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Strange times

Halfway through the year already, can you believe it? Time flies when you’re staying in, doing the same thing over and over and over...

And what a year it’s been. Already, we’ve seen the worst pandemic outbreak since the Spanish Flu of 1918, still very much ongoing and with no end in sight; large amounts of Australia have effectively been burned to the ground in bushfires at the start of the year, with more than 1 billion animals killed; Prince Harry and Megan Markle have stepped down from their duties as senior royals; President Donald Trump was impeached and acquitted; the UK has withdrawn from the EU; a new strain of Swine Flu has been reported in China, having already infected 10 percent of industry workers, although with no human to human infection reported to date. Each story has in turn shocked the global population.

It can be hard to communicate effectively in such times. We’ve all been at it: “Strange times,” “New normal,” “Stay safe.” These platitudes bring comfort to many, while expressing so little. Many are struggling in an entirely new world beyond their comprehension, with day-to-day life altered so drastically. Here at Satellite Evolution, we’re pleased to be able to continue to bring you the latest industry news and developments as always, providing a pillar of consistency to the satellite community.

In this issue, we explore the latest developments in oil and gas specialist satellites, small satellites, the international launch sector, and geospatial enterprise data. FocalPoint shares its thoughts on the future of smart cities, and EVONA opines on the impact of COVID-19 on space sector recruitment. We also have exclusive interviews with industry veterans from OneM2M and ViaLite.

We hope you enjoy this issue and look forward to seeing so many of you again in person when the situation allows.
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Big plans for small satellite launches

The small satellite sector has positively boomed in recent years, with everything from single R&D CubeSats to massive tens-of-thousands strong satellite constellations being embarked on. With so many more satellites due for launch than ever before in history, dedicated small satellite launchers are rapidly gaining in numbers and deploying some exciting new technologies.

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Global Distribution Services
Equatorial Space joins SSTL accelerator programme

Singapore’s answer to the global small launch vehicle movement, Equatorial Space Systems, has joined Singapore Space & Technology Ltd (SSTL)’s Space-based Accelerator Programme.

The programme is set to provide regional space and deep tech startups with insights, skill sets and resources to become commercially viable, and leverages SSTL’s deep space industry network to assist startups with high-growth potential.

But for the Founder and CEO of Equatorial Space, Simon Gwozd, this is more than business - it’s personal.

“I remember attending the presentation day of the Singapore Space Challenge back in 2015. I was looking for a way into the ecosystem and SSC looked like a good place to start. Some of the SSTL’s staff had a chat with me, and decided to give me a shot at volunteering at their events. That’s how I got the insights and contacts essential to starting Equatorial Space,” he says.

“It is heartening to see how SSTL’s suite of programmes synergistically spur and support interest in this exciting industry. The accelerator programme aims to take on the uphill task of encouraging practical adoption of space-related technologies and at the same time, grow a collaborative space tech ecosystem in the region. “ says Lynette Tan, Chief Executive of SSTL.

Equatorial Space Systems is a Singapore-based space tech startup developing innovative technologies for space launch and exploration activities. With its proprietary hybrid propulsion technology, ESS makes rockets safer, cheaper and more flexible than ever before.

Prepping for the first orbital launch by 2022, ESI has previously been crowned the winner of MBRSC Innovation Cup 2018 in Dubai, a Top 500 Deep Tech Startup by Hello and more flexible than ever before.

Millennium Space Systems completes DRAG RACER satellite qualification, preps for spacecraft integration with TriSept ahead of orbital debris mission

TriSept Corporation, a leading provider of launch integration and mission management services, and Millennium Space Systems have announced preparations are underway for the experimental DRAG RACER orbital debris mission payload to be delivered to New Zealand and integrated aboard a Rocket Lab Electron ahead of the planned launch this fall.

Millennium has completed space qualification of its two DRAG RACER small satellites that will embark on a first-of-its-kind Low Earth Orbit (LEO) mission to help solve the orbital debris challenge in space.

The DRAG RACER mission will use scientific methods to compare the deorbit performance of two identical satellites - one that will reenter naturally and a second satellite featuring a tether developed by Tethers Unlimited, Inc. (TUI) that is expected to significantly accelerate the deorbit process. Millennium plans to observe, evaluate and characterize

ConnecTechAsia announces virtual event and 365 marketplace

ConnecTechAsia - Asia’s leading Infocomm Media and Technology event organised in partnership with Singapore’s Infocomm Media Development Authority (IMDA), will be held on a virtual platform during the 29 September to 1 October 2020.

This shift to a virtual event is in response to the dynamic situation of the COVID-19 pandemic, where travel and physical restrictions are still in effect globally.

Pivoting to an online stage, ConnecTechAsia, incorporating BroadcastAsia, CommunicAsia, SatelliteAsia and co-located with TechXLR8 Asia, will be a three-day virtual event which will thereafter turn into a 24/7, 365 days interactive marketplace. Conference delegates can expect to engage at live keynote, Q&A and breakout sessions while the virtual exhibition floor will enable companies to showcase their vertical-specific products to registered attendees.

Mr Ivan Ferrari, Event Director, Tech, Media & Entertainment Events, Informa Markets, said, “In our function as market makers we must adapt swiftly to serve our community in all possible circumstances, all year round. The permanent addition of a 365 days virtual platform to ConnecTechAsia’s offering will enable a seamless, powerful, continuous engagement within our industry and unlock additional, measurable value for audiences in the community we serve. I am convinced that this significant investment in virtual will bring about a fresh experience that they will appreciate and gain from.”

Mr Howie Lau, Assistant Chief Executive (Media and Innovation) at IMDA, and co-chair of the ConnecTechAsia Advisory Committee noted the decision to organise a virtual event. He added, “In these extraordinary times, ConnecTechAsia as a virtual platform can bring the industry together, allowing companies to seek new opportunities and explore ways to navigate this new normal. We are heartened that Informa, one of the world’s preeminent event organiser, continues to invest in Singapore’s tech ecosystem. IMDA looks forward to even stronger partnerships in future.”

“In these uncertain times, it is encouraging to see Informa Markets adapt and reconfigure ConnecTechAsia to be held on a virtual platform. Such innovations are crucial for our MICE industry to re-open safely in a post COVID-19 world, and we are proud that our partners in Singapore are leading the way. ConnecTechAsia is one of Singapore’s flagship exhibitions, and we look forward to welcoming delegates here for next year’s live event,” said Mr Andrew Phua, Executive Director, Exhibitions and Conferences, Singapore Tourism Board.
the satellite hosting the 70-meter-long (230 feet) Terminator Tape tether aboard the control satellite, while calibrating predictive models through the use of radar tracking data. An onboard timer will trigger the tether deployment on the experimental satellite a few days into the mission, with reentry estimates averaging about a month-and-a-half, while the untethered spacecraft could take up to nine years to reenter the Earth’s atmosphere and burn up.

“We are motivated to study and quantify space tether applications as they will offer the LEO space community worldwide both improved deorbit capabilities and unique propulsive solutions,” said Stan Dubyn, Millennium Space Systems Founder and CEO. “This orbital debris mitigation experiment exemplifies our commitment to fielding innovative concepts using low-cost solutions.”

Once launched, the DRAG RACER mission payload will separate into two identical 6U satellites with identical stowed mass properties and drag coefficients.

“The DRAG RACER mission is built on an innovative collaboration between Millennium Space Systems, TriSept, Tether’s Unlimited and Rocket Lab that is dedicated to exploring and enabling creative and affordable solutions to the orbital debris challenge,” said Rob Spicer, TriSept President and CEO. “We look forward to leading the integration effort for this historic payload that could ultimately play an integral role in clearing orbital debris from Low Earth Orbit for years and generations to come.”

“The space community understands tether systems can expedite reentry, but this is our first opportunity to truly quantify performance directly and more effectively calibrate models developed over the last 50 years,” said Dr. Robert Hoyt, President of Tether’s Unlimited. “Predictions suggest the tethered spacecraft will deorbit in approximately 45 days, while the untethered spacecraft remains in orbit for approximately seven to nine years.”

Virgin Galactic announces Michael Colglazier as Chief Executive Officer and George Whitesides as Chief Space Officer in preparation for commercial service

Virgin Galactic Holdings has announced the appointments of Michael Colglazier as Virgin Galactic’s new Chief Executive Officer and George Whitesides as Chief Space Officer, effective July 20, 2020.

