

SATELLITEPRO

TECHNOLOGY INTELLIGENCE FOR THE SATCOM MARKET

MIDDLE EAST

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2023

RECRUITMENT IDEAS

8. IMPROVE
FACILITIES

1. SCHOLARSHIPS

2. MODIFY RECRUITMENT TECHNIQUES

3. SPONSOR SCHOOL ROBOTICS TEAMS

4. DEMONSTRATE FLEXIBILITY

5. REMOTE WORK OPPORTUNITIES?

6. EQUITY AS A HIRING INCENTIVE

7. RESKILL ENGINEERS

9. PAID
INTERNSHIPS

10. ARTIFICIAL
INTELLIGENCE?

ENGINEERING A SOLUTION

Specialists discuss initiatives to nurture a new generation of engineers for the space and satcom markets

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WELCOME



Working in the space and satellite market often gives you greater opportunities to meet with visionaries. Last month, I had the privilege of interviewing one such luminary – Emile de Rijk, the CEO and founder of Swissto12. His journey, from the humble origins of a PhD student at the Swiss Federal Institute of Technology (EPFL) to founding a satellite company, is quite awe inspiring.

When he didn't have enough funds to procure essential Radio Frequency (RF) components for his Magnetic Resonance research, de Rijk turned to the university's 3D printing lab. The outcome was not just cost-effective RF solutions, but the start of a long and arduous but fulfilling journey that eventually led to starting Swissto12. He harnessed the power of additive manufacturing to engineer RF solutions for HTS communication applications. Today, that has culminated in the development of HummingSat – a small geostationary satellite poised to revolutionise the industry.

Unlike its MEO and LEO counterparts, HummingSat was conceived for the demanding GEO environment. Its compact design, around five times smaller than conventional GEO satellites, is a nod to the changing tides of investment in space technology.

We are at a period when many GEO sats are reaching their twilight years, but their respective companies who should be planning their next big GEO moves are reluctant to pledge huge investments when businesses are shifting from the more reliable broadcast-business model to the dynamic, yet less predictable, broadband-business model. This is where the small GEO satellite is offering hope and evidently, its potential has not gone unnoticed, with industry giants like Inmarsat already reserving three HummingSats.

On a different note, *SatellitePro* congratulates India, which made history last month as its Moon mission became the first to land in the lunar south pole region. Again - the work of visionaries.

One place where we are likely to meet more visionaries is IBC. The show is the perfect platform for new product launches and glimpses into future technologies. There's a lot of anticipation for the upcoming month. Catch you at the show.

VIJAYA CHERIAN
Editor
SatellitePro ME

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Addressing the complexities of a multi-orbit landscape

To fully unlock the potential of multi-orbit networks and continue to revolutionise the way we connect and communicate on a global scale, the satellite industry must look to address some upcoming challenges



Yahsat reports \$205m revenue for H1 2023

REVENUE

Yahsat's revenue for H1 of 2023 has been stable at \$205m whilst EBITDA and net income increased, on a normalised basis, by 3% versus the previous year to \$125m and 5% to \$48m respectively.

Yahsat delivered revenue growth in Infrastructure, the group's largest segment providing communications capacity to the UAE government, and Data Solutions, offering satellite-based broadband data solutions. Managed Solutions provided complete value-added satellite communications solutions primarily to the UAE government and related entities, maintaining revenues versus an exceptionally strong prior year. Mobility Solutions recorded strong double-digit growth in Q2 with 12% versus the prior year, driven by higher equipment sales,



Ali Al Hashemi, Group CEO of Yahsat Group.

a trend that is expected to continue into Q3 and help achieve revenue growth for that segment by the end of the year.

As of June 30, 2023, the group's contracted future revenue remained strong at \$1.9bn, equivalent to around 4.4 times last-twelve-month revenue.

Ali Al Hashemi, Group CEO of Yahsat, said: "Yahsat continues to improve its business operations and profitability, and we remain

focused on growing both our core government business and commercial segments, whilst controlling and optimising costs across the group. In addition to completing the Thuraya-4 NGS satellite procurement programme, which remains on track to be launched in the first half of 2024, we have signed an Authorization-to-Proceed (ATP) with Airbus, a long-time partner of Yahsat, to commence initial activities relating to the procurement

of the Al Yah 4 and Al Yah 5 satellites. In parallel, we are in advanced negotiations with the UAE government to secure a long-term contract that would significantly increase and extend our backlog of contracted revenues beyond 2040.

"We have also commenced work on establishing a formal partnership with Bayanat to offer Earth Observation (EO) capabilities using, in the first phase, synthetic aperture radar (SAR) technology, which provides higher resolution data than conventional sensors. This partnership aims to develop a constellation of five satellites, with the first satellite expected to be launched in the first half of 2024, which will further diversify our current portfolio of fixed and mobile satellite communication services from GEO orbits and expand it to include Earth observation services from LEO orbits."

Egyptian Space Agency reappoints Sherif Sedky as CEO

APPOINTMENT

Sherif Sedky has been reappointed CEO of the Egyptian Space Agency, now holding the rank of Minister, as per a recent presidential decree.

Sedky has succeeded Dr. Mohamed Al-Qousi. Prior to this appointment, he held notable positions, including Director of the Yousef Jameel Science and

Technology Centre and the Office of Provost at the American University in Cairo. Additionally, he served as the Executive President at Zewail City of Science and Technology, a nonprofit educational institution.

With an extensive career spanning over 30 years across international institutions in the Middle East, Europe,

and the United States, Dr. Sedky brings a wealth of experience to his leadership role.

The Egyptian Space Agency, a government entity, is dedicated to achieving key objectives, notably the acquisition of space and satellite technology for the nation.

In a significant accomplishment in 2022, the agency

successfully launched four satellites into space, each serving scientific research purposes.

During his previous year as CEO of EgSA, Sherif Sedky oversaw the launch of the Horus-1 & 2 satellites, established agreements with foreign partners, and paved the way for the upcoming launch of the MisrSat-2.

Nilesat chooses Ateme video headend for better coverage across MENA and Egypt

PARTNERSHIP

Nilesat has selected Ateme's video headend to feed its latest satellite launch.

The deployment marks the third time that Nilesat has chosen Ateme for a video headend, this time to help revolutionise Nilesat's fourth space satellite launch, Nilesat-301. This allows broader, high-quality coverage across the Middle East and Africa. In its third project with Nilesat, Ateme provided its TITAN software solutions, which were instrumental in enabling the delivery of around 50 channels, including HD and



UHD. Project deployment was completed in H1 2023 with the assistance of Ateme's local partner, Systems Design.

Commenting on the deal, Maissa Kamel, CTO of Nilesat, said: "We launched

a new satellite to reinforce our commercial leadership in broadcast services and open new services over Southern Africa and the Nile basin. But we needed a more modern, compatible

video headend to send the feeds. Ateme provided the right technology and had already demonstrated its support throughout our ongoing relationship. We are excited to be working with them once again."

Razik Zaghloul, Ateme's Regional Sales Director for MENA, added: "Viewers in Africa have higher expectations and demand the best quality. We are honoured to support Nilesat, one of the largest satellite providers in the MENA region, in delivering exceptional video quality to a broader audience."

AMN expands mobile network access in Africa

BROADBAND

Africa Mobile Networks (AMN), which delivers services for the biggest Mobile Network Operators (MNOs) in Africa, has selected the Hughes Jupiter System ground platform to backhaul 2G, 3G and 4G cellular network traffic in Madagascar and Nigeria. AMN will deploy Hughes Jupiter gateways and remote terminals to connect several hundred cellular towers via satellite, enabling its operator customers to reach more subscribers in hard-to-reach areas and help bridge the digital

divide in the region.

Michael Darcy, CEO of AMN, said: "The biggest multi-national mobile network operators in Africa depend on AMN's networking business models to serve their customers, whilst we depend on partners like Hughes for the ideal technology for the rural environment along with reliable commercial and technical support. The Hughes Jupiter System meets our objectives for serving hard-to-reach customers in Madagascar and Nigeria with optimal CAPEX, OPEX and business support."

Eutelsat 10B satellite enters into service successfully

NEW LAUNCH

Eutelsat Communications announced the successful entry of its multi-mission high-capacity Eutelsat 10B satellite into service at the 10°East orbital position.

Eutelsat 10B is carrying two multi-beam HTS Ku-band payloads: a payload covering the North Atlantic corridor, Europe, the Mediterranean basin, and the Middle East, offering significant throughput in the busiest air and sea traffic zones, and a second payload to extend coverage across the Atlantic Ocean, Africa, and the Indian Ocean.

