of course, we are constantly seeking ways to further reduce size and weight and maintain the power needed.

On October 31, 2023, iDirect Government released its REVOLUTION 450mp (man portable) SDR modem with the Evolution Defense 4.6 software, which incorporates all the security features we've discussed. The new system gives the DoD options for satellite orbits and waveforms, including secure satellite communications and intelligence, surveillance, and reconnaissance (ISR). Featuring a small footprint with an overall 30 percent reduction in SWaP, the new system only requires one hook up. It exemplifies the direction we are taking at iDirect Government to deliver security, resiliency, and ease-of-use to the warfighter. ●



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Kratos and Kacific: Partnering to connect the unconnected in Asia Pacific

Delivering high-quality, accessible bandwidth to individuals living in remote locations with challenging terrain is a daunting proposition, particularly in the "Ring of Fire" which includes Indonesia and the Philippines. Fulfilling that need at the affordable price points defined by UNESCO and ITU presents even more of a challenge. Kacific Broadband Satellite Group and Kratos share the story of how they were able to accomplish those goals and potentially improve the lives of more than 600 million people across 25 countries in the Asia Pacific region.

Crispin Littlehales, Executive Editor, Satellite Evolution Group

On December 26, 2004, a tsunami devastated coastal communities in 14 countries in the Asia Pacific region killing 227,898 people. Christian Patouraux, then a consultant in the satellite sector, was caught in the midst of that disaster, and the memory of it informed the founding of his company, Kacific Broadband Satellite Group.

"I put together a humanitarian action with a couple of friends to rebuild the livelihood of some of the fishermen," Patouraux recalls. "We were helping fishermen rebuild boats, but I realized that there was more interest in the internet in my office."

That started Patouraux thinking about the massive need for internet access in the numerous rural and remote areas in many parts of the Pacific and Asia. Buoyed by the support of a small group of friends, a half million dollars in seed money, and 28 years of experience in the satellite industry, Patouraux began building relationships with operators, manufacturers, and potential customers. These efforts paid off, and eventually Patouraux partnered with Boeing to design and develop the company's first satellite, Kacific 1, which was launched into geostationary orbit atop a SpaceX Falcon 9 on December 16, 2019—fifteen years after the tsunami.

WIND, RAIN, AND FIRE

The Asia Pacific (APAC) region is characterized by mountainous terrain and expanses of water between the many island communities, which makes it impossible to serve using fiber or microwave. "The terrain is too difficult and the demand per activity center is not large enough,"



Christian Patouraux, CEO, Kacific ●●●

explains Patouraux. "What you have with broadband satellite is the ability to pinpoint a beam at these activity centers. You just put a small beam of high-power connectivity for a two-way communication exchange. By pinpointing those beams to match the various pockets of demand, satellite is able to compete with all the terrestrial systems."

According to Patouraux, Kacific 1, which has 56 spot beams, also complements the terrestrial systems located in major cities. "The internet is not very resilient, even in the middle of capital cities and we have about 15 percent of our customers using our services for backup," he notes.

"We live here in what is called the Ring of Fire. There are volcanic activities, earthquakes, landslides, and tsunamis. Now with global warming, we have typhoons and



John Loke, CTO, Kacific ●●●



Kacific Teleport at Broken Hill, Australia ●●●

tropical cyclones. Communities, cities, and regions here are vulnerable to such disasters and satellite provides an excellent response to that," says Patouraux. "The speed of deployment is a critical attribute of satellite in the aftermath of a disaster," he adds. "You have no connectivity, and you bring a terminal, install it in half an hour, and, in some cases, just push a button and the motorized system points at the satellite, and you have connectivity within two minutes."

THE RIGHT STUFF

Of course, putting together a robust cellular network from space that provides a high level of frequency reuse means having the right technologies in place. "You need to have a very large amount of bandwidth repeatedly pushed through a high throughput satellite in order to meet the price points that will be palatable to the market you're going after," Patouraux explains. "We also wanted to serve every area of a large country like Indonesia with the same quality of service, and that meant we needed to match the power of the satellite with an equivalent ground system."

"We had to make sure that the ground system would not give us problems and that the technology on the ground would match the technology of the satellite. We pushed the envelope a little bit further in order to try to scrape the bottom for whatever additional efficiency we could get," Patouraux remembers. "That was important for us because we wanted to push the prices down and have a higher volume."