Michael assumes the CEO role at an exciting time for Virgin Galactic as the Company progresses through its test flight program and prepares for commercial service. He will also join the Company’s Board of Directors effective July 20, 2020. Michael joins Virgin Galactic following a long and successful career at The Walt Disney Company, bringing over three decades of experience in developing and growing consumer-oriented multi-billion dollar businesses strategically, commercially, and operationally. Most recently Michael was...
President and Managing Director, Disney Parks International, where he was responsible for operations, strategy, and commercial and experiential development of Disney’s international parks and resorts.

George will assume the role of Chief Space Officer, focused on developing the Company’s future business opportunities, including point-to-point hypersonic travel and orbital space travel. George will also chair the Company’s Space Advisory Board, and in conjunction with his new role will step down from the Company’s Board of Directors. George joined Virgin Galactic in 2010 as its first CEO, after serving as Chief of Staff at NASA.

During the past decade, he has built the Company from 30 people to a workforce of over 900 today, and he has successfully guided Virgin Galactic through its human space flight research and development program as well as the progress to date in its flight test program, culminating in two successful space flights. These historic flights saw the first humans launched into space from US soil since the retirement of the Space Shuttle, as well as the first woman to fly on a commercial space vehicle. During the last year, George led the transition of operations from Mojave, California to Spaceport America, New Mexico, and oversaw the company’s successful public listing—creating the world’s first publicly traded human spaceflight venture.

Michael Colglazier said, “I am thrilled to join the talented team at Virgin Galactic at this inflection point in the company’s journey. Like so many others, including hundreds of signed-up customers, I have been inspired by this purpose-driven, world-class brand and the incredible opportunity it offers to open space to change the world for good. George’s vision and outstanding leadership have enabled Virgin Galactic to reach this point, and I am excited to work with him in his role as Chief Space Officer where he will spearhead our future development efforts. On a personal note, I’d like to thank my friends and colleagues at Disney, especially Bob Chapek for his mentorship and guidance over the years, and Josh D’Amaro, who is bringing superb leadership to Disney’s Parks, Experiences, and Products. I am grateful to the Virgin Galactic Board, our chair Chamath Palihapitiya, and our founder Richard Branson for their support and trust as we make history together in this amazing company.”

George Whitesides added, “Serving as the first CEO of Virgin Galactic and The Spaceship Company for the past ten years has been the honour and adventure of a lifetime. The next decade for Virgin Galactic will be commercially-focused, and it is the perfect moment for us to bring a visionary commercial leader like Michael to take the company forward. Michael brings enormous experience in building customer experiences for Disney all around the world, and scaling businesses into multi-billion dollar organizations. I look forward to supporting Michael as the company realizes Richard Branson’s vision to share the experience of spaceflight with people around the world, now turning my focus to building the next generation of aerospace vehicles and experiences.”

Sir Richard Branson said, “I want to thank George for his outstanding leadership of Virgin Galactic over the last decade. He has shown dedication and determination as its first CEO to build the company from early stage development through to space flight, the first from American soil since the retirement of the Space Shuttle. In the past year, George has taken the company public and moved it to Spaceport America. He transitions into his new role as our Chief Space Officer having created substantial value as CEO and with Galactic poised for an exciting next chapter.”

“At the same time, we are delighted to welcome Michael as the new Chief Executive to lead Galactic into commercial operations. I believe Michael’s long and distinguished career at one of the world’s leading customer experience brands provides a natural fit with Virgin’s culture as well as Galactic’s requirements as it prepares for commercial service.”

Chamath Palihapitiya, Chairman of Virgin Galactic, said, “Michael’s skillset is highly complementary to that of the incredible team that we have at Virgin Galactic. He has considerable commercial and managerial experience and a proven track record of successfully commercializing new and innovative products and services all over the world. He will create an amazing customer experience for our Future Astronauts as we ramp up for spaceflight operations.”

Airbus expands its SpaceDataHighway with second satellite

The EDRS-C satellite, the second node of Airbus’ SpaceDataHighway constellation, completed its commissioning tests on 15th July 2020 and is now ready to start operational services. Following its successful launch in August 2019 and manoeuvring to its geostationary orbital slot at 31 degrees east, in-orbit testing has been executed and laser communication links have been established to the Copernicus programme’s Sentinel Earth observation satellites.

EDRS-C doubles transmission capacity and the constellation is now able to relay the data from two observation satellites simultaneously. It further strengthens Airbus’ commitment to serve the existing Copernicus programme as well as future Sentinel missions. The additional capacity will also enable Airbus to accommodate further customer needs. By 2030, about 15 satellites should use the very high bandwidth data connectivity of the SpaceDataHighway.

From 2021 onwards, Pléiades Neo – Airbus’ most advanced optical Earth observation constellation with four identical 30cm resolution satellites – will be the next satellites to benefit from the SpaceDataHighway’s infrastructure. As...
News Review....

an integral part of Pleiades Neo’s full end to end service, SpaceDataHighway will further optimise mission reactivity providing for real time tasking and very high throughput data offload.

EDRS-C has joined the EDRS-A satellite which daily transmits images of Earth acquired by the Copernicus programme’s four Sentinel observation satellites. Since 2017, EDRS-A has achieved more than 35,000 laser connections. These successful connections have downloaded nearly two petabytes of data with an availability of 99.5 percent.

The SpaceDataHighway is the world’s first laser communication geostationary constellation. It represents a game changer in the speed of space communications, using cutting-edge laser technology to deliver secure data transfer services at a rate of 1.8 Gbit/s in near-real-time.

Its satellites can connect to low-orbiting observation satellites at a distance of up to 45,000km, to intelligence UAVs or to mission aircraft via laser. From its position in geostationary orbit, the SpaceDataHighway system relays in near real-time to Earth the collected data, a process that would normally take several hours. It therefore enables the quantity of image and video data transmitted by observation satellites to be greatly increased and their mission plan can be re-programmed at any time and in just a few minutes.

This readiness to start service is a new milestone in the roadmap of Airbus’ overall strategy to drive laser communications forward and invest in the next generation of infrastructure, which will be able to bring the benefits to airborne, ground and maritime connectivity. As such, it will be a key component of the Airbus Network for the Sky (NFTS) programme.

The European Data Relay System (EDRS) at the base of the SpaceDataHighway is a public–private partnership between the European Space Agency (ESA) and Airbus, with the laser terminals developed by Tesat-Spacecom and the DLR German Space Administration.

Northrop Grumman successfully launches Minotaur IV rocket carrying satellite for the national reconnaissance office

Northrop Grumman Corporation successfully launched its Minotaur IV space launch vehicle and placed a National Reconnaissance Office (NRO) spacecraft into orbit at 9:46 a.m. EDT on July 15. The Minotaur IV was launched from the Mid-Atlantic Regional Spaceport Pad 0B at NASA’s Wallops Flight Facility.

“This mission marks the 27th consecutive successful launch for the company’s Minotaur product line which celebrates its 20th anniversary this year,” said Kurt Eberly, Director, Launch Vehicles, Northrop Grumman. “Minotaur’s record of success along with its ability to responsively launch from multiple spaceports continues to be a valuable asset for our customers.”

The NROL-129 launch (L-129) was the seventh Minotaur IV flight. The Minotaur IV is capable of launching payloads of up to 4,000 pounds (or 1,800 kilograms) to low earth orbit. This mission’s Minotaur IV configuration included three decommissioned Peacekeeper stages and a Northrop Grumman manufactured Orion 38 solid fuel upper stage. The Minotaur rockets are manufactured at Northrop Grumman’s facilities in Chandler, Arizona; Vandenberg, California; and Clearfield and Magna, Utah.

The Minotaur family of launch vehicles is based on government-furnished Peacekeeper and Minuteman rocket motors that Northrop Grumman has integrated with modern avionics and other subsystems to produce a cost-effective, responsive launcher based on flight-proven hardware. Minotaur rockets have launched from ranges in Alaska, California, Florida and Virginia.
ViaLite is a developer of RF over fibre satellite communication components to support ground stations, broadcast, and GPS link operation. After releasing a plethora of innovative new products including the System Designer Tool, the company has gone from strength to strength. ViaLite’s Richard Jacklin, Director of Sales, reports on how customers have responded to their technology, and how they plan to continue their standard of reliability and ingenuity.

Question: How has ViaLite performed in the APAC region recently?

