SATELLITE EVOLUTION

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GLOBAL

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Crispin Littlehales, Executive Editor ●●●

On the brink

Science fiction is morphing into reality at an astonishing rate. University of Alaska professor Dr. Kelly Drew and her students have been studying Arctic ground squirrels and their ability to retain muscle and bone mass during their 8-to-9-month hibernation state called "torpor". The team's findings could be used to find a way to medically induce torpor in astronauts set to travel to Mars and beyond. Efforts are also underway to develop agricultural techniques that would enable space travelers to grow food on Mars using water harvested from the soil and cyanobacteria, or blue-green algae as it is more commonly called. NASA is also funding research conducted by Dr. Congrui Grace Jin of the University of Nebraska-Lincoln. Dr. Jin is working on a method to manipulate cyanobacteria and fungi into biominerals and polymers that can be combined with Martian rock and dust to create "self-growing building blocks" with which to build homes.

While these endeavors may yet take a decade or more to come to fruition, there are plenty of mind-bending projects that are nearing the finish line in our industry. At the Satellite 2023 show which took place in Washington, D.C. last month, industry leaders, top technology executives, and analysts confirmed that the satellite and space sectors are on a fast track that's gaining speed. Laser communications, artificial intelligence, machine learning, software-defined satellites and payloads were front and center topics at the CTO roundtable. Satellite operators were optimistic about the direct-to-device market and partnerships with telcos to bridge the digital divide. Launchers were bullish about progress with SpaceX targeting 100 launches in 2023 including its Starship demonstration flight.

It's worth noting that, a few days following the close of the show, NewSpace startup, Relativity Space launched the world's first 3D printed and liquid propellant rocket from Cape Canaveral Space Force Station. Powered by super-chilled methane and oxygen, the Terran 1 thrust from the pad for a successful liftoff. Unfortunately, the engine used to propel the upper stage of the rocket into orbit failed. Still, getting the rocket through Max Q (maximum pressure) after liftoff was achieved.

Clearly, our industry is reaching for the stars, not just figuratively, but literally. Theodore Roosevelt put it well, "Great thoughts speak only to the thoughtful mind, but great actions speak to all mankind."

In this issue of Satellite Evolution Global we hear from Kyle Whitehill, the CEO of Avanti Communications, who talks about the challenges, the solutions, and Avanti's commitment to close the digital divide in Africa. Matthew Shouppe, Chief Commercial Officer for Kayhan Space informs readers about the solutions at hand to achieve a sustainable space operating environment. Kieran Kunhya, CEO of Open Broadcast Systems shares his company's experience with broadcasting a major sports event at one location to another halfway around the world using satellite and 5G. Alistair MacLeod, CEO of Ground Control delves into the many ways that Massive IoT is transforming the utilities sector. Finally, Laurence Russell sits down with Kartik Seshadri, Vice President of the International Division of Hughes to talk about how far the space industry has come and what part Hughes has played as well as how the company's work can help further connect the world.

Photo courtesy Avanti Communications

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SBIRS GEO-6 satellite control authority transferred to Space Operations Command

NORTH AMERICA - The Space Based Infrared System Geosynchronous Earth Orbit – Satellite-6 (SBIRS GEO-6) was formally transferred from Space Systems Command (SSC) to Space Operations Command (SpOC), March 24, 2023.

SBIRS GEO-6's LM2100 Combat Bus™ is an enhanced space vehicle that provides even greater resiliency and cyber-hardening against growing threats, improved spacecraft power, propulsion and electronics, common components, and procedures to streamline manufacturing, as well as a flexible design that reduces the cost to incorporate future, modernized sensor suites.

"SBIRS GEO-6 exceeded performance expectations during on-orbit testing," said Col. Daniel Walter, Strategic Missile Warning Acquisition Delta commander, Space Sensing, Space Systems Command. "It was a very clean calibration campaign, allowing us to declare operational acceptance about 40 percent faster than our historic average testing times."

Space Delta 4's 2nd Space Warning Squadron at Buckley Space Force Base, Colorado, is now operating the satellite, and all systems are performing nominally.

The 2nd SWS operates SBIRS as part of their mission to defend and deliver trusted, persistent, space-based global missile warning and battlespace awareness in support of US and allied forces.

"Our nation depends on SBIRS and the dedication of our Guardians, Airmen and civilians who support this vital mission, which helps ensure our safety and security every day," said Col. Ethan Mattox, SpOC's Missile Warning/Tracking Mission Area Team chief. "The space professionals at the 2nd Space Warning Squadron and Space Base Delta 4 are proud to continue SBIRS GEO-6 operations in support of warfighters across the globe. Many thanks to our SSC teammates and industry partners for enabling this smooth transition to operations."

"The operational acceptance of SBIRS GEO-6 marks the completion of the SBIRS GEO system, representing a pivotal moment in SSC's history," said Col. Brian Denaro, program executive officer, Space Sensing, Space Systems Command. "SBIRS is the result of many years of hard work and collaboration with industry partners to leverage their knowledge and resources to deliver critical capabilities to the warfighter and our allies."

SBIRS GEO-6, built by Lockheed Martin, launched from Cape Canaveral Space Force Station aboard a United Launch Alliance Atlas V rocket August 4, 2022.

Upon separation from the Atlas V's Centaur upper-stage, SBIRS GEO-6 reached its intended orbit and satellite operations personnel began checkout activities of its light shade, solar arrays, and antennas. Following these
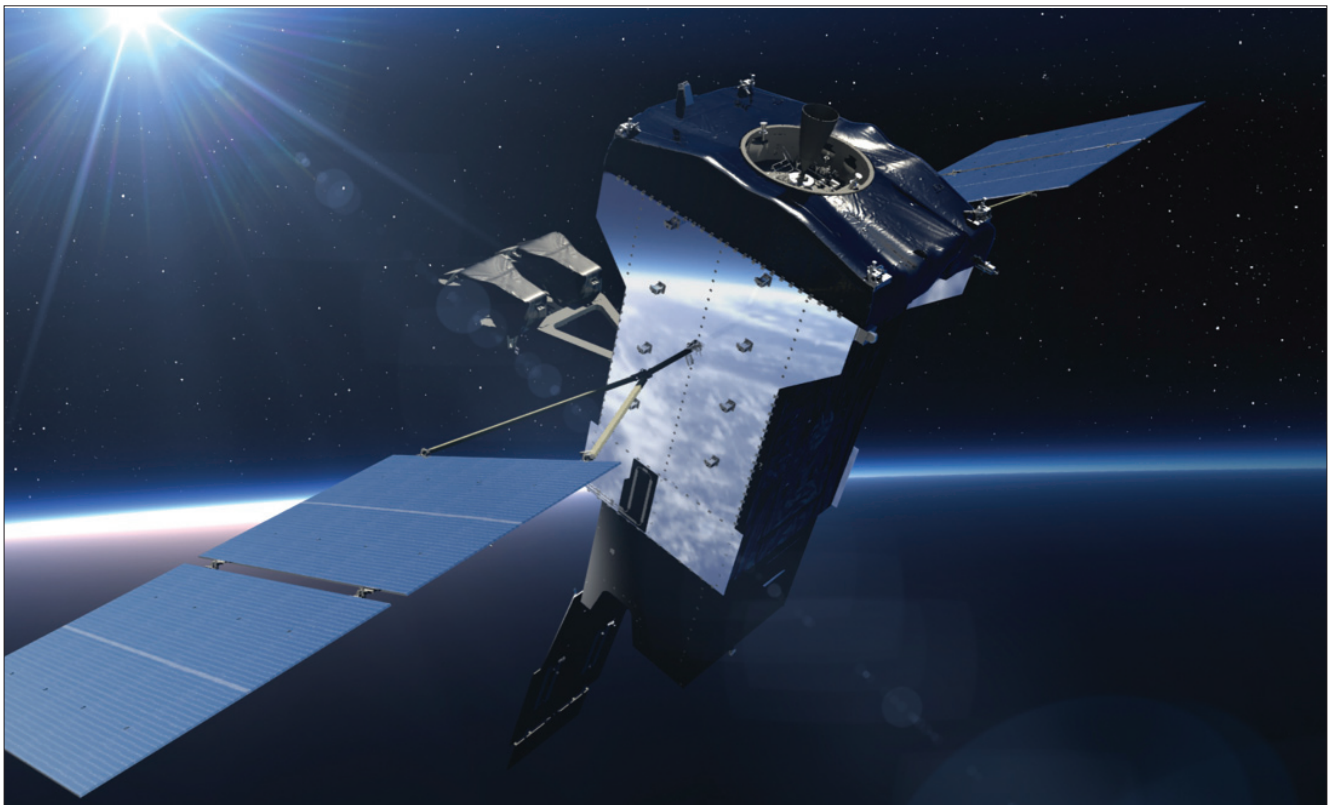
Notional image of a SBIRS Missile Warning Satellite built on the new, more resilient LM 2100 Combat Bus™. Photo courtesy Lockheed Martin ●●●

activities, the team tuned and calibrated the payload sensors and readied them for warfighter use.