The other goal was to de-risk the project as much as possible. "We wanted to work with world-class operators and world-class manufacturers to ensure the level of quality and resiliency that we needed as well as to establish the reputation required for the project to be seen as reputable," adds Patouraux.

Kacific's relationship with Kratos evolved early on in the company's history, growing sporadically during interactions at various industry gatherings and culminating in a contract whereby Kratos would build the end-to-end ground infrastructure for Kacific's new network. "I'd like to think that Kacific came to Kratos based on our experience and recommendations they had received from other

parties," notes Mark Lambert, President of Kratos Communications, Ltd. "We had installed many gateways in numerous countries around the world and we knew how to import products into the countries that were of interest to Kacific. Our approach to the project was to help all the way through the entire process. We were willing to discuss, to share ideas, and to compromise where necessary—to work together as a partner and deliver the optimum system."

TREAD CAREFULLY

The selection of the gateway location for Kacific included several important factors. Notes Patouraux, "You have to work with the locals and the culture of those communities. As you provide the internet, you're going to disturb the status quo so you must be prepared to work that out with members of each community."

"When you choose a teleport location, you need to make sure that for the next 15 years, this is going to be a home for these very expensive and delicate machines," he continues. "You want to put them in an environment where they are going to be well-connected, well looked after, and where they are going to be able to express their resiliency."

Kratos worked with the team to conduct site surveys of several different potential sites and helped Kacific work through their decision process as to which would be the premium locations. "Compliance with each country's regulatory requirements was a priority," states John Loke, CTO for Kacific. "For instance, in order to operate in Indonesia, we needed to establish a local telephone operation to meet the specific regulatory demands. Additionally, we sought to partner with hosts with existing infrastructure, such as diesel generators, uninterruptible power supply (UPS) systems, and incoming fiber connections."

In addition to five 9-meter antennas, Kratos supplied a complex suite of interconnected hardware and software components including:

- EPOCH® - the industry-leading C2 solution for real-time satellite command and control and payload status monitoring
- XR1 TT&C Modem – for RF signal processing of downlink data from the Kacific 1 satellite
- Monics® - for centralized RF monitoring and interference detection across the entire network
- Compass® - to manage, monitor, and control a wide range of devices on Kacific's network
- SpectralNet® - digitizers employed at each gateway location to convert RF signals into IP packets for transport over Kacific's IP network
- Skyminer – for real-time situational awareness tying performance data together to optimize operations over time

Table 1. **The Advanced Satellite Ground System.** Source - Kratos ●●●



Photo courtesy Kacific ●●●

The weather was also an issue. "Many people laughed at me when I tried to set up the first Ka-band system in Southeast Asia, which is notoriously rainy," recalls Patouraux. The solution was to strategically place teleports in the Philippines and Indonesia about 60 to 70 miles apart. The next challenge was to figure out a way to connect the locations by pushing the traffic through fiber between the teleports and switching between locations seamlessly when rain would hit one of the two places. "Kratos was able to deliver just that with the novel system they gave us in the early days," says Patouraux.

MAKING IT WORK

For each gateway, Kratos had to find a balance between performance, cost-effectiveness, and ease of maintenance to support the reliable and efficient operation of the satellite system. An on-site engineer was responsible for ensuring the installation process was carried out smoothly and efficiently.

"Operating a large antenna necessitates a reliable tracking system to ensure optimum performance. The ability to track and maintain alignment with the satellite is vital for consistent and high-quality signal reception," explains Loke. "Antennas that had easily replaceable parts and simple maintenance requirements were preferred so that any necessary repairs or replacements could be carried out swiftly, minimizing downtime and ensuring continuous operation."

Beyond the antenna hardware and digitizers, Kacific employed a suite of additional products to assure optimal operations and quality of service (see Table 1). According to Lambert, "These products provide advanced monitoring and control of the ground system and the satellite, supply information about signal quality and interference, as well as analytical on the entire system so that the Kacific team can operate their network with real-time information and in a constant state of operational improvement."

From when Kacific approached Kratos to when all five gateways were built and functional was about a year and a half. All the Ka-band gateways have been fully operational for five years and each works as anticipated. Lambert attributes this success in part to the fact that Kratos approached the project with extensive advance planning of logistics and work packages, including

Connecting the Unconnected

extensive testing at Kratos' facilities before the equipment was taken to the gateway sites. He explains, "We like to involve the customer at all project stages with regular technical reviews, status meetings and a collaborative approach to overcoming any issues."