Richard Jacklin: We have three major regions that we trade in globally: North America, Europe and Asia-Pacific (APAC). APAC is an interesting area, currently making up about 10 percent of our business, which is definitely exhibiting a connectivity demand that ViaLite is enjoying. To support that, we’re deploying staff out into the region, which we hope will accommodate further growth.

We’ve been in the business for many, many years now but in some areas, such as Southeast Asia, some businesses are new to Ka-band diversity links. We have had many projects in the region now, particularly in Indonesia, for installing long-distance links. Other works include rain fade diversity for the Ka-band antennas and site-sharing. We have been very pleased with that.

One dynamic in these areas is that infrastructure often requires more modernisation than you might expect, especially when compared to, say, North America. In that respect, the fibre quality we work with is typically poorer so the transmission losses can be higher. We need to address that to get clients back up to an acceptable standard by designing a system that fits their requirements and accounts for their circumstances.

That has certainly been a challenge, but it’s something we’ve been proactively responding to. We have a new High Sensitivity Receiver which has been designed to take a much lower optical input range - 20dBs lower in terms of sensitivity - and can handle the losses we may see in underserved environments.

On the transmit side of the link, we have the Hyper-wide Dynamic Range card which gives us a greater degree of range on the link. When you get to satellite, and especially high-throughput links, every dB you can add to the dynamic range makes a big difference.

Richard Jacklin, Director of Sales, ViaLite
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Richard Jacklin: We brought in several products then, one of them being the cloud-based ViaLite System Designer. The objective of that product was to take the knowledge of our RF over fibre engineers and bundle it into a comprehensive, accessible tool that could benefit our customer base.

The product itself is a drag and drop interface where you can arrange your components to quickly build the system that you need, even complex long-distance layouts. That allows users to understand what they need, and more importantly what they can expect from the setup they’re looking for, perhaps encouraging them to recognise problems far in advance and account for them long before they can cause an issue.

It’s been a very successful release. Some of our major customers have been making good use of it for their own projects. The tool has actually saved a few of our customers! One of our clients in Southeast Asia was looking to put multiple channels down in a single fibre core, so basically a CWDM system. They found that the dynamic range wasn’t sufficient with their setup, so we were able to show them a different model, a DWDM system which predicted a sharp performance improvement. If they’d ended up purchasing the CWDM system, it could’ve been a real crisis, but our tool averted the catastrophe for them.

Some of our customers want us to extend the tool at both ends; further into equipment - all the way to the feed point, and deeper into the core, so basically a CWDM system. They found that the dynamic range was not enough for their setup, so we were able to show them a different model, a DWDM system which predicted a sharp performance improvement. If they’d ended up purchasing the CWDM system, it could’ve been a real crisis, but our tool averted the catastrophe for them.

So, we’ve been accommodating for the growth we’ve seen in APAC, and we’ve been developing bespoke solutions to best accommodate the environment.

Question: With the NewSpace era of connectivity gathering speed, what are the most important objectives for developers like yourself?

Richard Jacklin: 2020 has been a pivotal year. We’re seeing a lot of the LEO constellations finally starting to launch. We’ll have to see how many survive, given the turbulence of the business environment for such high-risk ventures.

From our perspective as a ground segment equipment supplier, the RF over fibre technology we provide is a part of the ecosystem. What our clients need is scale, there are lots of gateways experiencing that kind of demand.

Another important concept is miniaturisation and flexibility. These gateways can be quite large arrays; anywhere from 5 to 25 antennas for a single gateway. We have been designing highly integrated, modular products appropriate for those dramatically varied locations. On the antenna side, it’s important that they receive ergonomic outdoor enclosure equipment that provides all the right functionality. We’ve been showcasing our ODE-MINI enclosure as it’s important for the LEO constellation market.

Question: Last year at Satellite 2019 you launched several new products – How has that been going for ViaLite?

ViaLite appoints dedicated Sales Manager for APAC Customers

ViaLite has appointed John Meyers as APAC Sales Manager. This new role sees the company’s expansion with the addition of a dedicated Manager for the APAC region; supporting the business’s growth in this area.

John brings over 30 years of experience in the Asia-Pacific market to the business and through his vast satcom experience, enhances ViaLite’s ‘experts in RF over fibre’ offering.

John’s experience within the industry has allowed him to develop closer working relationships with a number of satellite operators, cellular network operators and government entities. This experience and these relationships will prove an asset in his management and support of the expanding ViaLite APAC distributor network.
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Big plans for small satellite launches

The small satellite sector has positively boomed in recent years, with everything from single R&D CubeSats to massive tens-of-thousands-strong satellite constellations being embarked on. With so many more satellites due for launch than ever before in history, dedicated small satellite launchers are rapidly gaining in numbers and deploying some exciting new technologies.

Amy Saunders, Editor, Satellite Evolution Group

Back in the days before all we could talk about was the new plague – COVID-19 – the year 2020 was set to be a spectacular success for the satellite sector, with small satellite projects and dedicated launch companies really benefiting from the start of a fresh new decade.

Indeed, the influx of small satellite projects has created fantastic opportunities for launch providers. Existing providers have developed new launch vehicles with a much greater emphasis on rideshare capabilities, while more than a handful of start-ups have been created solely dedicated to small satellite launch technologies.

Frost & Sullivan expects a total of 20,425 satellites to be launched in 2019-2033, with high demand taking the small satellite launch market beyond US$28 billion by 2030.

“Serial production and rapid manufacturing will play a pivotal role in meeting market demands. To ensure the success of the industry, it’s imperative that launch frequency, inventory and manufacturing capability are optimized,” said Prachi Kawade, Research Analyst, Space, Frost & Sullivan.

Enter coronavirus

Then came the new coronavirus, COVID-19, to play havoc with the world.

NSR has reported that the satcoms sector had suffered tremendously, with a 35-50 percent decline in stock prices for SES, Intelsat, Eutelsat and ViaSat in just over one month in February. NSR believes that the overreaction by the financial markets calls into question the long-term strategy adopted by several publicly listed operators; consistently reducing contract backlog, higher commoditization and low product differentiation seems to have left investors searching for unique business cases. The impact of COVID-19 is expected to be felt through to the year end.

Similarly, the ACCESS.SPACE Alliance, which represents the small satellite sector and its stakeholders, has also expressed its concerns on the effects of the crisis for its members and the wider NewSpace ecosystem. The alliance has highlighted the following challenges:

- Cash flow constrains, lack of resources to fund operations, difficulties in accessing finance, reduction of customer orders, revenue losses and/or lack of visibility about the consequences of the crisis, with a disproportionate impact for start-ups and SMEs, which are at risk of business
• Delays in research, development, and innovation (RD&I) projects and operational problems to join, participate or continue such projects.
• Delays or difficulties in terms of networking, contract acquisition and business development due to restrictions in terms of mobility, flight cancellations, travel restrictions and prohibitions of conferences and other events.

While the business environment remains uncertain, ACCESS.SPACE has reported that global telecommunications networks have been facing unprecedented strain leading to data speed disruption and service level degradation at a time when connectivity is critical to keep the economy running, inform and educate the public and coordinate the battle against the virus. The risk of major outages, whether by congestion or unavailability of workforce or spare parts, is growing, calling for more disaster-resilient communication networks.

Satellite-based communication networks are of course largely independent from terrestrial infrastructure and should play a greater role in disaster communication strategies supporting mitigation, preparedness, response, and recovery. You’d think this fact would play in favour of satellite operators, however, market uncertainties have seen the downfall of many entities since COVID-19 hit the streets, not the least of which includes OneWeb, which earlier in the year cut many jobs and faced bankruptcy. The latest reports indicate that a new consortium of private investors, as well as £400 million from the UK Governments, will enable OneWeb to continue...
operations. Nonetheless, the dedicated small satellite launch sector marches on. How many players will be left standing by the end of the COVID-19 outbreak remains open for bets, however, we can be assured that we won’t lose everyone.

**Rocket Lab opens Launch Complex 2 for business**

Rocket Lab remains one of the few dedicated small satellite launch providers already successfully completing launch campaigns today.

In addition, the company has also developed its own in-house small satellite platform, the Photon, meaning that the company now offers an all-inclusive spacecraft build and launch service.

Rocket Lab’s Electron vehicle features two stages – the first is powered by nine Rutherford engines (the first oxygen/kerosene engine to use 3D printing for all primary components), and a second stage featuring one Rutherford engine variant – and an optional apogee kick stage that can execute multiple burns for different orbit placements powered by the company’s 3D printed liquid propellant Curie engine. The Electron vehicle, comprising carbon composite materials affording impressive weight savings, can lift a 225kg payload into SSO. Rocket Lab is also presently exploring the reusability of its Electron launch vehicle.