"The addition of SBIRS GEO-6 to the constellation ensures the viability of our missile warning constellation for years to come," said Maj. Matthew Blystone, program manager, SBIRS GEO-5/6, Strategic Missile Warning Acquisition Delta, Space Sensing, Space Systems Command.

The SBIRS GEO constellation works in concert with the Defense Support Program (DSP) constellation to provide missile warning capabilities by detecting missile launches, space liftoffs and nuclear detonations. The SBIRS constellation will augment and eventually replace the aging DSP constellation and is a direct upgrade to the current capabilities, providing enhanced support to the warfighter mission.   ●

Satellogic announces integration with SkyFi, allowing satellite tasking for users and businesses

NORTH AMERICA - Satellogic has announced a partnership and integration with SkyFi, a leading provider of EO data. This partnership will allow SkyFi's customers to task Satellogic satellites directly through the platform or on the SkyFi app. This capability is available to both businesses and individuals.

"SkyFi and Satellogic are both committed to democratizing access to Earth Observation data," said Emiliano Kargieman, CEO and Co-Founder of Satellogic. "This partnership expands the availability of affordable, high-resolution satellite images and enables customers to task their specific points of interest through a seamless app. It's a strategic step forward in helping to increase the adoption of Earth Observation across existing and emerging markets."

Satellogic is focused on delivering high-resolution EO data to help advance critical analysis for global challenges including climate change, energy supply, and food security. The Company currently has 30 satellites in orbit. Satellogic is working toward an unprecedented capability of daily global remaps in high-resolution – providing up to 40 revisits of points of interest per day for better decision-making at every level around the world.

"Satellogic's rapidly expanding constellation is enabling us to further easify access to Earth Observation data," said Luke Fischer, Co-Founder and CEO of SkyFi. "The company is a perfect partner as we are always focused on providing the greatest value at the lowest cost to our customers."

SkyFi streamlines access to EO data through its web and mobile app, providing a seamless user experience with transparent pricing. The company is developing an end-to-end EO marketplace with an integrated insights platform

and storage solution. Satellogic will soon be expanding its offering for SkyFi users with priority tasking, which offers shorter task-to-capture and delivery timelines. Additionally, more product levels for a wider range of applications, including higher resolutions to unlock new details and analysis, will be introduced.

Satellogic's integration with SkyFi marks a new venture into distributing Satellogic's data more widely. This program is expected to expand with additional marketplace integrations, which confirms the high demand for Satellogic's unique blend of capabilities and price point. ●

Speedcast achieves industry milestone, supplying the highest continuous capacity in cruise history

GLOBAL - Speedcast has announced the successful implementation of a specialized connectivity solution delivering unparalleled data rates for an international cruise line's newest vessel. The innovative, satellite-to-ship tracking solution was deployed for the ship, which runs on liquified natural gas and can accommodate 6,500 passengers.

The cruise line's new connectivity service was launched as part of the vessel's inaugural 14-day transatlantic crossing, and now plays an integral role in the success of the vessel's year-round service. Speedcast is delivering dedicated capacity, which is a CIR-based (committed information rate) service versus a 'best effort' solution. The capacity is available at all times throughout the itinerary.

Supporting the ship's onboard network is Speedcast's TrueBeam technology, a software-driven platform that maintains quality of service across satellite beams with automated, smart beam-switching and traffic-steering based on location, footprint contours and committed information rates.

Speedcast's TrueBeam platform enables comprehensive tracking between the satellite and ship for the highest levels of availability, meeting full vessel capacity demands.

The dual Ka-band antenna solution provides non-metered bandwidth throughout the full itinerary of the ship for the next two years, with the ability to burst to 1.8 Gbps on demand. This represents the greatest bandwidth delivered to a ship on a consistent basis in cruise industry history.

The bandwidth being delivered to the single ship surpasses the total capacity delivered across the cruise operator's entire fleet just a decade ago. Speedcast has previously partnered with the customer to demonstrate the ability to deliver significant bandwidth levels for bursting, setting milestones in 2016 and 2018.

Now, with the implementation of Speedcast's TrueBeam technology and complete satellite-to-ship tracking, the ship is experiencing consistent bandwidth levels throughout the entire itinerary, including transatlantic crossings.

The patented TrueBeam technology is part of Speedcast's advanced network management suite, which also includes the company's SIGMA network management platform, enterprise-level SD-WAN service, and Cybersecurity as a Service. Together, these tools deliver unsurpassed quality of service across satellite, cellular and fiber connectivity for customers.

"Since the cruise industry began its return to sea, demand for bandwidth has accelerated beyond all expectations to meet the needs of passengers," said Brent Horwitz, Senior Vice President, Cruise at Speedcast. "This unique technical solution, in which the satellite coverage follows the ship across its itinerary, ensures that the ship always remains in the centre of the beam, delivering maximum bandwidth levels consistently. We're proud to bring this industry-first level of bandwidth to our customer's latest ship and to implement it on short notice to support their growth requirements." ●

ANYWAVES enters the US market and signs a major contract with Maxar Technologies

EUROPE - ANYWAVES has signed a contract with Maxar Technologies, a US-based company specializing in the manufacturing of telecommunication, Earth observation, radar and in-orbit servicing satellites, satellite products and other related services.

ANYWAVES set its sights on the United States when it announced its •3 million fundraising in December 2022. It is now well underway with the signature of a contract with Maxar Technologies covering the supply of some 120 products to be delivered by the end of 2023.

Maxar has chosen ANYWAVES for its navigation, telemetry, and remote-control antennas, as well as for the associated test caps, in support of its proliferated low Earth orbit (LEO) product line.

With a planned launch in 2025, ANYWAVES is very pleased with this new contract. The company will continue plans to expand its US partnerships and will be an exhibitor at the upcoming industry shows including Space Symposium in Colorado Springs in April and Small Satellite Conference in Logan in August.

By signing a contract with one of the major US space companies, ANYWAVES is accelerating its international growth. By supplying more than 100 "off-the-shelf" products, a first step has been taken in this strategic market. The second one will soon follow, materialized both by the signature of new commercial partnerships or by the supply of specific antennas, another specialty of the European manufacturer. ●

How Massive IoT will continue to transform the utilities sector

The Internet of Things (IoT) has been transforming industry for some years. Enabling companies to collect and analyse data in real-time, facilitating faster smarter decisions across almost every sector. Massive IoT, simply, IoT on a massive scale, has created solutions that increase

Alastair MacLeod, CEO at Ground Control ●●●

operational efficiency and sustainability, enhance the customer experience, and facilitate growth opportunities. Given its obvious applications to the utilities industry – including smart metering and grid management—it is not surprising that 80 percent of energy companies reported having deployed at least one IoT project in 2020. But as the utilities sector continues to navigate surges in demand for sustainability, increased energy, smart cities and more, are they leveraging the full value of Massive IoT?

Alastair MacLeod, CEO at Ground Control

Massive IoT sensors allow for remote monitoring, maintenance, and assessment of data across a wide range of applications, including smart thermostats, smart bulbs, substations and much more. Using cloud and edge computing, big data, and AI (Artificial Intelligence), Massive IoT makes vast amounts of data more accessible for businesses, not least Utilities. But why is this so important?

Driving efficiencies in any business is essential to success particularly in the utility industry. In addition to the challenges associated with the energy trilemma, the International Energy Agency has reported that they expect global energy demand to increase by 37 percent by 2040. To even contemplate meeting such an increase in demand, suppliers must look to processes and infrastructure across entire operations to ensure these are as efficient as possible.

Advancements in technology have a history of providing the solutions we need, and thankfully, there are many ways Massive IoT is already and will continue to optimize operations.

FACTORS DRIVING MASSIVE IOT ADOPTION IN THE UTILITY SECTOR
The utilities sector is already using a variety of sensors to monitor water quality, manage smart meters and optimize power grids. In fact, by the end of 2022 it was reported that more than 56 percent of electricity customers within the European Union and the United Kingdom had a smart meter.

Though the pandemic slowed smart meter installations due to various lockdown measures, this experience also prompted utility providers to accelerate digitalization roadmaps. Why? When compared with 2019, 2020 saw a 20 percent drop in electrical consumption in commercial locations such as offices. Though residential energy demand increased, this wasn't enough to offset the downturn in commercial usage.

As Mike Carter, President of Inmarsat Enterprise explains, "This period was unexpected and unprecedented and has underlined to energy producers and distributors the importance of being able to effectively monitor and control their operations remotely and autonomously."

What's more, in a bid to meet sustainability goals, many governments have put forth initiatives such as smart cities and green buildings. They have also funded projects aimed at reducing carbon emissions through smart grid technology. For example, the UK government committed US$18 billion to a nationwide smart meter roll-out.

HOW MASSIVE IOT CAN BENEFIT UTILITIES PROVIDERS
1. **Optimize utility management**
   Smart grid technology is already revolutionising how energy is produced and distributed throughout the power grid. Specifically, *smart grid remote monitoring*, has been identified by GlobalData's Technology Foresights, as an emerging innovation set to shape the future of the energy industry. Gathering information from the grid provides companies with more accurate data on consumption patterns in real-time. With faster data transfer and two-way communications utility companies can save energy through optimizing service planning, energy utilisation, and distribution.