PASSION AND GRIT

Essentially, Patouraux started with a quest driven by what he knew was a desperate need. To get from that notion to a robust, reliable, and affordable broadband satellite network has been a remarkable journey. How, one might ask, did Patouraux manage to stay the course and deliver Kacific's service at such a low price?

"It's extremely difficult to actually make money through addressing the digital divide. You will need a lot of grit and tweaking of your business plan," stresses Patouraux. "There is a lot of back and forth, a lot of heartaches and headaches and you must be prepared for that. Eventually, it pays off because the grit gives you the competitive mode around your business. Once you've pushed through that and you have all the requirements in place, nobody competes with you."

Patouraux conducted some primary research where he talked to people. The result of these discussions resonated with what he believed—that there was a demand big enough to fill the satellite's capacity. "Once you believe in the demand and the market you go after, then you can set a much lower price," he emphasizes.

"It's volume times price. You need to be able to produce that volume on the satellite with your ground system," he continues. "We streamlined our entire business around that price and went as far down the value chain as possible. You need to find a business model where you can have customers that are a bit higher up the value chain, as well as another business model where you allow yourself to go down the value chain on the side of your more established customers, without competing with them. We managed to do this in order to push the volume."

According to Patouraux, there are now more than 3,000 connected education institutions, including elementary and primary schools as well as tertiary education in rural areas and on the outskirts of cities. "That fosters a better societal fiber with people receiving a better education where they live, and it also fosters gender equality since both boys and girls are receiving the same instruction," he notes.

Kacific's network also connects 1,000 healthcare institutions, dispensaries, clinics, and even large hospitals. "The estimation is that we must have saved in the order of several thousands of lives just by sometimes calling for medevac for critical cases, sometimes for a nurse to be able to call a doctor in the city, and sometimes simply via WhatsApp or Facebook Messenger," claims Patouraux.

Today, Kacific 1 connects up to 500,000 end users in 25 countries, and they have access to online education, healthcare, and the means to accelerate their economic development. External consultants who have reviewed exactly what Kacific provides confirm that by delivering affordable bandwidth—the per gigabit cost is less than 2 percent of Gross National Income per capita—Kacific is indeed changing peoples' lives dramatically. ●



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How to get more from your MSS satellites and spectrum

Satellite Network Operators struggle to meet demand for new and growing services such as UAVs, direct-to-device, ISR and IoT, yet there are opportunities to significantly increase capacity with the right technology.

Lewis Davies, Satellite and Space System Architect, TTP plc

Satellite spectrum can loosely be thought of as a highway with different spectrum bands equating to lanes that allow vehicles and their cargo to travel at different speeds (or for data to travel between two ground terminals via a satellite). The faster lanes let lots of vehicles through. The slower lanes provide capacity for those who are not in such a rush. Then there is the shoulder, a channel kept clear for vehicles that may need it in an emergency, much as L-band spectrum is used for emergency communications by maritime and aeronautical safety services.

Managing traffic was less of a problem when demand for roads, or spectrum, was lower. But in recent years, demand has risen for data via satellites thanks to new commercial services, such as those to UAVs, consumer services utilizing standard smartphones, and government applications including Intelligence, Surveillance and Reconnaissance (ISR). Just as it is always expensive and sometimes simply not practical to widen roads after they



are built, it is hard to add new spectrum and satellites. This means to serve this growing demand without vast investment, we need to make more of the capacity we have.

THE CHALLENGES OF LEGACY SATELLITE INFRASTRUCTURE

The overarching challenge is that satellite spectrum faces natural limits. Only so much data can be transmitted on each satellite beam and frequency channel, with each beam constrained to a certain area so it doesn't interfere with other beams. The width of the frequency channel places a limit on the data rate an individual terminal can support.

The frequency bands are assigned and licenced by international regulators putting a hard limit on the spectrum available. This means that if satellite network operators (SNOs) want to increase their service revenues – by delivering more services over existing spectrum allocation and with existing space infrastructure – they need to do more with what is already available to them.