Rocket Lab closed out 2019 with the official opening of its new US launch site, Launch Complex 2, at the Mid-Atlantic Regional Spaceport. Rocket Lab’s Launch Complex 1 on the Mahia Peninsula of New Zealand had achieved 10 flights of the Electron launcher by this time, including six in 2019. Launch Complex 2 is expected to open up new markets, including government customers and national security applications, with up to 12 missions per year. Following up this news in January, Rocket Lab announced the opening of a new manufacturing site and headquarters which will bring Mission Control Centre capabilities to the new Long Beach Regional Spaceport. Rocket Lab closed out 2019 with the official opening of its new US launch site, Launch Complex 2, at the Mid-Atlantic Regional Spaceport. Rocket Lab’s Launch Complex 1 on the Mahia Peninsula of New Zealand had achieved 10 flights of the Electron launcher by this time, including six in 2019. Launch Complex 2 is expected to open up new markets, including government customers and national security applications, with up to 12 missions per year. Following up this news in January, Rocket Lab announced the opening of a new manufacturing site and headquarters which will bring Mission Control Centre capabilities to the new Long Beach Regional Spaceport.

Rocket Lab is also set to perform a dedicated launch of the first ever synthetic aperture radar (SAR) satellite, expected to optimize hotspot monitoring of key regions in the world, for Capella Space, later this year from Launch Complex 1. Part of Capella Space’s Whitney constellation, the new SAR satellite will maximise coverage over areas in the Middle East, Korea, Japan, Southeast Asia, Africa, and the US, delivering sub-0.5m changes on the Earth’s surface.

**Nanoracks rocks in-space launches**

Another active dedicated small satellite launcher, and with a unique approach, is Nanoracks, which has opened up the International Space Station (ISS) for business. Launched in 2009, Nanoracks combines three key concepts in its workflow – low-cost, hardware standardisation and understanding the customer – to help launch small satellites to LEO from on board the ISS.

Nanoracks operates three distinct deployers from the ISS – as well as offering rideshare capabilities via SpaceX and India’s Polar Satellite Launch Vehicle – which target CubeSats and MicroSats:

- **The Nanoracks CubeSat Deployer (NRCSD)** is a self-contained CubeSat deployer that mechanically and electrically isolates CubeSats from the ISS, cargo resupply vehicles, and ISS crew. The NRCSD is a rectangular tube that consists of anodized aluminium plates, base plate assembly, access panels and deployer doors. For deployment, the platform is moved outside via the Kibo Module’s Airlock and slide table that allows the Japanese Experimental Module Remote Manipulator System (JEMRMS) to move the deployers to the correct orientation for the satellite release and also provides command and control to the deployers. Each NRCSD can hold six CubeSat Units – allowing it to launch 1U, 2U, 3U, 4U, 5U, and 6U CubeSats.

- **The Nanoracks Kaber Microsat Deployer (Kaber)** is a reusable system that provides command and control for satellite deployments from the ISS. Kaber enables Nanoracks to support the deployment of microsatellites up to about 82kg and with a 24U form factor from the JEM Airlock Slide Table. Kaber promotes ISS utilization by enabling deployment into orbit for a class of payload developers normally relying on expendable launch vehicles for space access. Microsatellites that are compatible with the Nanoracks Kaber Deployer have...
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AFRICA
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Small Satellite Launches

additional power, volume and communications resources enabling missions in LEO of more scope and sophistication.

- The External Cygnus Deployment Program is part of the first-ever program in which an ISS Commercial Resupply Vehicle is able to deploy satellites at an altitude higher than the ISS after completing its primary cargo delivery mission. Flying at 500km provides an open door for new technology development as well as an extended life for CubeSats deployed in LEO. The lifespan of CubeSat deployed from the Cygnus vehicle at 500km adds approximately two-years additional lifetime compared to Nanoracks’ ISS NRCSD deployment program. Cygnus can deploy CubeSats of 36U volume, 1U-6U linear form factors.

Times must be good at Nanoracks as the company is hoping to recruit a whole host of new engineers and technicians. Back in February, the company completed its 17th CubeSat deployment mission from the ISS, which featured seven CubeSats from a variety of research and educational institutions. To date, Nanoracks has deployed 263 small satellites.

Virgin Orbit nears flight demonstration

Taking an altogether unique approach to small satellite launches is one of my personal favourites dedicated small satellite launch providers, Richard Branson’s Virgin Orbit, which is on a mission to ‘open space for everyone.’

Virgin Orbit launched an orbital rocket for the first time in May. Launch vehicle LauncherOne was carried into high altitude onboard the Cosmic Girl aircraft prior to successful in-air separation at around 35,000 feet; the plan, in which LauncherOne was to enter freefall for four seconds before the NewtonThree first stage engine fires up and continues on towards the target orbit, failed at this stage, with LauncherOne never reaching its target orbit.

Virgin Orbit plans to enable high frequency launches from a selection of global runways, by manufacturing 24 rockets each year from its Long Beach production facility. The company will enable full vehicle launches and rideshare missions alike. Virgin Orbit is also looking for new launch sites and destinations this year, with the UK Space Agency having recently awarded the company £7.35 million to enable LauncherOne missions from Spaceport Cornwall, with the first launch expected not before 2022. Virgin Orbit is also collaborating with SatRevolution and Polish universities for up to three launches delivering small spacecraft to Mars, with the first launch due no earlier than 2022.

FireFly Aerospace readies for inaugural launch

Newcomer Firefly Aerospace is also gearing up to enter the dedicated small satellite launch market. Committed to providing economical and convenient access to space for small payloads, Firefly is on track to start delivering 1,000-4,000kg class payloads to LEO this year with a starting price of US$15 million. The company intends to launch from SLC-2 at Vandenberg Air Force Base, where it has a long-term lease in place, and SLC-20 at Cape Canaveral.

The company is beginning with the Firefly Alpha launch vehicle, which combines the highest payload performance with the lowest cost per kg to orbit in its vehicle class. Alpha can deliver one metric ton to LEO and 630kg to 500km SSO and will offer full vehicle and rideshare services via two monthly launches. The carbon fibre composite Alpha features a first stage with four Reaver engines and a second stage with one Lightning 1 engine.

Firefly is also developing its carbon composite Beta
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100/125 W Ku-Band
150 W X-Band

TITAN
200 W Ka-Band
200 W Ku-Band

The New Shape of Solid State
launch, a 2.5-stage vehicle capable of lifting 4,000kg to 200km LEO with Geosynchronous Transfer Orbit capabilities. The first stage features three Alpha Stage 1 cores comprising a total of 12 Reaver engines, while the second stage features one Lightning 1 engine. The company also has the vision for Gamma, a futuristic reusable launch vehicle rocket plane, which utilises aspects from both its Alpha and Beta vehicles, and offers air or ground launches, as well as the potential for hypersonic transport on Earth.

FireFly has partnered with Aerojet Rocketdyne to gain expertise on 3D printing for its Reaver engine production, as well as collaborating on its upcoming Orbital Transfer Vehicle and the Beta launch vehicle. The company has also partnered with Israel Aerospace Industries to cooperate on lunar landing technology, Genesis, which will be used for mission contracts under NASA’s Commercial Lunar Payload Services program; the first flight is expected at the end of 2021. Meanwhile, back in January, FireFly announced the execution of a Launch Services Agreement with Innovative Space Logistics BV (ISILAUNCH), which will see ISILAUNCH offer multiple dedicated and rideshare launch opportunities on FireFly Alpha starting this year.

The inaugural FireFly Alpha launch is due this year, with plans to launch a collection of rideshare payloads resulting from the Dedicated Research and Education Accelerator Mission (DREAM) competition. A total of 26 DREAM payloads from seven countries will be launched.

Orbex progresses with new contracts and spaceport plans

UK-based Orbex was founded in 2015 in order to provide low-cost orbital launch services for the small satellite sector. The company has gone on to develop one of the most advanced low-carbon high performance micro-launch vehicles in the world, which, according to the company, ‘means higher reliability, more flexible mission profile types and a regular, scheduled launch service.’ Since its launch, Orbex has raised more than £38 million in public and private funding, including from two of Europe’s largest venture capital funds (Sunstone Technology Ventures, now Heartcore, and the HighTech Gründerfonds), the UK Space Agency, the European Space Agency and the European Commission Horizon 2020 programme.