   In addition, smart battery storage systems enable providers to capture and store surplus power. These are particularly useful for optimizing renewable energy management, for example with solar or wind, whereby

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power generation isn't continuous. These applications can make an important contribution to supply, making integration with renewable energy sources easier.

2. **Increase network resilience**
Remote monitoring can help utilities improve network resilience while reducing costs. Using analytics and real-time data, companies can identify areas where customer usage is deviating from normal patterns (e.g. unusual spikes in demand) and remotely troubleshoot problems before they cause damage or disruption— all while maintaining safety standards for customers. For instance, it's possible for utility companies to identify problems like leaks in pipes or broken switches remotely, thus avoiding costly repairs or outages that may be caused by these issues.

Moreover, using predictive maintenance software, utilities can monitor assets and equipment within their infrastructure by analysing usage patterns and other factors such as temperature, to help identify any potential issues. This allows companies to schedule preventive maintenance which can help to reduce downtime related to equipment failure, and reduce overall operating costs.

Cognitive computing also facilitates risk assessment and insights generation, which is expected to increase new revenue generating opportunities for the global market.

BGAN installation to electric pylon. Photo courtesy Ground Control ●●●

3. **Improve customer engagement**
For smart meter users, data is collected, sent, and evaluated in real-time by the utility company, rather than once the energy is consumed. This allows utility companies to provide real-time alerts regarding grid damage or outages, and adjust pricing and supply based on real-time insights. Providing customers with this data empowers them to make more conscious decisions about their energy usage, often encouraging energy reduction and improving satisfaction.

Smart meters also can facilitate demand response programmes such as those that incentivize customers to reduce consumption during demand peak hours. This helps to prevent blackouts during those times when most people are using electricity at home or work.

Octopus Energy recently trialled the "Big Dirty Turn Down" – paying around 100,000 households to shift their energy out of certain peak times. This was considered a great success that helped to balance the grid while preventing renewable energy from being wasted.

4. **Optimize resource management**
With Massive IoT, utilities can automate operations by connecting sensors across their networks. This enables them to monitor key performance indicators such as voltage levels and temperature to ensure optimal performance of equipment in real-time. Additionally, this data provides utilities with valuable insights into how they are tracking against past performances, allowing them to make smarter operational decisions and prepare for future challenges.

5. **Greater environmental sustainability**
In addition to reducing waste and optimizing utility management, the smart grid has the potential to help reduce carbon emissions by improving the amount and consistency of intermittent renewables provided to the grid. In addition, it can incentivize localised renewables generation such as solar PVs (Photovoltaics), providing an alternative energy source to meet local demands thereby alleviating demand pressures put on national grids.

In fact, research has estimated that by 2027, globally, smart grid deployments will result in a reduction of almost 700 million MMT (Million Metric Tons) of CO_2e (Carbon Dioxide Equivalent) emissions.

CHALLENGES TO MASSIVE IOT DEPLOYMENT SUCCESS: CAPITAL, DATA SECURITY AND CONNECTIVITY

The motivation for continued Massive IoT is clear: smart grids enable utilities to reduce costs and improve safety, while enhancing customer service. But these opportunities aren't without challenge. For Massive IoT to deliver true value, companies require scale, to which there are barriers. Afterall, IoT is not just about connecting devices — it's about connecting people, data, and processes which often means tackling issues such as: raising capital, enabling interoperability, addressing security concerns, and managing organisational complexity.

Due to the volumes required, the modernisation and installation of new hardware is substantial. So much so, that installation is often cited as the largest cost challenge when deploying IoT solutions at scale. Though much of the legacy hardware doesn't need to be changed immediately, the cost to replace millions of batteries in the field for many utilities providers may not seem a viable option.

In addition, utilities often are dealing with legacy systems and ageing infrastructures, built up over decades or even centuries. Most utility networks are based on proprietary protocols and hardware architectures that cannot be easily upgraded or replaced with off-the-shelf components. This makes upgrading them extremely expensive and time-consuming. To put this into perspective, it's estimated that electricity grids alone will need to invest around US$600 billion annually, through to 2030, to meet the net zero trajectory.

Though utilities must and do ensure processes require the very minimum of customer data in each instance, with increased data and data transmission, keeping this information secure from the reach of hostile parties becomes more difficult and consumers have become increasingly concerned with IoT cybersecurity. Comparing consumer survey responses before and after the war on Ukraine, 40 percent of respondents (up from 26 percent) reported viewing political and cyber security threats as a risk to utility supply.

The "AcidRain'"malware attack in February last year, caused severe, prolonged disruption to operations on a mass scale. The attack wiped out Viasat's KA-SAT broadband service's satellite modems, impacting thousands in Ukraine and further across Europe.

Hydrology Weather Station. Photo courtesy RWE ●●●

Addressing this challenge requires utility companies to build security through every layer of the stack and is essential to successful IoT deployment.

It would be remiss to not highlight that the ability to quickly adapt to surges, peaks, and troughs is all dependent on reliable, consistent data. Ultimately your decisions can only be as fast and as smart, as the data at hand allows. It's estimated that just 15 percent of the Earth is supported by cellular, whereas Satellite networks like Iridium cover everywhere and anywhere – including both poles.

What's more, a recent paper found 75 percent of decision makers struggled to deploy their IoT projects because of connectivity issues. So, it's important for companies to consider connectivity options early in IoT planning and opt for a connectivity strategy that can consistently support all assets within a network. What's more, we'd advise ensuring this includes alternate connectivity options for backup and backhaul. This way, should there be a problem with the terrestrial networks, your IoT application isn't negatively affected by long delays or gaps in data. Ultimately, without a connection, nothing is smart.

In summary, unlocking the power of smart devices and data analytics, through Massive IoT and AI, is key to ensure utilities are able to create a safe and secure infrastructure for the environment into the future.

However, while progress has been significant, the smart grid has existed for more than a decade, with many countries introducing their own version of the technology. So, until the challenges are somewhat overcome, and full scalability achieved, the industry will not be able to fully realise the benefits.

To find out more about how Massive IoT and digital transformation is shaping utilities, you can download a free Ground Control report - *https://www.groundcontrol.com/ en/blog/datas-journey-in-shaping-digital-transformation-in-utilities* ●

Worker checking live systems. Photo courtesy Ground Control ●●●

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Satellite Evolution Global

Q&A

Can Jupiter-3 connect the unconnected? ●●

Hughes has long been one of the pillars of the Western satellite communications market and continues to hold a huge presence in the industry. With their Jupiter-3 offering on the horizon, we spoke to Kartik Seshadri, Vice President, International Division about how far the space industry has come, and what part Hughes has played in it, as well as how their work can help further connect the world.

Laurence Russell, Associate Editor, Satellite Evolution Group

Question: The satcom industry has come a long way in the relatively short span of time it's been around. What has it taken to establish a foundation for Earth to build an economy based on spaceborne technologies?

Kartik Seshadri: It's hard to believe it's only been forty years since the advent of the internet! And yes, the satellite industry has come lightyears in that time, but we have to remember that nearly a third of the global population is still not online. Economy aside, we still have work to do as an industry, with regards to standardization and capital investments – especially because satellite is the ideal transport to help connect the unconnected.

As for building an economy for spaceborne technologies, we're proud of the role Hughes has played in setting that foundation. First, it took an audacious vision and goal: which was to connect an enterprise network

JUPITER 3 Gateway. Photo courtesy Hughes ●●●

WiFi Hotspot. Photo courtesy Hughes ●●●

Question: Rural connectivity is often cited as the primary driver of growth for satellite internet, although there also exists considerable demand for connecting consumer handheld devices for metropolitan people on the move, and IoT connections for machines around the world. What's the potential of this market, and what's standing in the way of its realization?
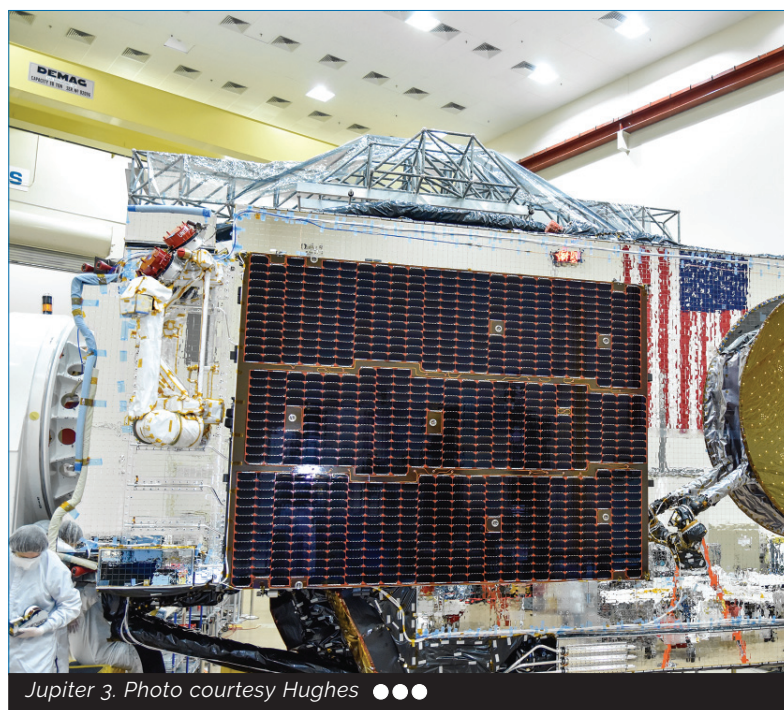
Kartik Seshadri: The potential for the direct-to-device opportunity is significant. Of course, satellite has been instrumental in improving rural and mobile coverage for handheld devices by providing cellular backhaul so mobile network operators can expand their coverage areas – 2G, 3G, 4G – or by creating satellite-powered Community Wi-Fi hotspots in remote communities. (As well as connectivity to planes, ships and vehicles.)