Whilst the Shannon limit places a theoretical maximum instantaneous data rate for any given communications channel, in practice, looking across an entire satellite network, we are well short of reaching that limit. Therefore, there is plenty of room to optimize practical capacity through improved technologies.

GETTING MORE FROM YOUR SPECTRUM

So, how can SNOs deliver as many services as possible across their spectrum and maximise their returns, without compromising the quality of those services? Perhaps the most significant opportunity is to carve up the allocated spectrum more flexibly. With more flexible frequency allocations, we could squeeze more into the same space. A motorway has three lanes but could fit four if they were narrower, enabling a 33 percent rise in capacity. This would be possible if cars were driven autonomously and could travel with greater precision. Similarly, as communications technologies improve, we can squeeze more data into less radio bandwidth.

Much can also be gained from being more intelligent about how we manage data transfer in time. Just as roads can optimise the flow of heavy traffic by varying signalling

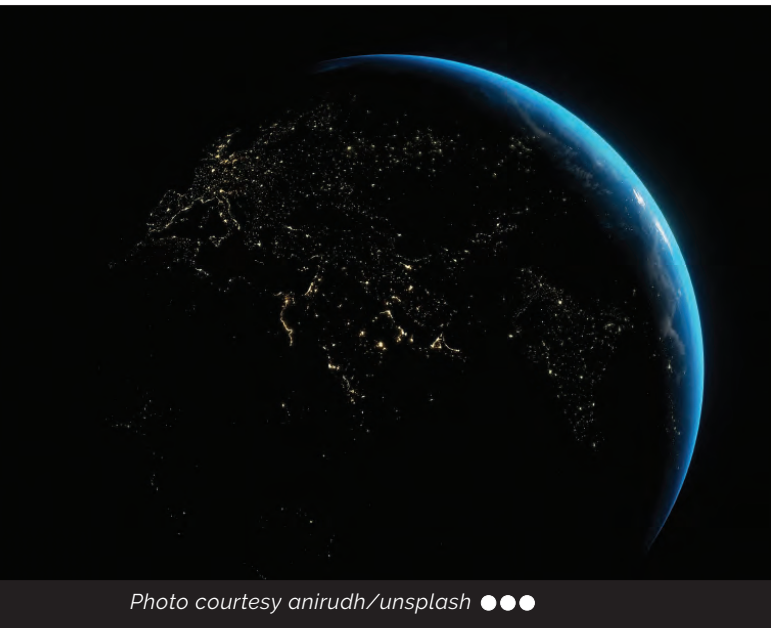


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and speed limits, satellite communications can control data rates and latencies to get more data through the same channel.

Non-urgent communications – such as once-daily backhauls from less time-critical IoT monitoring sensors – could be offered with a reduced fee if the user accepts that uploads can be scheduled at any time during a 24-hour period. For SNOs, this unlocks flexibility and an ability to open capacity at busy times by scheduling non-urgent signals at quiet moments or when gaps arise.

As we become more intelligent, we can also make better use of reserved channels. These channels sit empty most of the time because they may be needed in an emergency. But if we build in flexibility across the whole spectrum, we can quickly create a clear path at any time. Think of a highway full of autonomous vehicles. The moment an ambulance needs to get through, we hold back the queue to join, and make everyone already on the motorway slow down and switch lanes to create a clear path through. This is not just a technical challenge; it will require a shift in thinking from those who see reserved channels as a safe solution. There is no reason it can't work just as well.

HOW TO DO IT

Primarily it is a case of updating ground stations and terminals with new technologies. It is worth noting that, in most cases, the satellite is just a mirror and doesn't need updating. The complexity exists at the ground station and in the terminal, so these updates can all be done on Earth.

And where do these new, improved technologies come from? An obvious place to look is at the much larger cellular

industry, with its similarly large R&D budgets. This could be through the direct use of cellular equipment, possibly with some adaptations for use with satellites, or by applying elements of proven cellular technology to upgrade legacy SATCOM standards. 5G NTN activities within the 3GPP are exploring how cellular equipment can be adapted for direct use with satellites, enabling satellite-terrestrial convergence and lower-cost satellite equipment. However, at least at L- and S-Band mobile satellite service (MSS) frequencies, data rate is currently not a priority for the NTN working group.