A wide range of advanced materials and techniques are used to create each Orbex Prime launch vehicle, including the use of additive manufacturing for almost the entire propulsion subsystem and carbon fibre/graphene composites for the main structures and tanks. With a 150kg to Sun Synchronous Orbit (SSO) payload capacity, Prime utilises bio-propane, a clean-burning renewable fuel that cuts carbon emissions by 90 percent compared with traditional hydrocarbon fuels. Prime features a novel architecture that saves around 30 percent of inert mass, increasing efficiency by 20 percent.

Orbex has secured launch contracts with TriSept Corporation (rideshare contract launch due in autumn 2022); In-Space Missions (Faraday-2b satellite due in 2022), Deimos (formed a strategic partnership for launches), Innovative Space Logistics (wide-ranging cooperation agreement including technical launch services and orbital space launches), Astrocast (10 satellites of a 64 CubeSat IoT constellation due by 2023), and SSTL (experimental payload due for launch on Prime’s maiden launch in 2021) already from the UK’s first spaceport in Sutherland, Scotland. Orbex’s

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HAPITH V launcher can lift a 390kg payload to LEO and 350kg payload to SSO

Prime is expected to be the first rocket to launch from the Sutherland spaceport in 2021. In August 2019, Orbex’s partner, Highlands, and Islands Enterprise (HIE) confirmed that it had signed a 75-year lease option with landowners to build and operate a spaceport on its land. Meanwhile, in February, a planning application for the launch site was submitted, with construction due to commence later this year. Up to 12 launches are planned for the site annually.

TISPACE on track for 2020 launch

Established in 2016, Taiwan Innovative Space (TiSpace) has ambitious plans to provide innovative and cost-effective launch services for microsatellites and nanosatellites destined for LEO and SSO. TiSPACE aims to offer global coverage and 24-hour services to enable on-demand launches to meet orbit deployments and scheduling requirements.

The company spent 2019 increasing the efficiency of its non-explosive hybrid rocket engines to meet NASA’s Class-I rocket propulsion status while also keeping costs lower than competitors. The HAPITH V launcher can lift a 390kg payload to LEO and 350kg payload to SSO, and features a single hybrid rocket engine upper stage, a four-hybrid engine second stage, and a five-hybrid engine first stage.

Bad weather meant that the planned first launch in February at the Taitung launchpad was aborted. TiSPACE remains on track for its first small satellite launch later this year. Interestingly, the Taitung County Government has reported that TiSPACE did not file the required application before building the launchpad on private property, which is Aboriginal domain, and has been fined NT$400,000. The company is required to demolish the launch site or appeal to legally alter its land use.

Astra aborts DARPA Launch Challenge

Secretive US start-up company Astra plans to reshape how the space industry works, starting with access to space. Offering smaller more frequent launches, Astra envisages enabling a wave of innovation in LEO and improving life on
Small Satellite Launches....

Earth through greater connectivity and more regular observation. Launched in 2016, Astra built its first rocket test facility in California in 2017, launched Rocket 1.0 and Rocket 2.0 in 2018 (both initially believed to be failures, but were later reported as successes, although Rocket 2.0’s flight was shorter than planned) from the Pacific Spaceport Complex – Alaska (PSCA), and in 2019, built a new rocket factory and spaceport. This year, the company has embarked on the production of Rocket 3.0.

Very little was known about the company’s rocket technologies, tests or launch attempts until earlier this year. Rocket 3.0 has been revealed as a two-stage, five-engine kerosene, and liquid oxygen powered rocket. The first stage ‘Delphin’ engines feature electric motor pumps arranged in a pentagon shape, unique from other five-engine rocket designs. Rocket 3.0 can lift a 150kg payload to 500km SSO. The aluminium tanks are easier and cheaper to work with, although heavier than carbon fibre alternatives. In addition to the PSCA, Astra plans to launch from a second site in the Marshall Islands in order to access low-inclination orbits. The company reportedly has more than 12 signed launch contracts, but for who and when, remains a mystery.

In 2019, Astra was selected as a finalist in the Defense Advanced Research Projects Agency’s (DARPA) Launch Challenge (the other two finalists later dropped out). Astra was charged with integrating and lifting four small payloads into 445km orbit, although 150km would also be accepted. However, in March this year, Astra was forced to scrub the launch demonstration from the PSCA, pushing it beyond the challenge’s US$12 million prize fund window. According to Astra’s website: “Our team decided to hold the launch at T-53 seconds after a sensor reported unexpected data that could have impacted the success of the flight. Out of our commitment to safety, and to increase the probability of overall success of the three-launch campaign, we have decided to prioritize fully investigating the issue over attempting to win the DARPA challenge today….We remain determined to reach orbit and plan to attempt another launch attempt as soon as possible.”

Interestingly, the DARPA Launch Challenge seems to carry with it something of a curse. Vector Launch was also due to have entered the challenge with its carbon composite Vector R launch vehicle, having performed two subscale Vector R test flights in 2017, but the company dropped out from the competition last year after losing large amounts of funding and has since filed for bankruptcy.
The importance of IoT standardisation

Founded in 2012, oneM2M is a global partnership project comprising eight of the world’s leading ICT standards development organisations. oneM2M has developed and continues to evolve a body of technical specifications for a set of common service functions to support scalable and interoperable IoT applications across different industry sectors. Developers can embed oneM2M capabilities within various hardware and software components to connect the many devices in the field with IoT gateways and application servers worldwide. Ken Figueredo, one of oneM2M’s contributing members and a Market Development Consultant for Chordant Inc., outlines the importance of IoT standardisation and oneM2M’s actions towards that goal.

Question: What are the drivers for digital transformation, and why is data management a fundamental capability for digitally enabled businesses?

Ken Figueredo: A large part of digital transformation is to use data more quickly to make business decisions. Data is fundamental because we’re moving into an era where we have access to so much more data, not just data about people, but data from connected devices, smartphones, and sensors. Many organisations are learning how to adapt their operations now that so much more data is available. The scope is broader than static or snapshot data, because IoT devices are sources of time series data feeds.

We can break the digital transformation challenge down into several steps. The first involves managing the devices that supply the data. That is why we hear a lot of organisations talking about device management. Over time, many more IoT devices will be deployed and a significant proportion will be low-cost constrained devices. These devices don’t run continuously, but gather data, wake up from a sleep state, and pass the data on before going back to a sleep state in order to conserve energy. In data management terms, the entity that collects the data needs to recognise when devices are awake and ready to transmit their data, collect that data efficiently and quickly let that device go back to sleep.

Once you are handling a pool of devices, the next step is to figure out how to manage the data they generate. What is the data source, and what is its integrity? How do I pass data on to...
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users and exercise security and privacy policies over downstream users? Within a large organisation, how do I share data across different departments? The whole idea of sourcing and supplying data between different parties becomes very important.

These examples illustrate the layers of complexity and define the foundations on which digital transformation depends. They are the kinds of issues that oneM2M is addressing by creating an open standard for the IoT ecosystem.

**Question:** Operational boundaries are often reported to be one of the major factors in hindering data sharing and management; what is the solution to this challenge?

**Ken Figueredo:** We need to consider several different boundaries in practice. In the industrial sector, there is a boundary between operational technologies (OT) – all the devices, sensors and controllers that manage the processing environment in a manufacturing facility, for example – and information technologies (IT) – for enterprise resource planning and accounting, for example. Many organisational structures operate with that distinction, and that’s one of the boundaries to span in making data driven decisions.

A public sector example is where transportation and welfare-service departments can collaborate to improve citizen services. Take the case of shuttling house-bound patients for appointments at clinics or doctors’ surgeries. By using capacity planning and live data to coordinate scheduling between a regulated taxi fleet and welfare services schedulers, both departments can embrace digital transformation to improve resource utilisation and deliver a better experience for patients, care workers and taxi drivers.