Clearly, given the insatiable demand for connectivity, the next frontier is providing service for devices outside the range of cellular networks – some analysts place the size of that market at about $67 billion. The inclusion of satellite standards in the 3GPP NTN Release 17 was a significant step forward in enabling the industry to realize this opportunity.

Today, Mobile Satellite Service (MSS) spectrum is available for use to meet this demand. In addition, with the arrival of the 3GPP NTN standard, equipment and chipsets are beginning to be designed and manufactured to enable services in this spectrum. Nothing is standing the way – which is why we are moving ahead with the first stage of realizing our S-band capabilities with the 28-satellite constellation we announced in January.

Our next-stage S-band constellation will support wideband services including voice, full messaging, and email capabilities just as people are used to on their smartphones today. That's the ultimate end-goal for our entire industry (and others coming into it): ubiquitous connectivity that's transport-agnostic.

via satellite. That communications network, which Hughes engineers devised for Walmart in the 1980s, was the first to use VSAT technology across an enterprise.

The next quantum step was the innovation Hughes developed to build a low-cost modem to deliver satellite direct to the consumer for internet access – initially with dial up return and then both directions via satellite. Hughes then followed that up to better monetize the business via satellite ownership economics, with the innovative launch of services on the SPACEWAY satellite.

Contrast that now to the Hughes JUPITER™ system and satellites, which have grown more powerful and capable with each successive generation. Our JUPITER System Series 3, which is available today, is our highest performing ground system yet, capable of delivering 400 Mbps down, supporting cloud network management and enabling 5G cellular backhaul. At Hughes, we talk about a virtuous cycle of innovation driven by our effort to meet our customers' changing and growing needs – and I think that's essential to developing a sustainable business and industry economy. Besides making bold bets it took (and still takes) an enduring commitment to innovation and continually raising the bar.

Similar developments and innovations by new entrants in the launch space, causing a reduction in launch price, have now jolted the satellite industry. A slew of new companies now are angling to address additional market segments with solutions that would not have been economically viable before.

At this stage, we're entering an era of providing satellite solutions spread across satellites in different orbits and terrestrial network convergence. Viability is going to depend on three things: access to various transports (because no one type of connectivity can meet all the demand); smart, enabling technologies (such as multi-purpose electronically steerable antennas, highly adaptable modems etc.); and the ability to integrate them all together into solutions. That's how we'll realize the vision of the connected future.

Jupiter 3. Photo courtesy Hughes ●●●

Question: Experts have identified the quickly developing regions of the global south as the primary hotspots for the expansion of the satellite broadband market, where connectivity needs to be fast, but internet infrastructure rollout is too slow to keep up with rapidly accelerating demand. Will this be where the satcom industry scales the model of LEO broadband, and breaks the back of the digital divide?

Kartik Seshadri: LEO certainly opens up new connectivity options for parts of the developing world, as it provides coverage in areas not sufficiently served by wireline, and those places outside the reach of a GEO beam. It's not likely, though, that any single technology or solution will create an immediate "back breaking" solution for the digital divide for several reasons. The need is too large, and any solution has to be sustainable for the long term.

Most importantly, solutions must be affordable for the populations they serve. In much of the developing world, service costs for individual households are prohibitively high. That doesn't change with LEO, which is currently more expensive than GEO satellite service – especially given the high cost of the necessary antennas when compared to the very low-cost VSAT.

Shared cost models like Community Wi-Fi hotspots will help make LEO connectivity more affordable, but it won't likely be the panacea to connectivity in the developing world. In fact, no single transport or service will be able to support the growing demand for connectivity. We need every type, every provider to be able to meet the connectivity needs of people, enterprises and things. And even that won't be enough: in addition to the transports, we need the enabling technologies and service integration to transform the connections into solutions that meet specific criteria for cost, performance, and availability.

Question: Some commentators warn that LEO satellites can be the predominant threat in the fight against space debris due to the heavy propagation of constellations and a mixed history of effective orbit pathing and decommissioning solutions. How do we make the most of the full life cycle of LEO satellites to ensure they serve a sustainable market from production to end-of-life?

Kartik Seshadri: Space is a resource that we need to protect. At EchoStar and Hughes, we comply with all regulations and industry best practices when it comes to satellite launches and end-of-life procedures. We believe that there need to be rules in place to ensure space sustainability and we actively work with governments around the world to achieve this goal.

Question: We've seen a few more players move into MEO recently, urging that the middle elevation can offer the best-of-both-worlds provision between the binaries of LEO and GEO. What do you think is the future of MEO?

Kartik Seshadri: Every orbit – and indeed, every type of transport – has its relative advantages. MEO offers some similar benefits as LEO, with lower latency than GEO along with less investment for global coverage. It also shares some advantages of GEO, including greater bandwidth density. MEO also has its own unique attributes – it doesn't require handoffs as frequently as LEO which can be useful for reliability and resiliency. The ideal and future ecosystem will need to take advantage of each type in order to meet the demand for connectivity.

OneWeb Svalbard. Photo courtesy Hughes ●●●

Question: Last year Konstantin Vorontsov, a member of the Russian Foreign Ministry described commercial satellites as "legitimate targets" in their wartime military objectives at the UN Open-Ended Working Group (OEWG). To what extent do you recognize satellites as assets in war through their cyber and logistical value?

Kartik Seshadri: In every aspect of life today, connectivity is an essential asset. As a provider to the US Department of Defense (DoD), our focus is on delivering secure communications, anytime and anywhere. One example is a LEO implementation at the Thule Air Base near Greenland, where Hughes is providing satellite connectivity for the first time in the region.

The installation, which uses OneWeb LEO capacity, meets the need for connectivity to support scientific experiments as well as morale, welfare and recreation for the people living there. Another example of a DoD implementation our team is leading is a standalone private 5G network at the Whidbey Island Naval Air Base in Washington State. While the objective is to enable 5G capabilities to support on-base activity, the deployment includes both GEO and LEO connectivity for global communications and resiliency. Primary, Alternate, Contingency and Emergency (PACE) planning is essential for the DoD, with multiple transport paths and enabling technologies essential to realize every contingency.

Question: Given the meteoric rise of the NewSpace market, and the doubts raised over true interstellar colonization efforts, how do you see the economics of space evolving in our future?

Kartik Seshadri: Space exploration and colonization are exciting endeavors that fascinate many of us in this

Photo courtesy Hughes ●●●

industry. At EchoStar and Hughes, we are focused on realizing our vision for a connected future using space-based and terrestrial connectivity. We have enough of a challenge on Earth, which Hughes is continuing to address with innovative satellite and terrestrial based solutions.

Right now, that means working to prepare our next geostationary satellite, JUPITER 3, for launch so we can connect more people across North and South America and help bridge the digital divide. We'll leave interstellar colonization to those better qualified to lead the charge and once all humans have the connectivity they need, we can look forward to bringing our JUPITER System technology to the Martians! ●

Kyle Whitehill, CEO, Avanti Communications

Avanti helps to create a strong digital infrastructure across Africa ● ●

According to the International Telecommunication Union (ITU), only 33 percent of the population in Africa was using the internet in 2021, leaving approximately 871 million people without access. Furthermore, studies show that the usage gap on the continent was at 53 percent in 2020. Avanti Communications is working hard to change all that by partnering with governments, charitable organizations, and providers across Africa. Kyle Whitehill, the company's CEO, talks about the challenges, the solutions, and Avanti's commitment to close the digital divide in the world's second largest continent.

Crispin Littlehales, Executive Editor, Satellite Evolution Group

Question: There has been increased collaboration between the telecoms industry and satellite companies wishing to address the digital divide in underserved areas. What were the major trends you observed in 2022 and what can we expect to unfold in 2023?

Kyle Whitehill: 2023 will see the continuation of many existing trends that played out over the last few years. For instance, horizontal consolidation will continue, particularly between the larger GEO operators, with significant mature broadcast and C-band services. We also expect to see vertical consolidation, as operators move down into channel to get closer to customers and develop solution and distribution capabilities.

Satellite Evolution Global

Q&A

Avanti's HYLAS fleet. Photo courtesy of Avanti ●●●

Avanti's iMlango project in action. Photo courtesy Avanti ●●●

Typically, the SatCom sector has been very engineering-led, and there is a large amount of existing and planned satellite capacity which may be difficult to monetize. This is an area where Avanti holds a critical capability lead for key market sectors in carrier, education, and governmental services—especially across Africa. This year we plan to prioritize the development of effective solutions and distribution models which will help us continue to produce real change in such areas.