In the absence of this being driven by standards, cellular and other wireless technologies could be used in the short-medium term. A key element of this is Orthogonal Frequency Division Multiple Access (OFDMA), which allows multiple diverse users to share a common radio resource highly efficiently whilst avoiding radio interference between users and allowing channel filtering in the modem to be efficiently implemented digitally. This approach helps maximize overall network capacity and provides the ability to assign the capacity very flexibly across multiple users, potentially helping an SNO obtain more capacity from their satellites and spectrum.

Other applicable cellular techniques include Single Frequency Networks (SFNs), which allow adjacent beams to share the same frequency. These increase spectrum efficiency and capacity but do require interference between beams to be managed. Fortunately, there are a range of techniques to help with this.

A challenge for an SNO considering directly adapting cellular technologies or elements of technology such as OFDMA is how the multi-MHz cellular frequency



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assignments typically required fit with traditional SATCOM frequency band plans currently utilizing 200KHz or narrower channels.

Whilst there are opportunities to simply join contiguous channels into a wider block, limitations are imposed by the need to support legacy equipment with difficult-to-move operating frequencies. It is also necessary to maintain reserved channels and respect individual countries' radio licencing conditions. This is brought into sharp focus for SNOs when trying to increase the data capacity of a single terminal. In a 200KHz channel, data rates of near 1Mbps are just achievable. Beyond this, multiple 200KHz channels are needed. If contiguous channels are available, terminal data rates can readily proportionally increase with the number of channels available.

Without contiguous channels, complex techniques such as carrier aggregation are currently needed. A limitation of these techniques is that the terminal is heavy and expensive, making them unsuitable for some applications, such as with lightweight UAVs.

To return to our highway analogy – today's roads were designed for lots of human drivers, with speed limits and wide markings to avoid collisions. But with future highways, where automated driving systems make decisions such as speed and lane choice across the entire highway, it may be possible to dispense with some of these safety limits and fit in more vehicles at higher speeds, all with less risk.

In the satellite world, with each of the technological advances that might be possible, comes technical detail and limitations to understand and work through. There is no one-size-fits-all. However, by embracing a combination of new technologies, it is possible to realize significantly more capacity for the same finite spectrum.

A business plan establishing a possible ROI for this increased capacity can be created by an SNO, initially identifying the value of different types of increased capacity to them. This can take diverse forms and is seldom as simple as just increasing the data rate of a single, fixed-

frequency bandwidth satellite channel. For example, SNOs selling to government customers may find that their ability to sell high-value, high data rate lease services is hampered by the apparent lack of suitable spectrum and capacity. These services are ideally provided using a single frequency block within a beam, allowing lower size, weight, and power (SWaP) terminal equipment to be used, enabling, for instance, greater use in UAV-based reconnaissance applications.

For those selling to the cost-sensitive and higher volume IoT sector, it may be the network's ability to support a large population of low data rate terminals registered on the network, as opposed to the data requirements of the terminal itself.

The next step to a meaningful business plan is then holistically reviewing its target customer priorities and considering current spectrum, satellite capacity, and frequency usage to identify what capacity enhancements might be possible through selectively altering frequency plans and upgrading air interfaces. This will likely result in conflicting demands requiring complex technical trade-offs to be analyzed and evaluated independent of individual customer-facing groups. This can be undertaken centrally within an SNO if supported, where needed, by independent technical expertise. With this understanding, a costed roadmap relative to an SNO's customer priorities, with associated timescales and risk mitigation plan can be developed. Before full commitment to the plan, confidence can be gained through selective sandbox trials and experiments.

In summary, introducing these types of technical solutions depends on an SNO's customer priorities and needs, backed by a willingness to innovate as some of these ideas involve departures from long-established ways of doing things. Radically altering frequency plans and air interfaces is scary and may need to be introduced gradually. However, those willing to take risks and do things differently often end up leading their industry. ●