Chordant’s experience falls more in the area of data sharing, often across public and private sector boundaries. A case in point might be an organisation whose data is valuable to another company, and they want to find a dependable way of sharing that data. One example we are working on in the UK involves testing of connected and autonomous vehicles (CAV). Vehicles providers recognise that they can improve the quality of testing by combining CAV data with data about activity on the transport network and local weather data. A use case might be a road test that is run in February when it’s dark and raining. With data sharing, can a tester evaluate performance under simulated conditions for the month of June when traffic levels and the weather conditions are completely different? For that kind of testing to work and for each organisation to get value from their data, there is a need to share data. This scenario involves multiple data sources, many different technologies, and requirements to apply privacy controls for selective data sharing. It is ideally suited to using an IoT platform built on the oneM2M standard. The open standard approach means that Chordant’s platform operates as a neutral data exchange that different public and private sector organisations can rely on. It also demonstrates the value of reusability as the same set-up is being used by Transport for West Midlands (TIWM) and other organisations to create a market for connected and autonomous mobility data services.

**Question:** The IoT is expected to revolutionise the world, spanning government, commercial and consumer sectors alike. What route do you expect this revolution to follow?

**Ken Figueredo:** IoT is an attention grabbing label in marketing terms, but I think that we can expect to talk less about it over the coming years because it will just blend into the background. IoT will become a part of everyday life and everyday operations. The focus will be on services and benefits rather than the technology.

Look at this in the case of students in the pre-Internet era. They would have to go to libraries, find a librarian and navigate through a catalogue of publications. That process has largely changed. Through digital transformation, we take it for granted that you can access much more information and far more easily from our computers and phones. The emphasis now is on how we use that information.

The bigger picture is to think more about how we’re gathering and sharing
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Making Missions Possible
data, and how we’re using data to make decisions.

For the last five or so years we’ve seen a lot of market forecasts from analysts talking about the numbers of connected devices; it’s relatively straightforward to count and to forecast numbers of devices. It’s also easy to project the amount of data that these devices will generate. The change we need to see happen is to think about different metrics for the value of data – it’s not just in the volume; there can be small quantities of quite valuable data and large quantities of invaluable data. A shift away from forecasting device and data quantities will drive different behaviours in the way companies share and use data.

Question: Let’s talk about standardisation. How important is it in IoT applications?
Ken Figueredo: Some companies want to launch products quickly, and they’ll build something independently using proprietary technology to go to market in as little time as possible. There’s an implicit trade-off about long term viability. As organisations deploy new solutions it becomes a challenge to maintain them if only one company provides that solution. Once there’s a standard other vendors can be a backup.

Another consideration is that the IoT is helping organisations do new things through digital transformation so there is scope to add new standards to existing ones. For example, there are several standards such as Bluetooth, NB-IoT and Wi-Fi for connectivity as well MQTT or COAP for data transfer. They solve different parts of the IoT problem. The bigger IoT challenge is to connect any device, to collect data from that device, to supply data to an application that makes some sort of decision, and for that application to interrogate or remotely control that device. The more devices, applications, vendors and technologies that are added to the workflow, the more complex and interwoven this arrangement becomes. Also, each time a developer adds a new device or new application there is a cost of integration. This is a new paradigm – the ability to simplify the process of connecting any device to any application – and what oneM2M set out to solve when it launched in 2012. oneM2M standards define a middleware layer, between connected devices and applications, that masks technology complexities for application developers. You can think of oneM2M as a standard that solves a new problem but leveraging existing standards. oneM2M can use cellular connectivity with COAP or MQTT protocols; it does not displace existing or established standards. Instead, oneM2M provides a better way of using those standards to connect applications and devices with the added benefits of interoperability and scalability.

Question: The IoT famously requires secure, reliable and always-on connectivity. What roles do you expect 5G, satellite and terrestrial networks to play?
Ken Figueredo: I’d qualify the first assertion because there will be scenarios where connected devices won’t always be on. This will be the case for large numbers of low-power, power-constrained devices that are only on momentarily to transmit the data. This calls for some kind of intelligent middleware between these data producing devices and the applications that depend on their data.

Different applications will rely on different connectivity solutions. If you consider forestry management or agriculture, satellites might provide connectivity for remote and mission-critical areas in conjunction with cellular...
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connectivity for more accessible areas and building locations. There are drawbacks in building a data gathering application twice, once for cellular and once for satellite. It is better to be connectivity agnostic. This approach allows organisations to use different connectivity options – 5G, satellite and terrestrial - without having to invest in multiple silos.

Beyond connectivity, there is value in having a common framework for devices and applications to interact. The oneM2M standard defines these additional capabilities that add value to connectivity standards, all within a common framework.

**Question: What role does oneM2M have to play in the IoT agenda going forwards?**

**Ken Figueredo:** There is a very important role in the sense that the IoT opens the field for organisations to do new things through digital transformation. That calls for a new way of doing things, with open standardisation delivering economies of scale.

oneM2M stands out for its standardisation track record. Its members began early and invested a significant effort to analyse the requirements for IoT solutions in multiple industry verticals and to identify a set of common requirements. To put this in perspective, each of the previous cellular standards – 2G, 3G, 4G etc. – required around one million man-hours of effort via the 3G Partnership Project (3GPP). The corresponding level of effort for oneM2M is about 500,000 man-hours. There isn’t that level of investment elsewhere.

oneM2M saves organisations the time of having to reinvent the wheel. Having established the foundations for interoperable and scalable IoT solutions, the issue now is to spread knowledge more widely beyond the early set of users; anyone can access them and contribute to them. oneM2M published a joint white paper with the Industrial internet Consortium to help industrial organisations.

There is a liaison framework in place with the Internet Connectivity Alliance, an IoT developer community that Alibaba launched for the Chinese market and oneM2M is a candidate for India’s smart cities initiative.

A final observation is the concern that small and medium sized enterprises (SME) find it difficult or lack the resources to participate in standardisation activities. I heard an interesting story recently from Europe where a group of lift manufacturers collaborated on a proposal to standardise how data is collected on lifts to transform maintenance procedures.

The idea is to standardise data gathering from any kind of connected lift, regardless of the manufacturer. These businesses see IoT technologies as a means of digitally transforming their monitoring, predictive analysis and maintenance operations. The group presented a technical requirement to add to the oneM2M standard. Once approved, this will become a part of oneM2M’s Release 4 standards. It’s a great example of reusing the basic functionality in the oneM2M standard and adding new capabilities within a common framework. It proves that oneM2M is an active and evolving standard and that all organisations, small and large, can contribute to progress!
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Protecting our environment

The oil and gas sector relies heavily upon satellite technology for offshore and onshore connectivity, creating more efficient and effective industrial production. However, satellite is arguably even more effectively used to monitor the dangerous greenhouse gas emissions generated by the industry, helping governments and world agencies to better protect our environment.

Amy Saunders, Editor, Satellite Evolution Group

The satellite sector has long played a vital role in the oil and gas industry, as for many other energy and utilities segments which involve remote and rural locations, often far removed from infrastructure and terrestrial connectivity, and in extreme weather conditions and harsh environments. Satellites serve every part of the oil and gas chain, providing valuable connectivity and Earth observation applications across the world. Indeed, satellite technology is key for the maintenance and continued growth of the oil and gas sector:

• Data exchanges. Data is constantly being collected from offshore rigs during drilling and survey activities, with everything from rock formations, pump and valve control, flow measurements, pressure and temperature monitoring, leak detection, and corrosion monitoring under examination. Satellite connectivity enables this data to be transferred to onshore experts so that any areas of note can be highlighted. Moreover, access to secure Internet connectivity allows offshore or remote workers to communicate effectively and efficiently with headquarters.

• Efficiency boosts. As for many other industries, oil and gas is reaping huge operational efficiency boosts from the Internet of Things (IoT), with connected sensors playing a huge role already throughout the sector. Satellite-supported IoT enables oil and gas entities to remotely manage their operations, controlling any aspect of their business from oil flow volumes through to drilling speeds and angles.

• Crew welfare. Just like any industry requiring staff to stay away from home – maritime, aviation, logistics, etc. – employees stationed at offshore rigs or on-board vessels for weeks or months at a time require a certain level of creature comfort to remain happy and mentally well. With global, ubiquitous Internet connectivity now commonplace, the best and brightest can pick and choose between employers based on their standard of living whilst away from home. Being able to stay in touch with loved ones, consume media and browse online makes all the difference.

• E-health. Working in remote and rural locations, potentially a 24-hour boat ride from land, health and safety have always been a key focus for oil and gas workers. The effective delivery of telemedicine services via satellite connectivity helps ensure crew wellbeing during times of illness or injury; real-time video calls with onshore experts can aid greatly the diagnosis and appropriate treatment of crew in the field.