The other obvious trend that is already continuing to play out is the market disruption from Non-Geostationary Orbit (NGSO) satellites. There is a growing realisation from customers of the "reality gap" between the marketing claims made for NGSO services and the reality of what is actually being delivered. In particular, the reduced latency offered by NGSO constellations is only one aspect of service. In many cases the reliability, quality, and control offered by GEO satellites are a better fit for customer requirements - notably in Ka-band.

Question: Avanti has been very involved in providing connectivity in Africa. What were some of the challenges you faced in the last year?
Kyle Whitehill: One of the main barriers impacting access to connectivity is a lack of infrastructure and terrestrial networks. Combating this issue was one of the key challenges we faced in 2022, particularly in rural areas like Sub-Saharan Africa. Traditionally, you would use a large telecommunications tower to connect dispersed populations at a 50km or so range. But, this method of connectivity is expensive, takes a considerable amount of time, and often requires a level of infrastructure that ultra-rural areas cannot support. Deploying connectivity in hard-to-reach areas was a huge priority for us in 2022 and will continue to be in 2023.

To introduce rural connectivity, we are partnering with companies to install small and more efficient telecommunications towers which are designed to cover a couple of kilometres on the outskirts of remote villages. We also provide skills and training to regionally based field teams to ensure the sites are easily maintained for long-term service delivery.

The success of these partnerships resulted in Avanti launching its own managed service, Avanti EXTEND. Avanti EXTEND creates a strong digital infrastructure across Africa by providing high-performance and cost-effective 2G, 3G and 4G solutions to remote and hard-to-reach areas across sub-Saharan Africa.

Avanti's EXTEND is a built-in and fully operational CAPEX solution that integrates seamlessly into the terrestrial networks of mobile network operators (MNOs) to reduce network complexity and increase efficiency. It also offers the opportunity for MNOs and Tower Companies to undertake large deployments quickly and effectively, and scale operations to support long-term rural expansion at no additional CAPEX. This removes the need for them to manage satellite configurations, hub infrastructure or terrestrial networks to deploy a successful satellite cellular backhaul topology. This enables MNOs and Tower Companies to provide reliable cellular service to the 100 million people living in these challenging locations that would otherwise be impossible to reach using traditional terrestrial infrastructure. The rollout of Avanti EXTEND will be an ongoing priority this year.

Question: You recently announced a five-year deal expanding your relationship with Turksat and another partnership with Clear Blue Technologies. How can such strategic partnerships help to create a strong digital infrastructure across Africa?
Kyle Whitehill: When it comes to connecting rural Africa, I have personally experienced the benefits that strategic partnerships can have on individuals, communities, and economies alike.

Last year, we announced a new partnership with Turksat, which involved the integration of the capacity and coverage of Avanti's HYLAS 4 and HYLAS 2 satellites with Turksat's latest 5B satellite. It enables us to deliver extensive, continuous coverage, to customers across Africa and the Middle East that are operating in areas where terrestrial infrastructure is limited. Both our customers now have access to more than 100 Gbps of state-of-the-art high throughput GEO Ka-band capacity – which has been a huge milestone for both businesses.

Our partnership with Clear Blue Technologies has also continued to accelerated the rollout of low-cost connectivity solutions in some of the hardest-to-reach areas across sub-Saharan Africa. It has provided life enhancing services to underserved communities across the region, including eLearning for 3,000-5,000 schools in Africa. Even higher volume rollouts are expected between 2023-2025.

With the help of Avanti and its partners, Africa is expected to become one of the largest telecom markets in the world. It is an exciting period for the industry, and we cannot wait to see what unfolds in 2023.

Question: How have these remote and disadvantaged areas of Africa functioned prior to connectivity and how has being connected changed people's lives?
Kyle Whitehill: Connectivity is a vital tool that can empower people and strengthen communities. Something we are hugely passionate about at Avanti is helping girls across the globe to get a better education. With less than 40 percent of girls in Sub-Saharan Africa completing lower secondary school, Avanti is proud to have been working with the GPE (Global Partnership for Education) for over a year. The programme is helping to break down some of the social barriers preventing girls from reaching their full potential. The goal is to help build a greater understanding of the benefits and long-term impacts attendance at school can have for girls – with the hope that more women will

be able to go on to have careers, whilst also supporting their family.

Avanti also played a pivotal role in iMlango, an e-learning partnership which since 2014 has gone on to be Africa's most successful digital educational programme. It began when we received funding from the British government to deliver high-speed internet connectivity to marginalized girls in rural and remote schools. We soon found out that students who have access to the individualised learning platform for 60 minutes per week improve their "maths age" by, on average, 18 months within their first year of access. To date, iMlango has significantly improved outcomes in maths, literacy, and life skills to 180,000 students across 250 schools. This has been a huge success and something we hope to build on.

Question: Connecting communities in Africa must be fraught with difficulties; how do you inspire your employees to keep up the good work?
Kyle Whitehill: Inspiring employees through building a positive and healthy culture as well as prioritizing mental wellbeing within the workplace is at the forefront of our philosophy at Avanti. For instance, during the pandemic we started an "At Home with" project to keep our employees inspired. Each week, I interviewed a person who excelled in their field (be that sport, media, armed forces) and shared their story of resilience through challenging times in their career. This was a great way for us to address topics that often are overlooked in the office and provided a source of inspiration outside of our industry.

At Avanti, we focus on understanding an individual's priorities aside from just doing their job every day to provide a real opportunity to support their personal growth, and, as a result, the growth of the company. Each month, we all meet to discuss the "headlines", covering both the global news agenda and Avanti's agenda for that month. We also encourage a people update of key initiatives for our employees.

Connecting the unconnected in rural Africa. Photo courtesy Avanti ●●●

We know that a healthy work culture is all about balance. That is why this year we are sponsoring endurance runner Sally Orange to complete the World Marathon Challenge, where she will attempt to complete 7 Marathons on 7 Continents in 7 days for a series of mental health charities. We at Avanti are embodying Sally's 777 challenge by completing our own mini challenges within the company. For example, some of us will be running 7km for 7 days and encouraging friends to donate £7 to a charity of choice. Through such initiative we are hoping to encourage a healthy work culture and spark more conversations around mental health awareness.

Question: Can you expand on Avanti's commitment to sustainability?

Kyle Whitehill: Avanti welcomes the statement of the delegates of G7 nations in support of safe and sustainable use of space. Well established procedures among GEO operators have maintained a clean bill of health regarding safe operations, but the increasing congestion of the space environment calls upon regulators, spacecraft manufacturers, and spacecraft operators to do more. It is timely to address safe and sustainable use of space and strengthen the structures to support this.

As important as the work we do is the way in which we do it. We at Avanti are strongly committed to conducting our business in an ethical, socially conscious, and environmentally friendly manner. We are committed to protecting the environment by reducing our carbon footprint, encouraging recycling, and engaging our employees on environmental awareness. We follow sound environmental practices and conduct our operations in a manner that minimises our impact on the environment and protects our employees' health and safety. We are continuing to hold ourselves accountable to these commitments in 2023, and beyond.

Question: What does Avanti have on the drawing board for Africa in the next one to five years?

Kyle Whitehill: Our aim is to continue to connect even more people in hard-to-reach areas and continue our work to empower individuals, communities, and businesses across the continent. This year will see the further expansion of our network in the region with our own HYLAS fleet, through our 5-year partnership agreement with Free in Senegal, serving new capacity on our fleet across West Africa to Senegal.

This will be Avanti's third HTS gateway in Africa, following on from Nigeria and South Africa, with Avanti being unique in our approach as a Ka-Band HTS operator with African gateways for African capacity on our fleet. This approach brings huge benefits to our partners and end users in terms of technical integration, security, and geo-political aspects, as well as ensuring Avanti walks the talk in our investment and focus on Africa.

In addition to our growth in African infrastructure, capacity, and coverage, over the next few years we will be significantly ramping up the deployments of our EXTEND offering – our managed service for rural connectivity. With our partners in Africa, we are continuing to focus on the development of this service to ensure that we have the right systems, processes, people, and partnerships in place to achieve its full potential. Managed services for rural Africa are a challenging solution to crack, but the rollout of Avanti EXTEND to date demonstrates that we have a service that is poised for huge growth in 2023.

There are still three billion people in the world today who are not connected and we are passionate about changing that. By continuing to partner with providers across Africa, governments, and charitable entities, we believe we will be able to make significant progress towards worldwide connectivity this year. ●
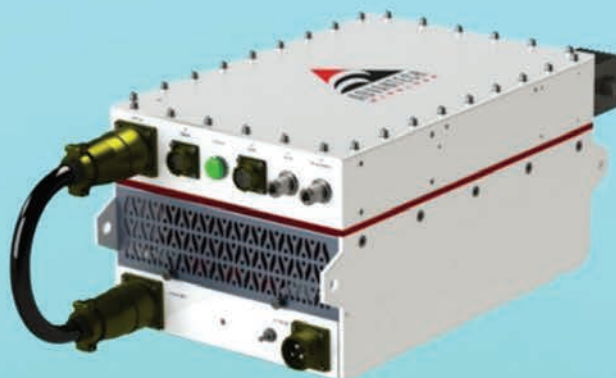
Introducing *GENESIS* - the new series of Ku-band SSPAs and BUCs from Advantech Wireless Technologies.