Firm multi-year capacity commitments are secured with several maritime and in-flight connectivity service providers – and discussions are well-advanced with others. Partners, such as Panasonic and Intelsat, will rely on Eutelsat 10B to provide ships and airlines with mobile connectivity services, in the air and at sea, for passengers and crews.

Eutelsat 10B will also cater to Eutelsat Advance services, a global network of coverage providing high-end connectivity to users.

Axess Networks and ABS expand satellite coverage over Middle East

PARTNERSHIP

Axess Networks and ABS, a global satellite operator, have signed an agreement to launch a new network increasing Axess' Middle East coverage.

The agreement provides Axess Networks with expanded opportunities for both terrestrial and maritime clients in the region strengthening Axess' dual-use strategy for the ABS-2A satellite.

This latest development complements Axess' existing Ku-band satellite coverage of the Middle East already bolstered by previous agreements supporting networks on the ABS-3A and ABS-2 satellites.

Guido Neumann,



President at Axess EMEA, said: "Our rapid successive roll-out of Axess networks in the Middle East promotes our service offerings in the maritime, oil & gas, enterprise and telco markets. Additionally, it provides an attractive option for new clients looking to improve their communications to their fixed and mobile activities in the region."

Adrian Redfern, Director of Business Development at Axess EMEA, added: "ABS-2A's coverage in the region is ideal for supporting Axess' maritime clients navigating through the Suez Canal. As more vessels benefit from satellite communications supported by Axess' unlimited, uncapped and unthrottled Ku-band networks, the

increased demand is promoting an organic expansion of our already substantial geographic network coverage."

Ramsey Khanfour, Chief Commercial Officer of ABS, added: "Through our collaboration with Axess Networks, ABS continues to extend its global reach, bringing seamless satellite communications to the Middle East and beyond. As Axess Networks promotes its service offerings to key verticals on land and at sea, ABS-2A's ideal coverage in the region provides robust and reliable communications, enabling all business segments to thrive in an increasingly interconnected world."

SpaceX launches Hughes Jupiter 3 satellite

NEW LAUNCH

Hughes Network Systems has announced its Jupiter 3 ultra high-density satellite has been successfully launched. Also known as EchoStar XXIV, Jupiter 3 was built by Maxar Technologies in Palo Alto, CA, and is engineered to deliver gigabytes of connectivity to customers across North and South America.

The satellite began sending and receiving its first signals, and engineers deployed the Jupiter 3 solar

arrays, which unfolded in space to their full ten-story span.

Hamid Akhavan, CEO, EchoStar, said: "Jupiter 3 is the highest capacity, highest performing satellite we've ever launched. [With this], we're proud to herald the start of a new era of connectivity and serve more customers where cable and fiber cannot. This purpose-built satellite is engineered uniquely to meet our customers' needs and target capacity where



it's needed most, such as the most rural regions of the Americas, so they can stay connected to the applications and services they depend on every day."

Once Jupiter 3 travels into its geosynchronous orbit 22,236 miles above the Earth to its destination at the 95 degrees west orbital slot, it will undergo extensive bus and payload testing before entering service and augmenting the Hughes Jupiter fleet with more than 500 Gbps of additional capacity.

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OQ Technology signs new IoT connectivity deal with Aramco

CONNECTIVITY

OQ Technology has signed a new MoU with Aramco to strengthen their existing collaboration and concentrate on automation and satellite IoT connectivity for Aramco's remote site infrastructures.

The MoU will create investment opportunities by converging automation and connectivity technologies, driving value creation in the Kingdom of Saudi Arabia.

Intelligent Integrated Node (IIN) technology is an automation infrastructure technology invented by Aramco and developed by MOXA Inc. It combines



instrumentation control, monitoring, and edge computing capabilities into a single fault-tolerant device. The technology unifies various devices from multiple vendors. The collaboration will see synergy between Aramco's automation edge technology and OQ's Low Earth Orbit (LEO) 5G NB-IoT infrastructure, offering significant potential to accelerate tech development in various sectors.

Yahsat strengthens presence in China

PARTNERSHIP

Yahsat has announced plans to reinforce its presence in China, as part of its growth strategy to diversify and expand across international markets with the Chinese and the Asia Pacific regions at the forefront.

Yahsat's senior

commercial team, led by its Chief Commercial Officer, Sulaiman Al Ali, travelled to Beijing to meet with Hussain bin Ibrahim Al Hammadi, the UAE Ambassador to China, who is leading the Diplomatic Mission's efforts to empower UAE businesses to expand

across the growing Chinese market.

The team met with Thuraya's service partners, including Zhongyou Century (Beijing) Communications Technology CO. Limited, to explore potential business opportunities in strategically important sectors, including government with a particular focus on search and rescue applications and enterprise.

The team presented its cutting-edge, next-generation mobility solutions, underlining its long-term objective to meet the evolving needs of Chinese customers across several sectors.



Nilesat achieves Tier 4 Certification of Cairo teleport

CERTIFICATION

The World Teleport Association (WTA) has announced that Nilesat's teleport located in Cairo, Egypt, has been awarded the Tier 4 Certification.

Sameh Katta, CEO of Nilesat, said: "Since Nilesat's inception, we have been keen to maintain a high level of service quality, and today by achieving the highest tier in the WTA certification programme, we confirm our commitment to maintain the highest international quality standards in satellite broadcasting services."

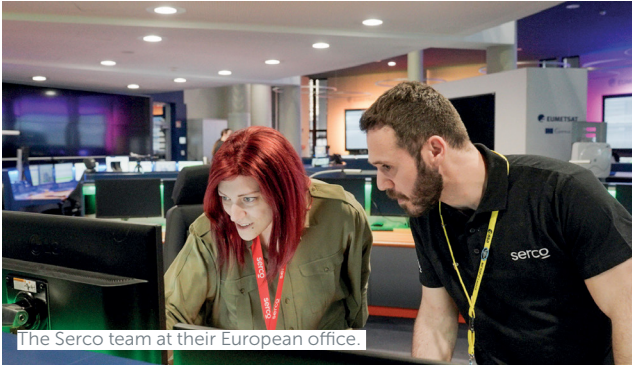
"Obtaining this certificate from an independent international organisation reflects what we can provide of distinguished services to our customers, whom we are keen to satisfy through our constant pursuit of continuous improvement in order to always be at the forefront of teleport service providers in the Middle East and Africa."

Serco graduate space programme in KSA to empower young Saudi engineers

TRAINING

Serco, the international public services company, which recently launched its Saudi Space Division in Riyadh, has opened applications for its Graduate Space Programme, with the aim of recruiting young national engineers. With the growth of its international reputation in the space industry, the Communications, Space & Technology Commission (CST) is tasked with ensuring that local talent is nurtured and developed in what is still a developing sector for the nation.

Serco, as a government impact partner will, through its Saudi Space Division, utilise more than 40 years of space experience globally to develop the talent and skills of national residents within relevant fields. The launch of its graduate programme



is the first phase in ensuring the transfer of operational knowledge and capabilities to young engineers and scientists in the Kingdom of Saudi Arabia. The space-specific programme is the first-of-its-kind within the Kingdom of Saudi Arabia and across Serco globally.

Applications are currently open and graduates will be recruited by October.

Graduates who are brought onto the programme

will benefit from on-the-job training through the programme's six-month placement at world-leading space facilities in Europe, offering them international exposure through Serco and its partners together with the opportunity to apply skills and knowledge in a global setting. Upon their return to KSA, they will continue their growth, through theoretical lessons, on-the-job training, shadowing, and

mentorship with the aim of deploying them into Serco's own operational contracts in the regional space sector.

Amar Vora, Head of Space for Serco Middle East, said: "With Serco's experience in space, it seemed only right we moved quickly to begin transferring our knowledge to the next generation to proactively support nationalisation goals. Our initial graduates will benefit from valuable placements that will equip them with the skills and know-how to support Saudi's own ambitions. Serco is a proud partner of the Saudi government and the launch of this specialised graduate programme is a demonstration of our commitment to the country, and our best possible contribution in ensuring Saudi has the local talent it needs to become a world leader in space."

Ooredoo Group appoints new CEO for Algeria

APPOINTMENT

Ooredoo has appointed Roni Tohme as the new Chief Executive Officer of Ooredoo Algeria, effective August 1, 2023, after a successful interim period as the company's Acting CEO.