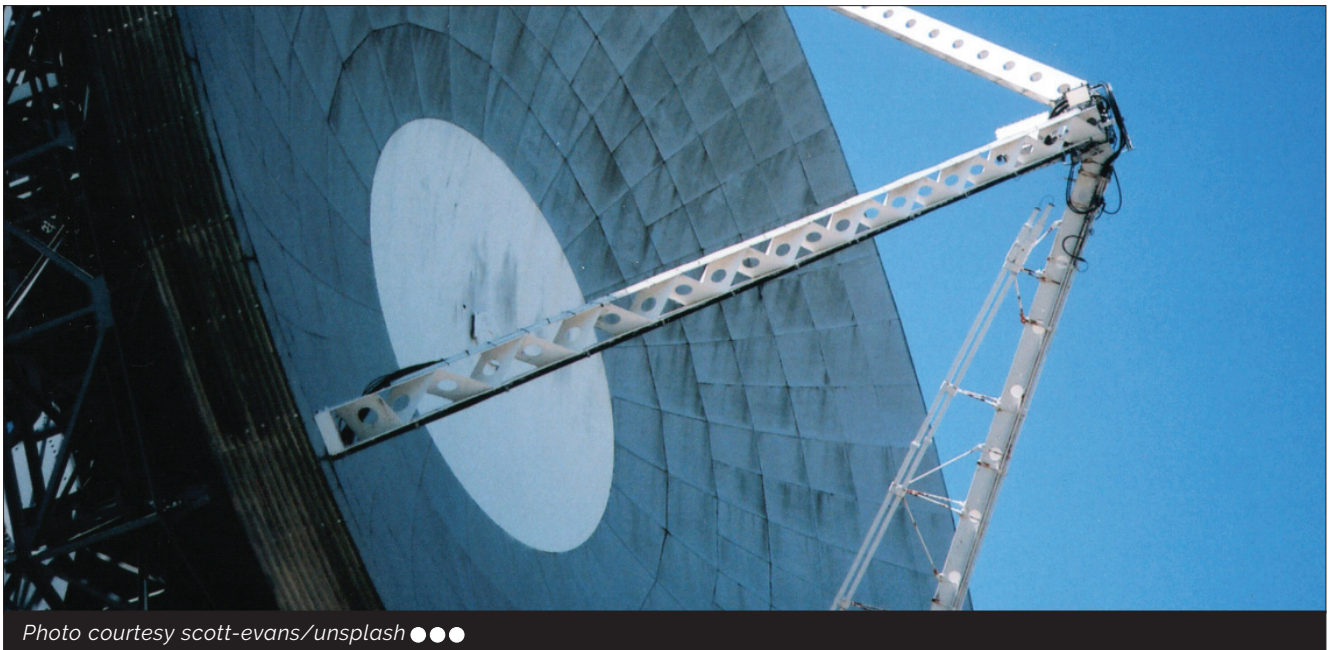


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ViewQwest appoints Lee Mun Fai as Field Chief Technology Officer to support security services

ViewQwest has appointed Lee Mun Fai as Field Chief Technology Officer (CTO). The move underscores ViewQwest's commitment to delivering innovative, fit-for-purpose solutions and maintaining service excellence amidst the rapid expansion of its Managed Security Services business and operations, and enterprise customer base across Asia. Headquartered in Singapore, the company continues to gain momentum with the increased adoption of its Managed Security Services solutions, particularly its Secure Access Service Edge (SASE), Software-defined Wide Area Network (SD-WAN), Managed Internet, Managed Firewall, and other Security-as-a-Service offerings. To support this growth, ViewQwest has made key regional talent hires in solutions design, project management, service delivery, and support. Furthermore, the company has strengthened its site and country-redundant service desks, ensuring round-the-clock proactive support and management of its customers network and security infrastructure and operations.

Key Leadership Addition

Joining ViewQwest in July 2023, Mun Fai brings two decades of deep technical and network engineering leadership and experience from global organisations, including BGC Partners and Bloomberg. His tenure at these pioneering financial technology and business information companies known for their strategic investments in technology to drive competitive advantage, positions him as a key figure in ViewQwest's leadership team amidst the comprehensive organisational ramp-up.

As Field CTO, Mun Fai leverages his technical and business excellence to guide ViewQwest's enterprise customers in fully optimizing the potential of the company's



Lee Mun Fai, Field Chief Technology Officer ●●●

suite of managed network and security services to successfully implement their network and security transformation programs. Additionally, he assumes the role of key technical advisor, leading solutions development to support the consultative sales process, offering insights and recommendations to enterprise IT leaders.

"We are delighted to have Mun Fai in the ViewQwest leadership team" said ViewQwest CEO Vignesa Moorthy. "His technical expertise, coupled with a keen understanding of business needs having been on the customer side himself, has proven invaluable since he joined us in Q3 2023. He has strengthened our ability to serve customers across Asia in diverse industries with larger and more complex requirements. As a leader, he has also built a strong team within a short time, enabling a rapid ramp-up of our design and service delivery capabilities."