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

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

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

Fostering a better future for space traffic safety

We like to think of space as being infinite – which in the grand scheme of things, is not a bad assumption – but it's not all infinite. Over the last six decades, the area of space nearest to Earth has become quite crowded with orbital traffic. The threats to satellites and the services they provide to humanity are becoming more real than ever before, but there are solutions at hand to achieve a sustainable space operating environment.

Matthew Shouppe, Chief Commercial Officer, Kayhan Space ●●●

Matthew Shouppe, Chief Commercial Officer, Kayhan Space

The US Government now tracks nearly 50,000 resident space objects that are roughly the size of a baseball or larger between low Earth orbit (LEO) and geosynchronous Earth orbit (GEO).

By the end of the decade, tens of thousands more satellites will likely have launched to these already-crowded orbits. They will join the clouds of debris resulting from previous explosions and collisions, which will remain in orbit for years to millennia, depending on their altitude. One such example is Russia blowing up one of its own defunct satellites in November 2021 using a direct-ascent anti-satellite missile launched from the ground. The kinetic impact of this event created more than 1,700 trackable debris fragments, with approximately 250 still in orbit today.

Additionally, there are hundreds of thousands more objects larger than one centimeter in size that are currently untracked, yet represent a real danger to orbital assets. A single penny-sized piece of space debris moving at 17,000 miles per hour has more than enough energy to destroy a satellite on impact and threaten other spacecraft in nearby

Kayhan Space' Pathfinder spaceflight safety platform is enabling satellite operators to navigate through busy orbits ●●●

orbits. This has happened many times, including recently with a Russian Soyuz module getting impacted by a small piece of debris around 1mm in size that still carried enough force to pierce the hull of the capsule and cause a coolant leak. As a result, the spacecraft was unfit to carry astronauts back to Earth.

It's an eye-opening example of just how risky it can be to operate in space. Thousands of satellites in orbit provide life-saving weather forecasting data, internet and broadband services, Earth observation science and climate change data, transportation logistics, and more. The loss of even a fraction of these assets would have a major impact on a growing number of industries – from agriculture and pharmaceuticals to national security – and our overall way of life on the planet.

TRAFFIC LIGHTS IN SPACE

Ultimately, we want to achieve one end goal above all others: simply keep things from colliding in orbit. We hear the term "Space Traffic Management" quite a bit, but there is no centralized government system that provides the equivalent of an air traffic control-like service for space. Space traffic management (STM) is currently decentralized, where satellite owner-operators self-manage their own orbital safety on a best-effort basis. In reality, this current state of affairs can be thought of more appropriately as self-managed space traffic coordination (STC), but even the coordination aspect is currently haphazard at best.

Though there is no "official" STM framework in place today, the US Department of Defense has played a leading role in global space safety for many years now in two very important ways. First, they operate a global network of radars and telescopes, and use this data to maintain a high accuracy catalog of resident space objects (RSOs) including satellites and space debris. Second, they routinely screen this catalog against itself to search for any possible scenario of two RSOs colliding in the coming days. Conjunction alerts are then delivered multiple times per day to any owner-operator flying a satellite who wishes to receive them.

This is where it gets interesting. What owner-operators do with those conjunction alerts is entirely up to them – there is no enforcement mechanism that says they must maneuver out of the way of a high-risk conjunction. In fact, there is no requirement to be able to maneuver at all. Many smallsats and nearly all cubesats launched into orbit today still do not have active propulsion systems (though some operators now utilize a technique known as differential drag as a form of non-propulsive collision avoidance).

One could argue, however, that the existing system has worked sufficiently well, as its current version was launched after the Cosmos-Iridium satellite collision of 2009, and there have been no other major accidental collisions in orbit since. (There have, however, been a variety of debris-generating events including fuel tank explosions, intentional ASAT tests, and collisions between satellites and untracked small debris. But these are not the types of events that can be mitigated with the current public conjunction alerts and existing tracking capabilities). While this system has seemingly worked well enough up until now, the writing is on the wall that it simply isn't enough to scale at the pace of the orbital traffic growth. We need more than just collision avoidance – we need actual systems and frameworks for STC and STM.
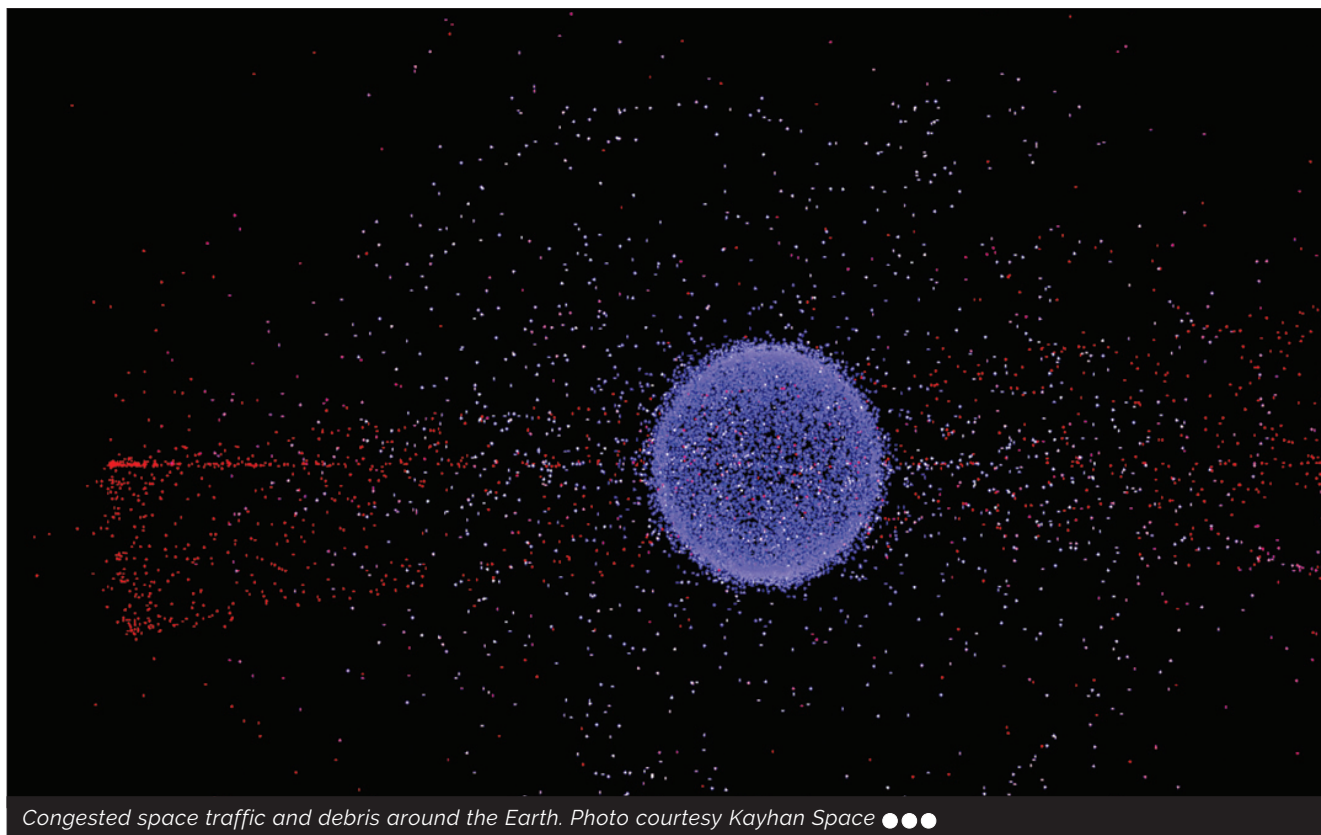
Congested space traffic and debris around the Earth. Photo courtesy Kayhan Space ●●●

THE TREND TOWARDS AUTONOMOUS SPACE OPERATIONS

Thankfully, if one thing has been shown to be true, it's that innovative commercial space companies can indeed keep up with this accelerating orbital traffic growth and provide services that enable reliable, continued access to space. At Kayhan Space, we are devoted to making spaceflight safer - a mission that drives us every day to develop commercially available software applications for operational safety of flight, including solutions for STC and STM.

As one example, consider the increasingly common scenario of a high-risk conjunction involving two operational, maneuverable satellites. Sometimes operators have several days advanced notice for events like this, but sometimes there are surprises. A conjunction alert received at the 11th hour cannot be addressed in a timely manner if spaceflight operations teams are forced to spend hours manually reviewing options and attempting to coordinate with one another through emails at 2am on a holiday weekend. It simply doesn't work, and this difficulty in communication and coordination could result in a scenario where both operators maneuver and still collide with each other.