Tohme brings more than 21 years of experience in telecoms and finance to his new role, having previously served as Ooredoo

Algeria's Chief Financial Officer (CFO). During his tenure as CFO, he played a vital role in shaping an agile and lean finance department, highly contributing to the company's business transformation. He has also successfully implemented cost-efficiency programmes that significantly improved profitability.

He was appointed



as Ooredoo Algeria's Acting CEO – succeeding Bassam Al Ibrahim – in February 2023.

Prior to joining Ooredoo, Tohme held positions in prominent companies across Africa and Asia – including Areeba, Africell, MTN, Airtel and Axiata Group – gaining expertise in Mergers and Acquisitions, Towerco and business transformation.



ENGINEERING A SOLUTION

Recent discussions within the satellite communications industry seem to indicate a shortfall of satcom engineers globally. We asked industry experts working in different sectors for their views on the topic and what measures were being adopted at various levels to tackle the global shortage of engineering talent



A recent discussion within the satellite communications industry has been the shortage of satcom engineers. Deloitte shared that in the United States, engineers between the ages of 20 and 30 comprise just 16% of the workforce, whereas 57% are aged over 40. Similarly, by 2040, Australia is projected to be short of engineers by a count of approximately 200,000, which is expected to affect the country's infrastructure, energy sector and economy. *SatellitePro* spoke with industry experts to hear their views on the shortage and potential strategies for reintroducing interest and inviting applicants, implemented by both their companies and the region.



Deloitte
Elizebeth Varghese,
Principal & People
in Space Leader

Over the past five to ten years, significant growth and capital investment in the space ecosystem have occurred. However, the availability of talent has not increased at a proportional rate. Aerospace engineers, especially software development engineers, have sought opportunities outside of space technology due

to factors such as strong labour market competition from tech giants. Software engineering is in high demand across all segments of the value chain, making it particularly challenging for us in the space industry.

There is a prevailing perception that the space industry is challenging to penetrate, which is further enhanced by its depiction as somewhat 'mystical' or 'otherworldly'. Engineers with technical skills are deterred from applying due to their non-space backgrounds. Those trained overseas face visa-related restrictions and migration barriers to entering the industry. There is also competition for engineering talent by non-engineering sectors, including financial services and consulting. Consequently, these restricts the recruitment pool, since fewer qualified applicants perceive they can apply.

In the United States, the space industry currently has thousands of job openings and a limited workforce to occupy them. The rapid expansion of space start-ups further strains the talent pool available. Company leaders and recruitment managers are adopting new strategies to overcome these challenges, including modifying recruitment techniques, improving facilities, promoting remote work opportunities, and demonstrating flexibility by considering candidates from outside the industry as well.

Several companies have adopted a candidate-centric hiring process. Organisations are focusing on the employee brand and the value proposition of working in space to attract candidates. Many companies are also being intentionally location-agnostic when sourcing. They are hiring where the talent is rather than the

other way around. Learning how to manage a decentralised workforce and a larger remote team has taken some effort, but it is yielding positive results.

Recruiters are also focused on growing the pipeline and bringing new people into the industry by emphasising adjacent skills. In today's job market, companies no longer have the luxury of screening out candidates. If someone lacks a specific skill or experience but checked four out of the five boxes, managers are encouraged to screen them in. If the candidate demonstrates the ability to learn and grow, it will pay off dividends because the company invests in that person.

Certain companies have seen more success by leveraging compensation – after becoming publicly traded via a special purpose acquisition company merger, one company used equity as a hiring incentive. As tuition costs and student debt have skyrocketed, companies are also enticing students with scholarships, paid internships, and a student loan repayment programme.

Several companies are also investing heavily in their internship programme and encourage an interest in STEM from an early age by sponsoring high school robotics teams and STEM programming with the National 4-H organisation.

In the UK, most people join the space sector at the start of their careers. About half (47%) join as new graduates and over three-quarters (77%) have joined by the age of 35. Approximately 6.1m people (19% of the UK workforce) hold engineering and technology occupations, with 25% of all job postings in the UK being for engineering roles. Demand for engineers is predicted to grow faster than

that for other occupations. Meanwhile, the US Bureau of Labour Statistics has estimated that there will be more than 125,000 engineering openings on average annually through 2030.

In the past, students in the Middle East experienced limited career opportunities for postdoc graduates of physics and mathematics outside of academia and teaching. As a result, students opted for other disciplines outside of space. To solve this lack of Emirati planetary scientists, the Emirates Mars Mission reskilled engineers to become apprentice scientists in preparation for the Hope. They partnered with the Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder, as well as Arizona State University and the University of California, Berkeley. Middle Eastern countries seek to establish a Middle East-wide space agency, like Europe and Africa. The region is heavily investing in their educational systems to create a workforce with the capability to build satellite technologies. For example, since 2018, Bahrain has been training a ‘space team’ focused on teaching younger generations about satellite technologies.



Es'hailSat
Hamad Al Mannai,
Vice President –
Commercial

The satellite industry has always struggled to find the right talented young engineers to build highly advanced technology solutions for global customers and applications. There continues to be a shortage of talent in the industry, and this is now true across most of the globe. Es'hailSat has been investing in education for many years now, so we can groom the young workforce and help build our own technology for the future.

Es'hailSat conducts outreach programmes with universities and schools to educate and promote

satellite engineering among students. We have outsourced application development to universities where senior students work in a group and with supervision from our engineering team to develop and enhance solutions for certain parts of our teleport operations. As an example, Es'hailSat is working with Qatar University under the Academia-Industry Cooperation program on smart manufacturing for projects such as ‘SkyCubesNet: A Ka-Band Cubesat-Based Communications Infrastructure for Smart Cities of the Future’. This is just one part of our initiative to provide guidance and advice to the CubeSat teams at the university and support their development.

All these initiatives nurture talent, broaden their horizons and improve the skillset of the youth in the field of satellite engineering for generations to come. Within Qatar, we have undertaken many such initiatives with the younger generation across various age groups. Ultimately, these are key to fulfilling our vision of being a world-class satellite operator and service provider that effectively contributes to the success of Qatar’s National Visions 2030 by supporting young students to become the driving force behind the diversifying economy.



Satcoms Innovation
Group (SIG)
Martin Coleman,
Advisory Board
Member

Having been involved with a local school in the UK and, in particular, helping with a new ‘Future Classroom’ concept, has been a revelation from the get-go. The spin-off? The school now has a steady stream of students each year opting to study math, engineering and scientific subjects, with a view to a career in the aerospace industry. Getting school students interested in this way has been my specific area of interest and action to help fill the skills gap facing most industries.

The limited choice of currently qualified students from university to suit any industry begins by ensuring students have better career advice. This requires a combination of educational initiatives, engaging activities and exposure to real-world applications – the Future Classroom does exactly this. The most interesting change of focus in our school is STEAM, adding the Arts to into the STEM equation. There are several strategies to foster that interest.

Hands-on-activities, such as workshops, science fairs and engineering competitions, where students can build and experiment with simple rockets, model satellites



or other aerospace-related projects. These practical experiences can help them see the real-world applications of theoretical concepts. We also invite professionals working in these industries to share their experiences with students and get them to be regular visitors. Field trips to aerospace companies, research centres and space museums can inspire and highlight what they can achieve with a career in these fields. Also beneficial are STEAM clubs in schools that focus on engineering and space sciences. These clubs can conduct regular meetings and plan activities related to space exploration. Interactive learning tools and virtual reality experiences that allow students to virtually visit space missions or understand the mechanics of spacecraft can make complex concepts more accessible and exciting; these are already a part of the Future Classroom.

Celebrating significant space milestones or achievements, like satellite launches, spacewalks or rover missions, can be educational opportunities and spark curiosity among students. Integrating project-based learning into the curriculum, where students work

open-ended engineering challenges related to space and aerospace, encourages creativity, problem-solving and collaboration.

Also beneficial are mentors from the space and aerospace industries, who can provide students with guidance, career insights and motivation to pursue a similar path. Actively encouraging and supporting female and minority students can promote diversity in the space and aerospace industries. Movies, documentaries, books and other popular media that highlight space exploration and aerospace achievements can make these subjects more relatable. Students are also encouraged to participate in national and international space and engineering competitions.

Offering scholarships and grants for students interested in space and aerospace fields can support their educational journey. Giving motivated students real-world exposure, through collaborations with aerospace companies and research institutions that offer internships, apprenticeships, or summer programmes, can solidify their interest in pursuing a career in these industries.