"We are confident that Mun Fai's leadership will further augment our capabilities and contribute to greater achievements in the coming year" added Vignesa. "Together with our COO and CMO Juri Francisco-Gamban, and our CCO and Head of Enterprise and International Business Benjamin Tan, we look forward to helping more enterprises achieve their goals through our growing reach in the region" ●

LCR Embedded Systems names Sean Campbell President and General Manager

LCR Embedded Systems has announced that Sean Campbell has been named President and General Manager of LCR's Jeffersonville, PA; Orlando, FL; and Jackson, MS facilities.

Having previously worked with Safran/Zodiac, K2 Energy, Trenton Systems, and DEWESOFT, Campbell brings with him a proven track record of leadership as well as a wealth of knowledge and expertise in the military, aerospace and defense industries.

Campbell shares LCR's passionate commitment to serving the critical needs of America's armed services by providing the most reliable products in the embedded computing industry for defense. He is laser-focused on meeting and exceeding the complex needs of our

customers by ensuring the highest level of service at every point of engagement.

With deep insight into industry dynamics, Campbell is poised to elevate LCR's products and services portfolio to new heights.

"The team here at LCR is hands-down among the best in the industry and I look forward to playing a major role in driving the company to become the go-to name for rugged systems and packaging solutions in defense applications. LCR's customized solutions address SOSA/CMOSS system build requirements that benefit DoD primes, system integrators, and their clientele as they transition towards secure Open System VPX Architectures. From our East Coast facilities, LCR is able to serve its DoD clientele, contribute to the US economy and grow the onshore ecosystem of rugged, embedded computing applications," said Campbell. ●



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Comtech names satellite and defense industry leader John Ratigan as Chief Corporate Development Officer

Comtech has appointed satellite communications (SATCOM) and defense technology industry leader John Ratigan as the company's first Chief Corporate Development Officer (CCDO).

With differentiated expertise across the global satellite technology sector, Ratigan brings over three decades of leadership experience to his position as Comtech's CCDO. Ratigan's experience is uniquely well aligned with Comtech's strategic business priorities and continued expansion into new growth markets.

Prior to joining Comtech, Ratigan served as CEO and President of iDirect Government as well as holding a position as an Executive Committee Member of ST Engineering iDirect. As its first employee, Ratigan established iDirect Government and grew the company to over \$100 million in annual revenue. During his tenure as CEO and President, Ratigan assembled a team of over 200 outstanding professionals and was responsible for taking iDirect Government from a startup to a well-known technology leader that deployed thousands of innovative modem solutions and satellite technologies supporting US Government and Department of Defense (DoD) customers across the globe. Ratigan was also responsible for acquiring GlowLink and its unique interference mitigation technology (CSIR) and fused it with iDirect's own Evolution technology, which helped the company become the largest provider of Time Division Multiple Access (TDMA) SATCOM capabilities for the U.S. DoD.

"As a renowned leader in the satellite and defense industry, John's deep expertise and unique experience will



John Ratigan, Chief Corporate Development Officer ●●●

help enhance our strategic positioning, accelerate Comtech's new technology trajectories, and further improve our ability to accomplish our near and long-term strategic priorities," said Ken Peterman, President and CEO, Comtech. "John will be instrumental in identifying new opportunities, strategic partnerships, and technology synergies that will help Comtech democratize access to communications technologies, bridge the digital divide, and empower a truly connected planet. We are thrilled to have him on board as we enter our next chapter as One Comtech."

In his position as CCDO, Ratigan will oversee new business initiatives aligned with Comtech's strategic pursuits as the company continues its One Comtech journey.

"I'm excited to be part of Comtech's transformational growth and it's an honor to help lead a company where I spent 10 years earlier in my career," said Ratigan. "I'm thrilled to be working with Ken Peterman and this incredible Comtech team where we're bringing some of the best and brightest minds together to push the limits of innovation and make a lasting, positive impact in the world. As CCDO, I'm looking forward to helping the company identify and secure new opportunities that can unleash the full potential of the One Comtech transformation." ●

A graphic for Proactive International PR featuring a blue background with a laptop and a smartphone displaying data charts and graphs. The text is white and yellow.

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