We believe the solution to scenarios like this is to implement robust operational systems and processes built around coordination and automation. For example, we created a rules-based framework for STC and STM with our Pathfinder service, which allows owner-operators to set their own maneuver capabilities and preferences ahead of time so they can autonomously pre-coordinate decisions with one another. This eliminates the need to make manual decisions or search for another operator's contact info to call them in the middle of the night. For a given high-risk conjunction event, the risk of collision is calculated, an optimal maneuver is recommended that fits within the operating constraints of the company, and the result is communicated with the other party for review and acceptance. Each of these steps can be automated such that the full sequence is done within a matter of minutes.

The whole process is seamless and simple, as it should be. We call this sequence of steps a Coordinated Optimal Avoidance Maneuver, or COAM. We believe COAMs (and in particular, autonomous COAMs) are an integral part of an effective, scalable solution for STC and STM.

COMMERCIAL INNOVATION FOR SPACE SUSTAINABILITY

We are not alone at Kayhan Space in working towards solving the challenges of increasingly congested and dangerous orbits. There are space firms dedicated solely to removing or recycling existing space junk, with promising business opportunities built around in-space servicing, assembly and manufacturing (ISAM) and active debris removal (ADR). Additionally, propulsion companies are developing more capable thruster systems that can be used on smaller satellite platforms including cubesats, and novel solutions are being brought to market for rapidly de-orbiting satellites from higher altitudes to comply with the FCC's new five-year disposal guidelines.

It's exciting to be at this period of exponential growth in the space industry – progress is happening so fast, it's truly hard to keep up with all the advancements and innovations driving the space economy. But we must always take a responsibility-first approach of operating safely and transparently. Kahan Space looks forward to collaborating with our customers, partners, and the industry at large to develop solutions that empower spaceflight safety and open all orbits to their full potential for exciting growth, development, and exploration.   ●
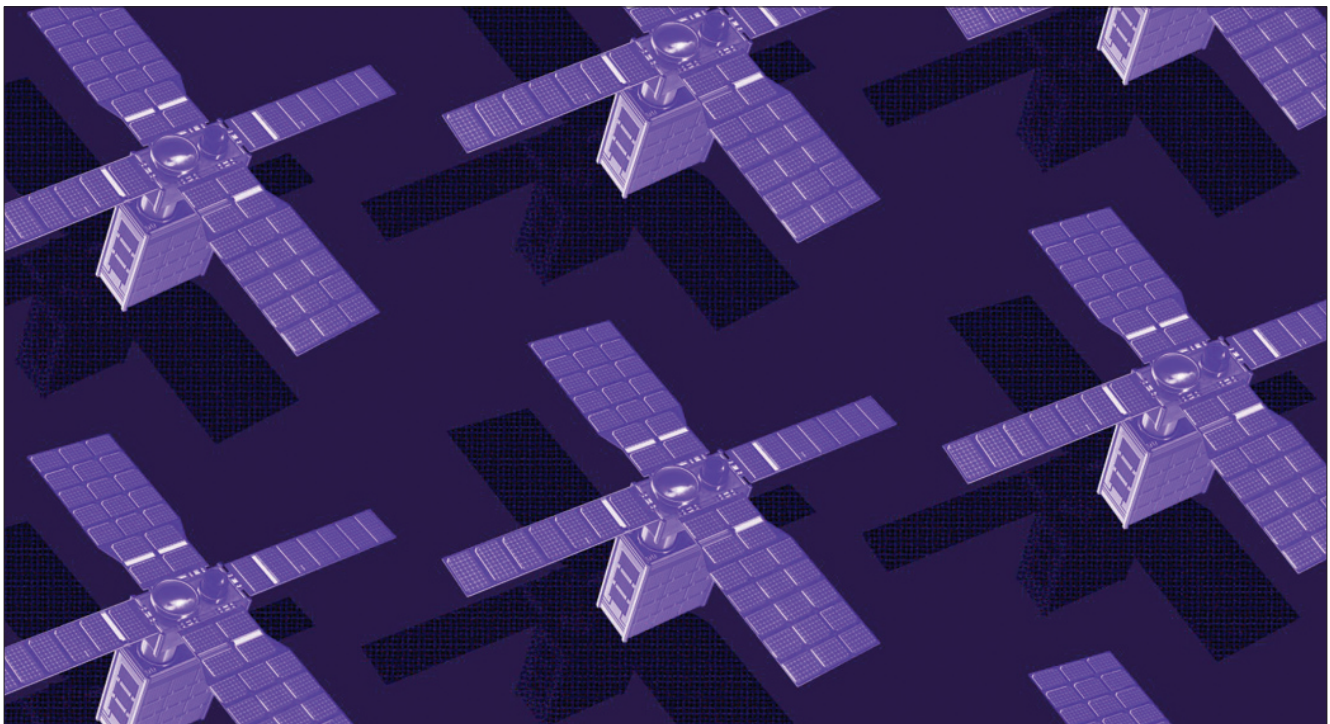
Congested space. Photo courtesy Kayhan Space ● ● ●

Can 5G and satellite work hand-in-hand?

Satellite has lost much of its relevance for B2B broadcast contribution. Broadcast compounds full of satellite dishes for uplinks are now much smaller at major events. At the same time, competition is set to get more intense as technology improves further and we are already seeing 5G revolutionise broadcast contribution. The question is: Can satellite hope to remain relevant in this environment?

Kieran Kunhya, CEO, Open Broadcast Systems

Kieran Kunhya, CEO, Open Broadcast Systems ●●●

If the last few years has taught us anything it is that broadcasters can use Internet Protocol (IP) to deliver high quality feeds from almost anywhere in the world. At the same time, IP delivers much more flexibility, scalability, and cost-efficiencies than satellite could ever provide, making it the best choice in many instances. With IP, a broadcaster can turn up at a live event on very short notice, quickly establish a feed, and simply switch it back off when it is no longer needed. This is especially critical for live sporting events where the schedule can change at the last minute, but it is equally valuable for other kinds of broadcast.

MSTV used C-band satellite to get the live coverage over very quickly to multiple broadcasters. Photo courtesy of Open Broadcast Systems ●●●

THE SATELLITE VALUE

While it is true that other technology is replacing satellite for certain types of broadcasts, there is undeniably a value that satellite delivers that cannot yet be replicated by anything else. For example, satellite delivers the ability to distribute very high bit-rate content quickly and efficiently as well as providing unrivalled point-to-multipoint making it possible to get that high quality feed to multiple takers almost instantaneously, no matter where they are located. Satellite also enables global coverage delivering access to satellite feeds pretty much anywhere in the world, even the most remote sites which are otherwise unconnected. In addition, satellite technology and processes are well established. Broadcasters have been using satellite for many years and are well equipped to continue.

COMBINING FOR CONTINUED SUCCESS

This value cannot be underestimated but at the same time remaining relevant will mean combining with technologies to provide the best solution for various use cases. MSTV Live Broadcasting has been doing since it was established in 2017. As a full-scale multi-camera live sports TV production company, MSTV provides global coverage of a wide range of sports events whether for less well-known leagues or events for the major sports disciplines.

From the start, MSTV has using EuroBroadband's satellite newsgathering service, NewsSpotter, and an IP connection. The NewsSpotter service connects with IP to enable MSTV to use a broadcast-grade MPEG Transport Stream over IP. Using encoding and decoding software from Open Broadcast Systems, MSTV can produce a consistent and high-quality feed. As well as making live coverage attainable for niche sports, this approach makes it easy for MSTV to get setup and start delivering feeds on very short notice. This capability was thoroughly tested in November 2022 when the company used satellite and 5G to deliver live football from the United Arab Emirates to viewers in South America.

THE CHALLENGE

The International Friendly, which was to be held at Al Hamriya Sports Club Stadium, took place between

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Venezuela and Panama, with fans back home keen to keep up with the action. However, the organisers were faced with a big challenge. Although the takers in Venezuela and Panama were keen to receive satellite transmissions, there was very little time to set up ahead of the event. This meant that securing satellite capacity capable of performing the double hop that would be required to reach South America might prove problematic.

The organisers contacted MSTV to see if the production company could help. Having received the request on the Friday and with the match on the following Tuesday, the setup, including time for the crew to travel to the UAE, needed to be done very quickly.

THE SOLUTION

Just two days ahead of the live match, MSTV arrived at the stadium situated in the desert near Sharjah. The crew quickly set up six cameras to capture footage from different angles and ensure fans wouldn't miss any of the action on match day.

MSTV used the small form-factor C-100 encoder from Open Broadcast Systems along with an error correction bonding technique from Zixi. The combination enabled MSTV to automatically switch to other networks when 5G was not available and keep the stream going even when the signal quality fluctuated. Thus, MSTV was able to mitigate any connectivity issues which can arise at locations where there is less coverage or at large events where an influx of fans on their own devices can impact existing coverage.

### THE COMBINATION OF 5G AND SATELLITE

Once captured at the venue, MSTV used C-band satellite to get the live coverage over very quickly to multiple broadcasters and onto TV screens to the fans at on the other side of the globe. For the receiving broadcasters the feed needed to be like any other satellite transmission. To do this, MSTV used AWS Elemental MediaConnect and the Zixi Software-Defined Video Platform (SDVP) to essentially upload the feed via 5G directly into a C-band transmission.