Satcoms Innovation Group (SIG)
Helen Weedon,
Managing Director

The theme of talent acquisition has come up regularly at our recent workshops. In fact, earlier this year, I asked participants to note the single biggest challenge they are facing, and this was top for many. This has been a concern for a number of years. I remember it being a discussion topic very early on in my time working with the Satcoms Innovation Group. One topic we discussed on a

panel at CABSAT was the lack of diversity in the satellite industry and that extends to diversity in age as well as many other factors. That said, I'm aware that there are a great many activities underway across the world to encourage more children into STEM subjects. There are also a growing number of industry-specific initiatives, but we certainly need more.

In the UK, there has been a rise in students taking engineering courses over the past couple of years, so maybe we are starting to see the impact of some of the activities that will eventually lead to more engineers leaving university and entering the world of work. However, the rise in students opting for computer sciences is even higher at almost 50%. Given the cool factor of companies like Apple and Google, that is hardly surprising. Perhaps the satellite industry needs to do more to show that it is just as exciting, if not even more so. How we get there likely will involve input from across the industry and collaboration with some of those initiatives already in place.



Quadsat
Joakim Espeland,
CEO

As a small company based in Odense, it is hard to make a sound judgment on whether the shortage of engineers is true or not. There is some expertise that it is harder to find than others. Whether that is due to our location or company size is not something we have done research on.

As an example, for Quadsat, it is hard to get RF competences. However, if we were based in Aalborg, it might be easier to get RF but harder to get robotics. Overall, I would expect that there are more engineers educated per semester, together with a growing trend for people to get more educated. Of course, there are also many more tech companies that might be equally exciting to young engineers as a career in space.

However, finding people with existing satellite or space experience that are familiar with emerging technologies, like AI, is probably difficult. Satellite companies may be more successful considering upskilling current employees on emerging technology or educating candidates with the right skillsets on space and satellite. Another thing that is important to keep in mind is that the newly educated workforce today is much more concerned about purpose and the direction of the company than building a traditional career and job security.



Atheras Analytics
Charilaos
Kourogiorgas,
Technical Director

Atheras Analytics uses AI to design and operate Ka-band and Q/V-band satellite networks. The core engineering competencies that we seek are software engineering, machine-learning engineering and satcom

engineering. In practice, however, we find that our engineers are often proficient in more than just their core competency.

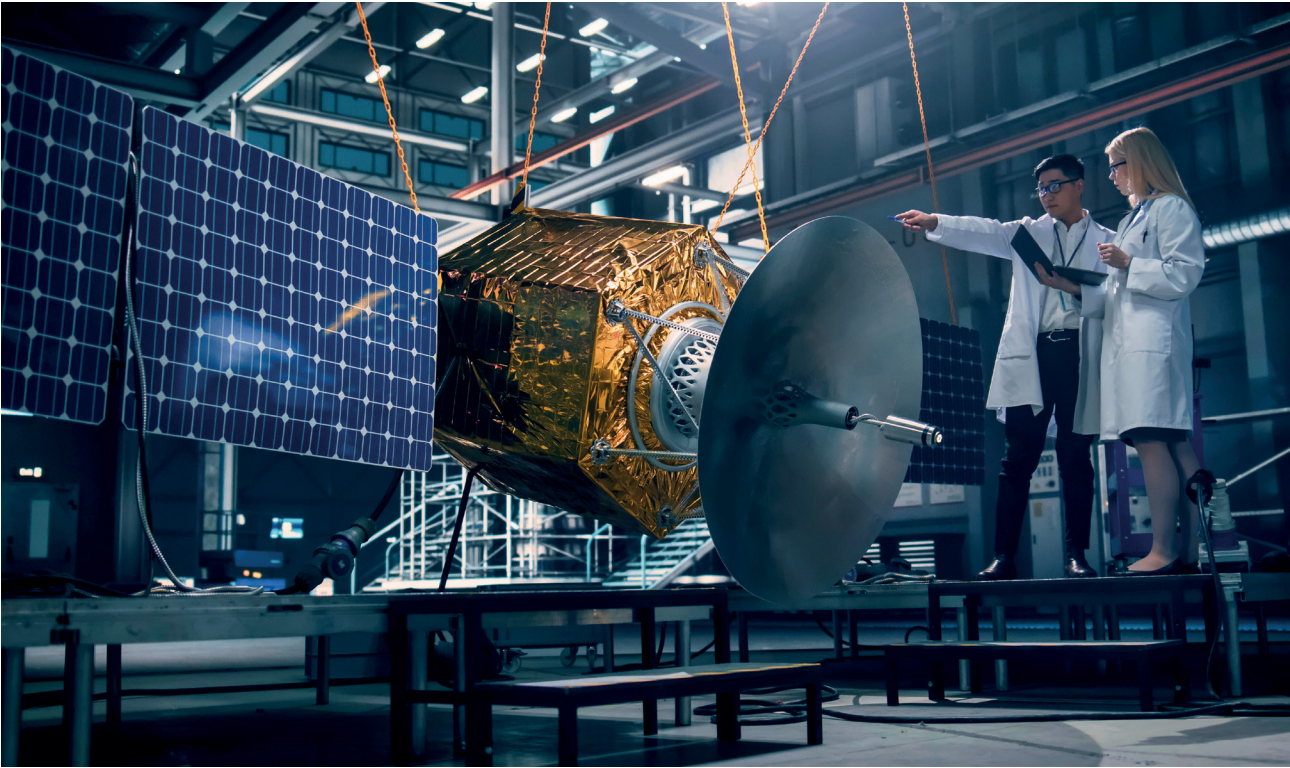
We operate as a virtual company, so we're flexible on location. However, from a practical perspective, the time zone should be reasonably aligned with the core team in Europe.

We primarily use LinkedIn for our recruitment campaigns, which seems to work well for software and machine-learning engineering roles but attracts fewer (around 50% fewer) applications for the satcom engineering roles. As a start-up company, we can't provide the salaries that some of the larger, more established satellite companies are able to offer, but we hope that we compensate for that through our employee share option scheme, extremely dynamic and fast-learning work environment and opportunities for early advancement and responsibilities.

Perhaps in recognition of that, most of the applications we receive for the satcom roles are from younger engineers who are keen to take advantage of these opportunities, while applications from more senior engineers are fewer.

We have had excellent success with the UK Space Agency Space Placement in INdustry (SPIN) programme. In the last two years, we have taken on two machine-learning SPIN interns, both of whom were subsequently offered, and accepted, permanent positions with the company. We have also benefitted from the UK Visa Sponsorship Scheme, which was a fairly straightforward process and has enabled us to directly employ a specialist non-UK satcom engineer in the UK.

Through a combination of all of the above (and a lot of persistence!), we have managed to assemble a world-class engineering team, which we continue to grow.





Yahsat
Mohamed Al
Ali, A/EVP of
Human Capital

The Middle East, especially the UAE, is witnessing tremendous growth in its space and satellite sector. The UAE's driving efforts to venture into the global space economy sector has triggered strong interest from younger generations. One of the key messages that our leadership is keen to convey to the youth, not only in the UAE, but also in the entire region, is that it is about time for Arabs to resume their contributions to the advancement of the planet. This is why the UAE Mars Probe was named 'Hope'. The outcome afterwards has been impressive and the number of young Emiratis flocking to the sector is on the rise, as the successes of the UAE National Space Programme in a remarkably short span of time are inspiring future generations to pursue exciting opportunities in the satellite communications industry. There is no dearth of interest or talent, but the challenge is how to harness latent potential to boost innovation and productivity.

While the situation may vary from one region to the other, it is a fact that phenomenal growth of the satcom sector has driven demand

to exceed supply recently. For instance, 2022 was a record year for the space sector, according to a Deloitte study, with 186 successful rocket launches (41 more than in 2021), signalling a rapid transformation of the space sector.

Yahsat has been committed from the very beginning to attracting and nurturing young engineers and specialists in this sector. We are one of the key drivers of the UAE's space ambitions and its space economy, with our own space programme continuously identifying and training homegrown talent. As the UAE transitions to a knowledge-based economy, the space sector will be increasingly important in accelerating the country's economic, scientific and social development. We expect the domestic space sector to flourish and develop further, fostered by continued investments in in-country research, technology and infrastructure development.

We believe that a self-sustaining economy bolstered by local talent and strong learning and career development programmes are vital for both Yahsat's and the UAE's long-term success in the satellite communications sector. In this regard, we are working closely with the government to support the National Space Programme for further progress and growth.