• Environmental safety. The oil and gas sector is often called one of the worst environmental scourges of our plane today, and the risks of oil spills and other accidents is significant. Continuous remote monitoring via the satellite supported IoT can make a big difference to the relative safety of a specific rig, with many potential problems identifiable before incident.

The oil and gas sector is still in a state of cost-cutting measures as a whole following falling oil prices, necessitating certain luxuries to be cut. While some owners are questioning the value of some satellite connectivity services, others are increasing their spend, viewing it as a smart way to improve cost-efficiency and output.

Indeed, according to Maximize Market Research, the global mobile satellite services market is expected to grow to US$13.74 billion by 2026, with the oil and gas and mining sectors expected to grow at the largest CAGR between 2018-2026. The increase in demand for mobility, advancement in digital technology and rise in integration between mobile and satellite technology are highlighted as the major factor for driving the market.

It’s inarguable that satellite delivers absolutely vital connectivity services for the oil and gas sector, improving operational efficiency and quality of life for tens of thousands of oil and gas workers globally. However, satellite also delivers vital emissions monitoring capabilities for the oil and gas sector too, a much-needed service in today’s world.

Reducing oil and gas sector emissions

It’s hard to be blind to the issue that is climate change – it is the 21st century, after all – and the impact that the energy sectors are having on global emissions volumes (try as climate change deniers might to deny it). Greenhouse gases, which absorb and emit energy within the thermal infrared range, maintain the temperature of planets throughout the solar system; the primary greenhouse gases in Earth’s atmosphere are water vapour, carbon dioxide, methane, nitrous oxide, and ozone.

The media has historically focused on carbon dioxide – perhaps because human activities since the industrial revolution have resulted in a 45 percent increase in atmospheric carbon dioxide levels, from 280ppm in 1750 to 415ppm in 2019 – however, methane, which has more than 80 times the warming power of carbon dioxide during the first 20 years after it is released into the atmosphere, is coming increasingly into the spotlight.

The oil and gas sector is one of the largest sources of methane emissions today, releasing an estimated 75 million metric tons of methane into the atmosphere annually. However, the International Energy Agency estimates that the industry can achieve a 75 percent reduction using technologies available today. Recent years have seen a new wave of Earth observation satellites being placed into orbit in order to track greenhouse gas emissions, some with a particular focus on methane emissions. As well as the oil and gas sector, methane emissions are coming from landfills,
SATELLITES FOR DIGITAL ECONOMY
GHGSAT gears up for new launches

Global emissions monitoring company GHGSat has made major advances in the remote sensing of greenhouse gases, air quality gas and other trace gas emissions over the past few years. In June 2016, the company launched the world’s first high-resolution satellite capable of measuring carbon dioxide and methane emissions – which combined account for more than 90 percent of all global emissions - from any industrial facility in the world. The Claire microsatellite provides greenhouse gas emissions monitoring data and services globally, with better accuracy and at a fraction of the cost of comparable alternatives, enabling owners of industrial facilities to monitor all of their facilities, anywhere in the world, with a common technology, in near-real-time.

Following on from the success of Claire, GHGSat is now moving further afield, with a new series of high-resolution satellites and very-high resolution aircraft for measuring greenhouse gases. The first of its next-generation satellites, Iris, is due for launch imminently, having suffered delays due to Arianespace’s Vega rocket failure last year. Iris will deliver better resolution, precision, and throughput with a more sensitive spectrometer, and, reportedly, will be focusing solely on methane emissions. Iris also holds a game-changing optical communications downlink, a world-first for a microsatellite, which will reduce the operational bottleneck and enable GHGSat to take many more observations per satellite.

The new satellite has garnered a great deal of interest already; in August 2019, GHGSat confirmed a CAD$3.3 million funding agreement from Sustainable Development Technology Canada (SDTC) to provide emissions measurements of oil and gas facilities in the Montney region of British Columbia. The project’s primary objective is to demonstrate that a tiered monitoring system using GHGSat’s Iris satellite and under-development aircraft instruments can detect more leaks quicker and at a lower cost than the regulatory standard, based on optical gas imaging cameras. Meanwhile, in September 2019, GHGSat signed a memorandum of intent with the Canadian Space Agency (CSA) and the European Space Agency (ESA) in which GHGSat will provide five percent of the Iris satellite capacity free of charge. The CSA and ESA will use this capacity for remote sensing, climate research and data validation projects. During the same month, GHGSat Inc. and Shell Global Solutions International B.V. signed a framework agreement for the provision by GHGSat of monitoring services with the aim to obtain methane emissions data of certain agreed Shell facilities globally. The initial pilot phase is intended for GHGSat to demonstrate its technology and the reliability of the data recovered and will cover initially four of Shell’s assets.

GHGSat is also planning on a second 2020 launch, for its third emissions monitoring satellite, Hugo. This third satellite is reportedly a culmination of many improvements upon Claire and Iris and will in fact be the basis of the company’s following 10 satellites. Expected to provide an order of magnitude improvement in performance compared to Claire, Hugo will also increase GHGSat’s observation capacity, enabling GHGSat to monitor more sites, more often.

MethaneSAT plods towards completion

One of the most important projects underway in the satellite/oil and gas sector today is the MethaneSat satellite, designed to locate and measure methane from human sources worldwide as a step forwards in reducing emissions.

Under development by a wholly-owned subsidiary of the non-profit Environmental Defense Fund (EDF), MethaneSat will monitor more than 80 percent of global oil and gas production regions with unprecedented accuracy, generating data that will enable both companies and countries to identify, manage, and reduce their methane emissions, slowing the rate at which our planet is warming. MethaneSat will cover a wide 200km view path passing over important target regions every few days, utilising advanced sensors which will pick up the sun’s reflected infrared radiation as it passes through the atmosphere and parse them to reveal methane’s unique fingerprint. A series of sophisticated algorithms will sort through the data - factoring in the influence of clouds, tiny particles of air pollution, and reflectivity of ground cover - to calculate even small changes in methane emission rates.

In September 2019, MethaneSAT signed an agreement with Ball Aerospace to design and build the upcoming satellite’s advanced new sensing instrument, consisting of two spectrometers, as well as flight integration and testing, launch support, and commissioning services.

Shortly after in November 2019, the government of New Zealand announced that it will contribute NZD$16 million to MethaneSAT, and also plans to host the ground-based mission control centre and develop an expanded scientific research effort using data from the satellite. This investment marks New Zealand’s first government foray into space.

More recently, January saw Blue Canyon Technologies (BCT) selected to develop and build the bus for MethaneSat, scheduled for launch in 2022. The satellite will be designed using BCT’s newest X-SAT line of spacecraft, the X-SAT Saturn-Class, which can carry payloads up to 200kg. The high-agility platform will enable the onboard instrument to collect data and revisit sites frequently, while its compact profile is designed to maximize the volume, mass, and power available for the methane measuring instrument.
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The big picture – The ever-rising business case for geospatial data enterprise

With data enterprise roaring ahead in top gear at a time of unprecedented satellite rollout, it's only natural to expect the orbital insights of geospatial data to gain traction in the global economy. With start-up enterprises building increasingly sophisticated business cases left and right, we can expect a geospatial data analytics revolution in the near future.

We are said to be living in the information era, though it is perhaps more accurate to call it an era of data. We live in a world where cameras may link our faces to records on file, where GPS knows where we go, and where our every search result is a statistic. We create pages of data every day through any number of minute decisions, the extent to which is increasingly expanding.

As these methods of collecting data broaden, so too do their applications. Optimising workflows, market analysis, and statistical prediction are only the beginning of the business cases booming around the world of data.

Statistics do not have a historical reputation for simplicity, far from it, but the democratising nature of modern media and technology has taken steps to change that. The ability to break down multiple datasets into simple, clean-cut reports is something every organisational group on the planet could stand to benefit from.

The combination of automated generation of tailored analysis and straightforward answers arranged by user-friendly systems multiplies the potential for data enterprise by some remarkable margin.

The ability for those untrained in statistics to benefit from their insights, especially when the entire process is self-serviced, does not only benefit the individual and their work but allows them to build upon them in bespoke reports for use in presentations and meetings.

As is so often the case at the cutting-edge of technology, the world of data is being stimulated by the sophistication of satellites. Various satellite services previously reserved for...
GVF brings together organizations from around the world across the breadth of the satellite ecosystem.

Our members are on the forefront of the satellite industry creating the path for others to follow.
governments and militaries have opened up to commercial spheres in the last few years, allowing their potential to be extended to the general population.