MediaConnect is a high-quality transport service for live video that delivers the reliability and security of satellite and fibre-optic combined with the flexibility, agility, and economics of IP-based networks. The Zixi SDVP is a complete solution for managing high performance live video delivery at scale by managing all facets of live video distribution over IP networks.

BEST OF BOTH WORLDS

With very little time to prepare, MSTV was able to distribute the live feed in record time. Using 5G allowed the speed of connectivity, especially at contribution, that is simply not feasible with satellite alone. The production company already had much of the necessary equipment ready to go and all the software-based tools to be spun up as required at a moment's notice. All that remained was getting 5G coverage at the venue which turned out to be a simple case of getting local sim cards. At the same time, using satellite for the second hop meant the receiving broadcasters would get a normal satellite transmission ready to distribute to fans at home. For many broadcasts, especially more niche content, the complexity, and cost of a double hop on satellite is simply not feasible but with the combination of satellite and 5G any type of content, no matter where it is being captured, can be delivered. ●
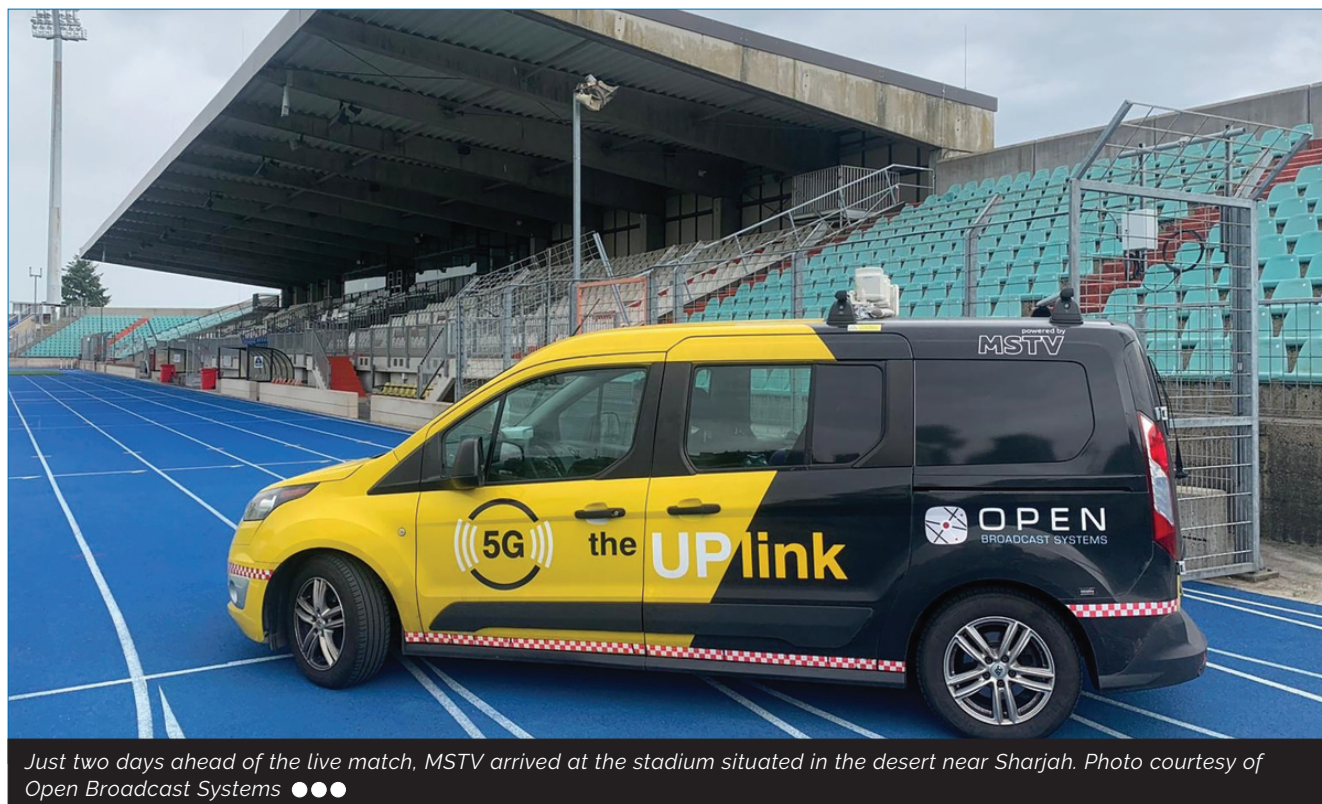
Just two days ahead of the live match, MSTV arrived at the stadium situated in the desert near Sharjah. Photo courtesy of Open Broadcast Systems ●●●

Ubotica expands technical advisory board with new appointment

Ubotica Technologies™, a leading provider of smarts for smart satellites, is pleased to announce that Tony McDonald has joined its Technical Advisory Board.

Tony has many years of experience of working within the space industry to develop strategies to exploit opportunities both in institutional space programmes (ESA) and the commercial space market. While at Enterprise Ireland, as the Irish National ESA Delegation, Tony was responsible for coordinating Ireland's industrial participation in European Space Agency Programmes. He was part of the ESA Council, Joint Communications Board (JCB), Navigation Programme Board (PB-NAV) and Industrial Policy Committee (IPC). In addition, Tony was Chair of the ESA industrial Policy Expert Group and Deputy Head of the ESA Delegation.

Now retired from Enterprise Ireland, Tony joins the Ubotica Technical Advisory Board, to provide strategic advice to the CEO and the executive team, especially with regards to facilitating access to the space community.

Tony commented on his appointment: "Ubotica is an innovative technology startup providing smarts for smart satellites which I believe has huge growth potential with its products and services which are used by global space industry partners to deliver real-time insights directly to users. Space has become such an integral part of so many applications that we use daily, and I see opportunities for Ubotica across a whole range of different sectors. I am looking forward to working with the Ubotica teams in Ireland, The Netherlands, Canada and Spain."

Fintan Buckley, Co-Founder and CEO of Ubotica Technologies, said: "With his extensive ESA network and

Tony McDonald ●●●

deep understanding of the space industry, Tony brings a wealth of sector expertise to the Ubotica Technical Advisory Board, and we look forward to working with him to expand our activities in the Space sector."

Ubotica is at the heart of semi-autonomous satellite systems that provide real-time insights from flexible on-board processing and that use affordable, low energy hardware. The Ubotica CogniSat platform was developed with deep insight of processing hardware, computer vision software and AI system integration. CogniSat technology has already been proven in multiple space flown projects with partners in Europe and the USA, including NASA JPL and the European Space Agency (ESA). ●

Boeing nominates Sabrina Soussan to Board of Directors

The Boeing Company Board of Directors has nominated Sabrina Soussan to be elected as a new director at the company's upcoming annual meeting of shareholders.

Soussan, 53, currently serves as chair and CEO of SUEZ SA, a Paris-based global utility company specializing in water and waste management with a focus on sustainability. Over a more than a 20-year career at Siemens AG, she held multiple leadership positions as Division CEO, Business Unit CEO and as an engineer in transportation, automation and energy management sectors. Prior to joining SUEZ, she was CEO of Swiss dormakaba, a global leader in access and security solutions.

"Sabrina is a proven leader who brings a global mindset with extensive engineering and senior leadership experience in manufacturing, safety, sustainability, transportation and digitalization," said Boeing Chair Larry Kellner. "With a track record of success and a shared commitment to our values, Sabrina will add essential perspective to our Board."

Subject to her election at the company's annual meeting of shareholders on April 18, Soussan would become the eighth independent director to join the Board since April 2019. These eight directors collectively bring significant experience in aerospace, safety, engineering, manufacturing, cyber, software, risk oversight, audit, supply chain management, sustainability and finance. Based in France, Soussan would also become Boeing's first board member based outside the United States and she would join the Board's audit and finance committees. ●

Sidus Space names 40+ year industry veteran Richard Kube as Chief Production Officer

Sidus Space has appointed Richard Kube to the role of Chief Production Officer (CPO). With over 40 years of experience in the engineering, manufacturing and aerospace industries, Rich brings a wealth of knowledge to Sidus Space.

Kube was most recently VP of Engineering at Cape Design Engineering, where he was responsible for multiple commercial and government contracts. Prior to joining Cape Design, Rich was Director of Engineering at Craig Technologies, where he oversaw the design and development of hardware supporting multiple space launch providers, as well as commercial and government agencies.

"We are excited to welcome Rich to our team," said Carol Craig, Founder and CEO of Sidus Space. "Rich brings a unique and valuable set of skills to the table that will help us optimize our manufacturing processes as we accelerate growth in the quarters ahead. We look forward to leveraging Rich's expertise as we continue our mission of 'Bringing Space Down to Earth™.'"

Kube's extensive experience in manufacturing spans over four decades and includes more than 20 years as a senior manager overseeing hardware build, test, and repair in support of NASA's Space Shuttle program. Kube has a master's degree in Aeronautical Sciences from Embry-Riddle Aeronautical University.

"I am thrilled to join Sidus Space as it enters a pivotal period of growth and revenue acceleration," said Kube. "I look forward to applying my extensive experience in the manufacturing and aerospace industries to help Sidus Space fully capitalize on the wealth of opportunities available in this rapidly evolving market."