Yahsat attaches high priority to developing future generations of Emirati space and satellite engineers. In line with our sustainability goal, 'Investing in People', we are involved in several initiatives to build Emirati youth's knowledge and STEM skills. In 2017, we founded the Yahsat Space Lab, besides launching a master's programme in advancing space systems engineering in partnership with Masdar Institute and Orbital ATK.

In 2020, Yahsat partnered with Khalifa University and the

UAESA to establish a lab that will be a hub for manufacturing and designing small satellites. The Yahsat Space Lab is part of the Khalifa University Centre for Space Technology and Innovation and is the UAE's first space systems laboratory with assembly, integration and verification facilities to build miniature satellites called CubeSats. Students of Space System and Technology at Khalifa University learn and gain experience in the entire CubeSat lifecycle from design to development, mentored by Yahsat engineers.

In addition, we have career enhancement programmes such as GROW and Yahsat Youth Council to train space leaders of tomorrow, while providing on-the-job training and interaction opportunities for new Emirati trainees and employees through internships, satellite programmes and job site visits.

The Programme Management Office for our latest satellite, Thuraya 4-NGS, comprises young Emirati engineers who are heavily involved in its development and launch. The Middle East's first Flight Dynamics engineer, Fatma Al Yammahi, is a key member of our Technology team. Abdullah Essa Sharif, who joined us after a stint at Yahsat Space Lab, is now part of the UAE's ambitious Multiple Asteroid Exploration mission. Aida Al Yaaqoubi, Senior Engineer of Spacecraft Analysis, was handpicked by the UAE Ministry of Industry and Advanced Technology to represent the country in the International Electrotechnical Commission (IEC) Young Professionals Programme. She was also elected as the 2022 IEC Young Professional Leader for Asia and the Middle East. They are stellar examples of our rising stars with many more yet to come. **PRO**

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FROM COVERAGE TO CAPACITY: THE IMPACT OF SATELLITE NETWORKS ON THE GCC'S 5G ECOSYSTEM

5G is expanding rapidly in the GCC region with countries like the UAE, KSA, Bahrain and Kuwait introducing standalone 5G networks to enable ultra-low latency, innovative industrial use cases and additional capacity. As 5G demand starts to surpass existing infrastructure capabilities, industry players explore the potential of satellite technology to fully realise the benefits of 5G



The primary use case for satellite-enabled 5G in the region is to provide high-speed connectivity and widespread coverage for internet and mobile services; for example, in difficult to reach and rural areas, and to enable remote industries such as Mining and Agriculture, as well as for disaster response and emergencies, that could render regular terrestrial infrastructure unusable. By seamlessly integrating with terrestrial networks, satellites offer tremendous potential for delivering seamless wireless 5G experiences across the region.

Comprehensive Coverage for Rapid Demand

The GCC is one of the fastest-growing regions in the world for 5G adoption. 5G subscribers in the GCC are expected to reach 75% by 2027, according to Nokia's most recent Middle East and Africa Mobile Broadband Index and 86% by

2028, according to Ericsson's latest Mobility Report. Usually Low Earth Orbit (LEO) satellites are a popular choice for enabling 5G as they facilitate a relatively lower latency, and faster transmission of data than satellites at higher altitudes. Although regional development of integrating satellite technology for 5G is in the early stages, LEOs covering adjacent geographies can combine constellations that ensure seamless, wide-scale coverage over a specific geographic area, allowing for increased 5G coverage and faster deployment than land-based networks alone, which in turn could enable operators to meet the growing demands of 5G in the region.

Satellites are well-positioned to supplement wide 5G coverage for terrestrial cable infrastructure in unserved or underserved areas in the region such as deserts and rural locations housing industrial, military or aerospace activities. A patchy coverage in hard-to-reach geographies would defeat

the purpose and make the service unattractive; therefore, it is key to ensure adequate coverage across the relevant target geographical areas. Saudi Arabia witnessed the first steps in the development of space-based 5G mobile communications services combining cellular and satellite non-terrestrial networks earlier this year.

Satellites face fewer hindrances from physical assets making them suitable for extending higher capacity and faster 5G coverage. This can accommodate areas with overcrowded data traffic or which are logistically challenging to access as these locations would normally offer disproportionately low financial returns for fibre optic cables or terrestrial 5G networks. Therefore, satellite-enabled 5G can be cost-effective for aiding the Middle East's biggest industry vertical – Oil & Gas – handling enterprise traffic and real-time surveillance over expansive geographies. A successful demonstration of the

first satellite-enabled 5G backhaul in the Middle East utilising Medium Earth Orbit (MEO) satellites was held at the beginning of the year proving its viability.

Reliable and Efficient Communications

Satellite-enabled 5G offers a durable backup for terrestrial networks and uninterrupted communication in unfortunate situations such as natural disasters. Offshore maritime and energy sites, rural healthcare centres, agricultural farms and manufacturing plants in the GCC require high throughput and low latency network connectivity that could be provided by satellite-enabled 5G, ensuring reliable and resilient communications for emergency and business-critical applications in case of any unavailability of terrestrial networks. Further reduction in latency and increase in throughput will enhance the effectiveness and appeal of satellite usage. Satellite technology could also enable efficient bandwidth utilisation for 5G and a seamless transition between satellite and land-based networks will ensure ubiquitous connectivity.

Moreover, newer software-defined satellites that allow satellites to be reprogrammed while in orbit can boost telecommunications operator flexibility. Satellite-enabled 5G can then provide more reliable broadband capacity customisation to different geographic areas and at different times, allowing for optimized resource usage. Earlier in the year, the UAE received its first 5G network capabilities over a software-defined satellite, giving users access to enhanced speed, coverage and scalability to cater to future high bandwidth demands.

Novel User Experiences

The proliferation of mobile devices in recent years has shifted consumer preferences towards



“Satellites will play an increasingly critical role in the coming years in complementing the GCC's existing land-based networks”

Saurabh Gupta, Chief Technology Officer, Beyon

low-latency on-demand streaming. 5G-enabled satellites can help make immersive mobile experiences, such as high-definition streaming and virtual reality, the norm by enabling higher broadband capacity transmission and cost-effective backhaul for mobile networks across expansive geographical areas. This can facilitate the rapid rise of relatively novel services like cloud gaming and drone delivery that have immense potential in the GCC.

Enabling Security in the Internet of Things (IoT)

The growing number of IoT devices constitutes an enormous operational challenge for data transmission in the region. Additionally, satellite infrastructure will need to maintain high security posture to ensure the end-to-end

communication networks remain highly secure and fully compliant with all user expectations and regulatory obligations on baseline security and data privacy. With constant updates needed to maintain device security, satellite-enabled 5G can provide a more efficient data distribution through expansive coverage and broadcast capacity with shared connectivity. This means satellite-enabled 5G can support managed connectivity for moving cars, vessels, airplanes and other IoT devices, enabling applications for integrated navigation and fleet management. As a result, the Mohammed Bin Rashid Space Centre (MBRSC) in the UAE recently launched the PHI-Demo satellite, which includes an advanced IoT communication payload enabling data collection and transmission from IoT devices utilizing state-of-the-art 5G technology.

Although satellite technology integration with 5G is still nascent in the GCC, 5G supplies a networking framework, allowing satellites to build on terrestrial networks and deliver enhanced connectivity through improved coverage, reliable and resilient communications, novel use cases and advanced IoT devices integration in the region. An extremely critical factor to consider is that satellite providers will require spectrum allocation to use relevant frequencies for data transmission. This is to avoid interference with existing networks, and as a result, they will need appropriate regulatory approvals and close coordination.” In conclusion, satellites will play an increasingly critical role in the coming years in complementing the GCC's existing land-based networks and advancing the potential of regional connectivity. **PRO**

Saurabh Gupta is Chief Technology Officer of Beyon



REACHING FOR THE STARS

Existing space treaties do not entirely cover recent developments such as commercial and private operations. But with cosmic highways becoming busier than ever, operators and insurers are looking at alternative and innovative solutions, reports Keith J Fernandez



Space exploration has been indispensable to the way we live today. From phone calls to watching a movie on a streaming channel to remote financial transactions and national security, space technology plays an indispensable role.

Until recently, the field has been the playground of a small clutch of wealthy nation states. As exploration costs have fallen and technology has become more widely accessible, more countries are aiming for the stars, putting satellites into orbit and launching new space missions – whether to the moon, Mars or further afield. At the same time, the emergence of commercial and private actors – often collectively referred to as New Space – is transforming the industry as fields such as tourism and even asteroid mining signal routes to future economic growth.

The impact of our expanded use of space and the increasing range of activities are naturally shaping the landscape of satellite trade and insurance.

Just one example is the accumulation of space debris. With more objects in orbit than ever before, there are now 170m pieces of junk in space, according to the ESA. There is therefore a greater risk of collisions between space objects, whether these are satellites or debris. With that come potentially more disputes among space operators and a greater number of insurance claims.

As space becomes busier, then, current legal systems will need to evolve. On the one hand, they need to continue supporting this emerging economy, support innovation and promote equitable access for all. But they must also anticipate evolving challenges, mitigate new kinds of risks, establish a process for commercial dispute resolution

and ensure the stewardship of space for future generations.

That requires new governance. “The current regime isn’t optimum for today’s commercial space environment,” says Christopher TW Kunstadter, Global Head of Space at international insurance provider AXA XL. The risk professional has been advising and managing space underwriting for four decades.

“There are close to 100 countries that have put satellites in space, so you have many more nations in space active today than at the time when existing space treaties were enacted in the sixties and seventies, when three or four countries were working on space programmes. These treaties were agreed well before things like commercial space activity or commercial human spaceflight started. They don’t really work as well for the current wave of commercial activity, such as communications, Earth Observation, human spaceflight, and so on. Those weren’t anticipated in the 60s and 70s, when those treaties were promulgated,” he explains.

Cosmic rulebook

Space activity remains largely governed by five international treaties agreed between 1967 and 1984, and five declarations by the United Nations’ General Assembly from 1963 to 1996.

Each treaty underscores the idea that outer space, and its activities and benefits should contribute to global well-being and promote international cooperation. Among other provisions, the treaties together prevent a single country from claiming outer space, regulate the use of arms, guarantee the freedom of exploration, preserve the environment and space resources, establish liability for damage to interplanetary objects, and ensure

the safety and rescue of spacecraft and astronauts, and determine how disputes can be settled.

The treaties are the foundation of international space law. They include: The Outer Space Treaty (1967), the Rescue Agreement (1968), the Liability Convention (1972), the Registration Convention (1976) and the Moon Agreement (1984). Together they cover principles around free exploration, celestial land grabs, placing certain types of weapons in space, the return of astronauts and objects launched into space, and liability for damage caused by space objects.

In addition, the Space Debris Mitigation Guidelines, enacted in 2007, outline best practices for reducing space debris and ensuring sustainable space activities. Separately, the UN's Space Law for New Space Actors project supports member states with capacity building to draft national space legislation and policies in line with international laws and sustainability frameworks.

"It's been 65 years since the international community first started grappling with regulation of the use of outer space and almost 60 years since the Outer Space Treaty. These early efforts were very much premised on international cooperation and the idea of outer space as a 'global commons' to be considered for the benefit of humankind collectively," points out Scott Atkins, Global Chair and Global Co-Head of Restructuring at the international law firm Norton Rose Fulbright. He is an industry leader in restructuring, insolvency and risk, and an expert on emerging issues such as the commercialisation and governance of outer space.

But the gaps in these treaties are becoming clear with recent developments. Updating them is essential to accommodate rapid technological evolution, the surge in



"The space insurance industry has really been in the forefront of helping develop industry guidelines and best practices, but also of helping governments with legislation"

Christopher TW Kunstadter, Global Head of Space at international insurance provider AXA XL

commercial space ventures and the expansion of space activities among an increasing number of nations.

Galactic challenges

New technologies leading to the growth satellite mega-constellations, commercial space travel, and asteroid mining, for example, have introduced capabilities and possibilities that were not envisaged when existing treaties were drafted.

Just the rising number of satellites begs a new approach. While independent agencies such as the US Federal Communications Commission regulate American satellite launches and

communications, there is no central, global organisation to ensure sustainable and responsible satellite use. This has become particularly important as private players such as SpaceX, Amazon, Boeing and One Web compete to launch new satellite services.

Likewise, existing treaties don't cover all the use cases arising from the growing involvement of private companies in an area once restricted to national entities. It requires a regulatory framework that addresses deeper challenges such as liability, intellectual property rights, liability and resource exploitation.

Other considerations include ensuring equitable access to space by enabling a role for developing countries; issues around space mining and the ownership and use of these resources; war and the potential weaponisation of space; and sustainability concerns around space debris and the space environment.

"National and international legal frameworks applying to the use of outer space have not kept up with the sheer pace of commercialisation and technological change in outer space activity," Atkins says.

"Legal frameworks must be enhanced in order to fully realise the undoubted scientific, economic and commercial potential outer space presents," he adds.

"There remains room to grow when it comes to creating a uniform, predictable and consistent property rights framework. Similarly, a more sustainable and accountable approach is needed to tackle the growing issue of space junk, including a detailed, binding debris mitigation framework. This issue is becoming more and more prominent with the acceleration in global launch activity."

By the end of this decade – just seven years away – the global space economy could be worth

approximately \$1.1tn, according to forecasts by Bank of America Global Research. The financial institution estimated the 2021 aggregate at \$469bn, a 60% growth from estimates just a decade earlier.

Collaborative approaches to regulation are therefore more important than ever. Although the UN has made several attempts to update these treaties, several factors are hindering its efforts. On their own, differing national interests and the complex nature of modern space activities make it difficult for the many nations involved to come to a consensus. Geopolitical tensions, such as tensions between the US and China, and the war in Ukraine only intensify divisions.

In November 2021, Russia intentionally destroyed one of its own outdated satellites by launching a missile from Earth's surface. The resulting debris cloud poses a risk to various space assets, including to astronauts aboard the International Space Station. The event occurred just two weeks after the UN General Assembly's First Committee formally acknowledged the crucial role of space and its assets in improving the human experience. The committee focuses on disarmament, global challenges and threats to peace.

"It is very unlikely that any of the existing international space treaties will be extended and even less likely that new ones will be agreed," says Darcy Beamer-Downie, Senior Counsel at global law firm Clyde & Co. An advisor on arbitration and other commercial matters, including in aviation and the energy sector, she is a guest lecturer at University of Leiden Institute of Air and Space law has presented numerous papers on space law and public access to space.

"The Moon Agreement 1979 was the last of the suite of UN Space treaties which specifically attempted to prevent commercial

exploitation of outer space resources. The treaty had a very low uptake mainly because states did not want further restrictions on their access to space even then," she says.

Parallel framework

Countries have now begun to take both individual and bilateral approaches to address the issue. Some nations are independently reviewing and amending their space

"National and international legal frameworks applying to the use of outer space have not kept up with the sheer pace of commercialisation and technological change in outer space activity"

Scott Atkins, Global Chair and Global Co-Head of Restructuring, Norton Rose Fulbright



laws to reflect evolving technologies and commercial interests.

"The rapid realisation of space-enabled services – from telecommunications and GPS to the authorisation of payment transactions and monitoring of the effects of climate change – allied with an ever-improving understanding of the economic and commercial potential of outer space has seen that original, multilateral approach somewhat superseded by individualist state and private entity actors," Atkins says.

The United States and Luxembourg have individual laws for space mining. Under these laws, citizens of these countries can own, use, sell, or transport any resources they extract from interplanetary activities – challenging notions of space being 'the province of humankind'.

Meanwhile, the UAE Space Law aims to attract international investment and increase participation from the private sector by laying down regulations for activities such as space tourism, mining and logistical support services.

In 2021, the nation went one

step further with the launch of Courts of Space, positioning the UAE as a leading adjudicator for commercial space-related disputes.

“An integrated space industry, supported by human resources, infrastructure, and scientific research, is under way. The Courts of Space is a global initiative that will operate in parallel, helping to build a new judicial support network to serve the stringent commercial demands of international space exploration in the 21st century. As space commerce becomes ever more global and countries ever more connected, diverse and nimble economies will need to enable growth. Complex commercial agreements will also require an equally innovative judicial system to keep pace, offering assurance and certainty to support and protect businesses,” Zaki Azmi, Chief Justice, DIFC Courts, said when

the new forum was announced.

Bilateral and multilateral approaches are also being taken. In March, the European Union presented a Joint Communication on a European Space Strategy for Security and Defence for the first time. In a statement, the bloc said the strategy represented action to protect its space assets, defend its interests, deter hostile activities in space and strengthen its strategic posture and autonomy.

Alongside the more recent draft council recommendations on Fair and Sustainable Use of Space, enacted in May, and last year’s EU Approach for Space Traffic Management, enacted in 2022, the strategy signals the bloc’s intent to safeguard space, while promoting responsible behaviour in outer space. A new joint European space law is also being developed, even as EU member states begin to work on individual legal approaches to space.

The March announcement specifically highlighted how the current geopolitical context of increasing power competition and intensification of threats require action to deter hostile activities in space and strengthen the bloc’s autonomy.

Elsewhere, the Artemis Accords are a multilateral arrangement between the US and another 28 countries and territories that create a framework for cooperation in the civil exploration and peaceful use of the Moon, Mars, and other astronomical objects.

But bilateral agreements are no substitute for comprehensive consensus-based treaties.

“Bilateral agreements... are not binding instruments of international law, which set out the rules of a particular group of commercial space actors, the most notable being the Artemis Accords. The Accords are controversial because they are

considered, by many, to be a blatant political attempt by the US (and the invited state participants) to codify various principles of space law. The Accords do reference the existing space law treaties but crucially the Accords also require the invitees to in effect accept expropriation in space, which is direct conflict of article II of the Outer Space Treaty,” Beamer-Downie says.

The problem with the bilateral approach to codifying space law is that it is not as inclusive as an international treaty and will inevitably restrict and influence future frameworks for commercial space activities, she adds.

Innovative approaches

For now, alternative dispute resolution (ADR), which seeks to solve conflicts and disagreements outside of traditional courtrooms, could provide one way forward. ADR methods include mediation, arbitration and negotiation.

With ADR, the complex technical and diplomatic issues associated with space-related conflicts – whether in the insurance sector or beyond – can be addressed less formally and more flexibly. The mechanism can also help facilitate more effective restructuring outcomes for financially distressed commercial space actors.

As Atkins says, “The existing international architecture to facilitate outer-space dispute resolution... could be re-visited with an eye to successfully deploying ADR processes in other contexts. Such processes can also play an important role in facilitating more efficient and effective restructuring outcomes for financially distressed but viable enterprises.”

The mechanism is part of the liability convention, although it does not cover private actors. In this sense, Atkins and other lawyers believe private arbitration and mediation offer a viable



“It is very unlikely that any of the existing international space treaties will be extended and even less likely that new ones will be agreed”

Darcy Beamer-Downie,
Senior Counsel, Clyde & Co

option to resolve complex cross-border outer space disputes in a timely, efficient and cost-effective manner – although the framework remains underdeveloped.

Other players are exploring different ways to mitigate space risk, promote safety and responsible space activity. Using technology to find new solutions is one way forward.

AXA XL recently partnered with commercial space situational awareness data and analytics provider LeoLabs to develop a collision hazard tool. Called LeoRisk, it uses data from space radars and input from the insurer’s underwriters to evaluate the likelihood of collisions. This sort of predictive analysis enables operators to take action that protects their satellites.

“One of our big concerns today is collision risk. So, we engage with industry to try to make sure we don’t create debris and we don’t have collisions,” Kunstadter says. “The space insurance industry has really been in the forefront of helping develop industry guidelines and best practices, but also of helping governments with legislation.”

Some current issues are already integrated into insurance policies.

The sector covers everything from pre-launch through to launch plus life. Solutions are usually customized to each policyholder’s needs. They may cover both material damage and loss of income, among other considerations.

AXA XL’s contracts address both war and cyber risk coverage, for example.

And in the event that a dispute does occur, it is also often covered by insurance agreements. (However, not all space objects are insured; in 2022, just 38% of the 186 launches that attempted to reach orbit were insured, according to AXA XL data.)

“We would rather see any sort of disputes or issues between parties handled through contracts, rather than through legislation or regulation. We would much rather see if to say two companies are interacting and see them use to contract to address [potential] issues.

“We would rather see disputes settled contractually rather than in courts... We want to encourage people to resolve any disputes through the contracts that they sign. It’s really better to have the mechanism in place before problems happen, than to have to go to court and try to resolve it that way. So, we encourage our clients to really engage with the insurance industry to allow us to help them to make sure that the contract is well written and addresses potential issues.” **PRO**



SMALL GEO SATS TO CREATE

BIG IMPACT

When Emile de Rijk fell short of funds to procure expensive Radio Frequency (RF) components for his research, he leveraged the capabilities of the university's 3D printing lab to create cost-effective, high-quality RF products. This ultimately led him to establish Swissto12. The company has since engineered a compact yet powerful geostationary (GEO) telecommunications satellite that has captured the attention of major satellite operators. In a discussion with Vijaya Cherian, he recounts his trajectory and underscores the significance of small GEO sats in today's broadband-centric market



What's the story behind SWISSTO12?

It's a business. I started 12 years ago as a spinoff from EPFL, the local university here in Lausanne. Our initial developments were around how to use 3D printing to efficiently build RF products. Initially, our focus was on antenna products and signal routing components for wireless communication applications, particularly satellite communications. This innovative approach disrupted the conventional method of machining and assembling machine parts. By utilising 3D printing, we could replace multiple components with a single piece.

You can then free up the design space of the RF products and work towards enhanced performance. So, in the context of building a telecommunications satellite, it offered greater flexibility for advanced payloads and improved manufacturability. 3D printing enables improved performance while adhering to size, weight, and cost constraints.

How did you progress towards developing small GEO satellites?

Over time, our role as a product manufacturer evolved, and we got more involved in a higher level of integrated assembly and subsystem projects, in both space and ground operations, including diverse platforms like user terminals. And we took a keen interest in satellite systems and the market there.

We discovered that there's a really interesting opportunity in the GEO market, because it's been the historic sector that gave birth to satellite communications. It's a well-established segment with an excellent business case but it's transitioning from a broadcast-dominated business model to a

broadband-dominated business model and that has created some challenges for operators. The two markets don't work in the same time scale and typically, with broadcast markets, there's longer-term visibility on the customer base for a satellite operator than there is in the broadband segment. The latter has made it harder for satellite operators to predict where the market will go long term and that complicates investment decisions. One way to go around this problem is to make increasingly flexible satellites that also have digital signal processing capabilities onboard.

Another way is to make satellites smaller, so they cost less and enable you to take a more incremental approach towards investing in satellites. This is how we came up with the idea of a small GEO satellite and that concept gave birth to HummingSat. It gives a satellite operator the opportunity to buy much smaller assets, which cost less but which preserve a good ratio of value for money if you compare the amount of transponders or the throughputs that satellites can achieve as compared to a larger platform.

These small GEOs sats are not there to replace the large platforms because if you look at what is the best way of creating economies of scale, the large platform is still the best metric out there and there are very good market segments for these large platforms. But the distinctive features of small GEO satellites provide opportunities for secure connectivity in small- and medium-sized countries. All these business cases today are very difficult to address with larger geostationary satellites, which often leads to an investment not being made. Whereas if you can offer a smaller sized GEO asset out there, it makes such investments feasible, thereby

expanding the applications and reach of GEO satellites beyond their current scope.

Can a small GEO sat complement an existing big GEO satellite or does it operate entirely on its own?

It can. Of course, you need to organise all the co-location logistics and frequency coordination and aspects like that but fundamentally, it allows you to incrementally enhance capacity on a position that is already occupied by a large spacecraft and is perhaps full. If the operator wants to add some capacity to that orbital position but doesn't want to double the capacity but just make a more measured investment increment, the small GEO sat offers that opportunity.

Would the reliability and the stability be the same for a small GEO sat and what cost reductions are we talking about here?

Okay, let's tackle reliability first and the way these satellites are designed and architected. HummingSat is a significantly smaller satellite, so it's about a tonne or less and about 1.5 cubic metres. So, it's several times smaller than a traditional satellite, maybe five times smaller in mass and probably more than 10 times smaller in volume than a large satellite.

We do have a measured approach to architecting the systems because it is a GEO environment, which is often very harsh. We're designing for 15-year-long missions. Having established that these are long missions, we cannot take shortcuts on reliability and quality, and have to work towards space standards. So, we actually make a lot of products and subsystems that have GEO flight heritage.

We have designed a system

that is scaled down in terms of size, but we use a lot of suppliers, products, and a lot of flight heritage in our design to meet the reliability figures that are very similar to a larger legacy spacecraft that's out there. So, there's no fundamental change in terms of reliability for the HummingSat.

The lifespan is pretty much the same. We innovate on payloads. So, our core RF product USP really is important to enable us to put more payload in the small satellites, which allows us to increase the value for money of the small spacecraft for our customers.

But the products that we use and those that are relying on 3D printing technology are products that have extensive flight heritage today in GEO and larger spacecrafts.

In terms of size, it appears to be similar to the MEO range. So how would you differentiate between the two? First, the design approach is very different for a 15-year GEO mission even if the size is small. You have a very different engineering and reliability posture than if you design a LEO or MEO satellite that has a shorter life span.

Fundamentally, we design towards higher reliability standards for the specifics of our GEO missions.

We already have direct access to established markets and that sets us apart. While LEO markets are evolving, small GEO satellites leverage existing demand and infrastructure.

For small GEO sats, you're not talking constellations? Not in the LEO sense. But with the Inmarsat 8 programme announcement that we recently made, for instance, Inmarsat has procured three satellites from us. So, one could call this

a mini constellation in GEO to cover the entire earth with some very important services and their L band safety services, space-based augmentation services and those applications that require global coverage.

3D printing is what provided you with the inspiration to go down this road?

That was the initial spark. 3D printing allowed us to develop a unique and proprietary technology that gives us a big advantage in building cost-efficient RF products that are compact but high-performance solutions. It has enabled us to build efficient RF payloads and helped us build HummingSats and enabled us to enjoy commercial success as a prime satellite contractor.

Do you have any statistics on the GEO market that favour what you are doing? There has been a decline in orders in GEO since 2015. It went from something north of 20 orders a year to around 10 to 15 orders per year for the last five to seven years. And this has mostly been prompted by this transition from broadcast to broadband, which has introduced some uncertainty

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Emile de Rijk, CEO, Swissto12

in the markets. Added to that, Leo constellations offer a lot of promises and operators are waiting to see how they develop. Over the years, however, less investments have been made in GEO satellites. A lot of Geo spacecraft are reaching the end of their lives at a higher pace than if investments had been made more regularly. In fact, a third of the GEO spacecrafts out there today are more than 10 to 11 years old. This is typically a class of spacecraft that is entering into a critical phase, where if you don't initiate a procurement now, which always takes a few years to build and launch, then there's an increasing risk that the follow-on satellites will not arrive on time to meet the end of life of the existing satellite.

We're talking about something in the order of a hundred satellites that are in that condition now. In the coming years, some of them will need to be replaced while some may be discontinued because the business cases they were associated with are no longer relevant, but it's nonetheless significant.

Ageing satellites will become a concern because a lot of them support critical services that need to be continued. So, there is going to be continued interest in GEO for that reason. And because there's an increase in demand in GEO, specifically for broadband services, that also needs to be addressed.

I think in the class of larger satellites, the software-defined satellites of the main legacy manufacturers have shown that there is a solution to introduce more flexibility in GEO satellites and to make them more adaptable to changes in market conditions in the future.

In parallel to that, small GEO sats address those business cases that are difficult to address with larger spacecraft.

When is HummingSat scheduled to launch?

By 2026, the first of our HummingSats will be in orbit, delivering services to billions of people. The second mission on Inmarsat 8 combines L band safety services. So, in continuation of the safety services that Inmarsat already provides today, there will be opportunity to expand into other types of safety services with these payloads and adjacent L band services that enable them.

And then, the second important service that will be distributed through the Inmarsat 8 satellites is a space-based augmentation transponder, which is present on all three satellites and provides the ability to increase the precision of GPS positioning signals for users down to as little as 10 cm.

Typically, how many small sats would you require to do something that a Big Geo sat can do and what cost reductions are we talking about?

It really depends on the use case but I would reckon three to five. So if that ratio is preserved, it would be three to five times cheaper as well, and that's very important. Because when the operator looks at the business case, the bottom line is going to be the CAPEX investment into the satellite. What're the number of transponders it provides and what's the lifetime and then there's a simple calculation of RF.

For this, we need to come into a similar ballpark as large spacecrafts to be able to create a real business for small GEO sats, which is what we've done through the first programmes we've announced. So, you are making incremental investments rather than huge investments at one go.

What are specific trends you are seeing in the market?

Broadband, in general, is a very favourable context because there are some demands irrespective of how you distribute broadband connectivity specifically for satellites. There's still a lot of growth and mobility applications. So there are a lot of maritime and aero business cases emerging as well as direct-to-home services, enterprise services and government services. They're all growing. There are major trends to try and integrate satellite networks into 5G networks, which means it makes it

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easier to make them interoperable with ground infrastructure.

What are some of the challenges that small startups like you typically face?

We've managed to have a very successful funding journey with predominantly Swiss and European investors who have backed us very solidly. I think in space, the main challenge is it takes time to get to a product that is deployed operationally that proves a real business case.

We've been in business for 12 years and we've taken an incremental approach starting with products, then going into subsystems, then going to a spacecraft. And we are still servicing today very successful businesses with many customers who buy our products and subsystems.

We do support other satellite manufacturers or aerospace integrators. But it's a hard journey. It's a lot of proof points, a lot of technical proof points to score, a lot of flight heritage and validation to accumulate to build the momentum. But if you develop a good product and if you deliver, then positive results come with it.

Essentially, you need the ability to execute and the ability to fund it from the start to the finish.

What's next for you? Our immediate focus is on delivering ongoing programmes and expanding HummingSat's user base. We plan to enhance payloads for increased flexibility and incorporate digital signal processing capabilities. Assisting government users in adopting small GEO satellites is pivotal for market expansion. Swissto12 remains committed to innovation and improvement, and driving the potential of small GEO satellites. **PRO**



NAVIGATING THE COMPLEXITIES OF A MULTI-ORBIT LANDSCAPE



The satellite industry is moving fast towards a multi-orbit environment, with providers operating across LEO, MEO and GEO orbits. Given the distinct advantages that these different orbits offer in terms of latency, bandwidth, coverage, and capacity, operators are racing to combine orbits to provide better solutions, to meet customers' varying needs. But to maximise the benefits of a multi-orbit network, satellite operators need dynamic and flexible ground segments.

While this move is driving forward innovation in the ground segment, it's also adding a new level of complexity to the industry. And if not managed properly, there is a very real possibility that the increased use multi-orbit networks could result in a concerning increase in unacceptable interference.

Meeting Customer Needs

The expansion into the multi-orbit world is being driven by the desire to meet the diverse needs of customers more effectively. A single orbit often cannot meet all the demands nor provide the required resilience. Multifarious networks are needed to meet the growing demand for high-speed connectivity. And different orbits hold different benefits. GEO satellites provide wide-area coverage and high capacity, MEO satellites offer broader coverage areas and improved signal quality while LEOs are designed for high-speed internet

connectivity and applications requiring real-time two-way data transmission, such as gaming, communications, and the internet of things.

By integrating these orbits, satellite operators can leverage the strengths of each individual orbit to create comprehensive solutions that are flexible, resilient, and can be tailored to their customers' specific requirements. In addition to multi-orbit architecture, we're also starting to see multi-band networks with satellites operating in different frequency bands. This multi-orbit, multi-band network design offers even greater resilience, enabling providers to protect networks from disruption, to provide uninterrupted connectivity.

Ground Segment Challenges

The success of multi-orbit and multi-band satellite networks hinges on the capabilities of the ground segment. Ground level infrastructure for use with multi-orbit networks, however, is complex, and must be designed to handle the complexities associated with LEO satellites which require switching, tracking, and pointing as non-geosynchronous satellites pass overhead travelling at high speeds.

The requirement to dynamically track and switch between satellites in different orbits is one of the key challenges of multi-orbit networks. Ground segments need to be able to lock on to GEO satellites, as well as be equipped with tracking systems capable of precisely

locating and following fast moving LEO and MEO satellites. And ground stations must facilitate seamless handovers and transitions between satellites, ensuring uninterrupted connectivity as satellites transition in and out of range.

Ground segments must also be able to lock on to two satellites in different orbits and potentially different frequency-bands, simultaneously, and communicate and coordinate between them seamlessly. This requires sophisticated optical beamforming technology and frequency management capabilities that can handle diverse signal characteristics. Efficient resource allocation mechanisms are also crucial so that operators can maximise the utilisation of their assigned spectrum and minimise spectrum splitting, which reduces capacity.

Antenna design then becomes a critical part of ensuring these cross-orbit networks operate properly, but additionally, we'll also need interference mitigation techniques to prevent cross-traffic interference. Advanced interference suppression techniques using machine learning and AI will play a role in reducing the impact of multi-directional interference. There is also a need for greater collaboration between ground equipment manufacturers and satellite providers, in order to develop standardised antenna design, and improved interference management protocols. **PRO**

Joakim Espeland is CEO of Quadsat



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