One recent application that has swept the world has been satellite tracking with Global Navigation Satellite Systems (GNSS). A reliable and precise method of keeping track of singular assets has proved to be highly pragmatic, fuelling ongoing enterprise growth, especially with the movement towards IoT technology gathering steam.

Vehicle tracking has already forever changed the way we navigate the world and is still innovating to tackle traffic congestion, but other applications are still being realised such as agricultural and conservational uses. The ability to monitor livestock or endangered animals could have a dramatic effect on the nature of those efforts. That’s to say nothing of the potential in personal GPS for loved ones, which has the potential to unlock a revolution in personal safety.

Geospatial Innovation: The success of UP42
A more emerging market exists in geospatial satellite imaging. While tracking offers minute information, an orbital photo can really deliver ‘big picture’ data in a very literal sense.

UP42 is one such start-up enterprise capitalising on the business case. The company operates a platform offering affordable satellite geospatial data, as well as the analytics services that can help interpret it. Whilst a very young company, they’ve established strong cases for providing insights to verticals such as agriculture, infrastructure, land management, and climate tracking.

The ability to see a massive area and watch it concurrently offers a level of in-depth awareness customers haven’t been able to make use of in the past, but that hasn’t necessarily been due to technological limitations. Accessibility has been a serious barrier to making use of the wealth of data satellites are capable of recording, which is something UP42 has been striving to correct.

Sean Wild, the company’s CPO told Satellite Evolution: “As we move into the future, the way we grow the geospatial industry as a whole is by making access to the data as easy as possible. We have the modern tools to create that. We run off of LTE, modern APIs and 5G data, and we can stream it to allow up to the minute tracking. With all that rolled into dynamic UI and simplified contracts, we’re pulling out all the stops to throw open the doors to this sector.”

But accessibility isn’t only about usability, it’s also a question of affordability. Enterprises like UP42 and services like them are striving to make geospatial data not only useful but priced reasonably enough to motivate the establishment of a new kind of marketplace.

Niche disruption: Small business re-writing the rules
Bird.i is an enterprise much like UP42 with a more niche business model. The Scottish developer combines the latest satellite imagery with artificial intelligence (AI) technology to provide valuable land and building insights to construction companies.

Recently acquired by Hanley Wood and Meyers Research, a business intelligence and data analysis firm serving the design and construction sector, Bird.i allows provides data and analytics to support the observation of the construction lifecycle, allowing for faster planning and progress tracking.

Bird.i is fuelled by the same trailblazing mentality as UP42 in forging revenue streams to further support geospatial data development and investment. The company’s founder and CEO Corentin Guillo explained: “Bird.i is pioneering the democratization of satellite imagery, and the insight it contains.” Finding new ways to make satellites work for the people they orbit.

Geospatial take-off
Brave new platforms built to serve bespoke industry demands are cropping up with increasing speed as the geospatial trend takes off with no signs of slowing down. A recent report from Research and Markets projected that the global geospatial industry was valued at US$239.1 billion in 2019, expected to grow to over US$502 billion in 2024, realizing a 13.2 percent CAGR.

The advancement of geographic information systems (GIS) software, including 3D and 4D, augmented and virtual reality are predicted to be strong drivers of this growth, although a compounding trend toward remote sensing over physical inspection is also expected. Alongside technology, the popularity of data science specialising in geospatial analysis is predicted to increase, producing scientists and developers with the skills to better refine and commercialise it.

The culture that has given rise to the realisation of the geospatial industry has been remarkable, but as the market truly forms as services prove their worth, geospatial platforms have the potential to become as ubiquitous as GPS tracking. Whatever form the industry takes, the next five years are sure to be an interesting time as the evolution takes place.
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Smart cities rely on smart signals

Smart cities are the cities of the future, with everything from refuse collection, traffic management and deliveries being automated using next-generation technology. However, such smart cities require fool-proof signal capabilities, necessitating more stringent technology than today’s GPS.

It’s hoped that smart cities will improve traffic and public transport, monitor energy usage, and link residents and visitors to everything from real estate to utilities, from education to health and government services. One aspect of this is the roll-out of autonomous vehicles - helping to simplify deliveries, reduce human error on the roads, make public transport more efficient and even enable workers to maximise their commute as they work while their car drives them to the office or a meeting, unaided.

Smart city hurdles

However, there are two hurdles that need to be addressed before we can relax in the back of an autonomous vehicle on the streets of a smart city. The first is a perception problem. How will we be able to teach an AV the difference between a dog in the road or a plastic bag, or get them to ‘understand’ that someone stumbling along the pavement after a boozy lunch needs to be considered an unpredictable hazard? Anyone working with AI knows that this is a work in progress. However, a more immediate hurdle is the current inaccuracy of the positioning provided by satellite signals that autonomous vehicles rely on for navigation. Until the accuracy and integrity of GPS is improved, it will be impossible to see any city fully embracing smart technology and reaping the benefits.

Whether it’s the Republic of Korea’s purpose-built Songdo International Business District, or the €31 million project to turn Malaga into Spain’s smartest city, all smart cities rely on GPS to provide location-based analytics, insights, and services to citizens. Toyota and NTT DoCoMo recently announced a $1.8 billion deal to develop a smart city platform, with Shinagawa Station in Tokyo and Woven City their testbeds. It’s estimated that smart city technology investments will reach $61 billion by 2026. But each of these futuristic utopias will become just another urban sprawl without effective and immediate location orientation.

The way cities have grown, with many reaching for the skies to maximise space, means that most have become urban canyons, making them a challenge for GPS. GPS requires a straight line of sight to determine exact location. In an open landscape, it’s possible to get a clear signal. However, in a built-up environment signals bounce off tall buildings, cars and other human made obstacles, which in turn results in less accurate GPS readings or (even worse) low integrity GPS - where a strong reflected signal can be interpreted as truth, causing location-based technologies to act with high confidence despite being incorrect. It’s one thing to not get a signal and for the AV to pause – anyone who has waited for their wearable to give them a ‘ready to run’ message knows that this can take a while – it’s another if the AV is mistakenly confident in the information it’s receiving and moves ahead. For an individual using Google maps to locate an address, it’s frustrating but not a big deal; for a drone
Smart Cities....

attempting to deliver a package, or an autonomous vehicle (AV) attempting to make a left turn, an error can be disastrous. There are alternatives to GNSS for autonomous vehicles, such as LIDAR, but none are cheap, and they can be thrown off by poor weather conditions. In addition, these power-hungry solutions won’t meet the energy efficiency goals that many governments have established as smart city objectives. Waymo - formerly the Google self-driving car project – recently announced its next generation tech but it is still dependent on light detection and ranging radar, so will have the same issues as other camera-reliant solutions. One can expect that LIDAR technology that’s perched atop the roof of each Waymo to cost about $5,000, making it too expensive for a largescale roll-out, not to mention making it a theft risk. Mesh technology, 5G and street furniture are other options, but they require many sensors on the vehicles which ups the price and makes a large-scale project out of many governments’ reach.

A classic imagining of a smart city is one with autonomous vehicles nipping through the streets, augmented wheelchairs making swift progress across pavements, defibrillator drones flying to patients, and robots digging and building with millimetre precision. However, in each case the reliance on precise location fixing is imperative. It doesn’t take much imagination to recognise that if a GPS result is metres out, a smart city environment is going to be treacherous.

Combining sensor fusion, machine learning and signal processing

The demand to address these issues has inspired a new approach. FocalPoint's patented Supercorrelation technology uses sensor fusion, machine learning and signal processing to determine the arrival angle of signals and remove reflected and non-line-of-sight signals from positioning. This software upgrade, at the GPS chipset level, enables 10x improvement in GNSS performance on devices in urban environments, including urban canyons and indoors. We believe it’s a game-changer and both the Royal Institute of Navigation and the US-based Institute of Navigation recently awarded prizes to Supercorrelation in recognition of its ground-breaking potential. The demand for the technology is strong and FocalPoint is working with leading chipset companies to bring it to market.

Smart cities must be secure cities. ‘Honest’ GPS can inform an AV which signals are useful, and which are not. It can also determine if people are broadcasting fake data. The civilian versions of GPS are currently unprotected and malicious individuals, who can purchase cheap equipment online and download free code, can broadcast spoof signals, disrupting radio mast signals, interfering with emergency services, even potentially interfering with financial trades. From a security perspective, broadcasting fake GPS signals (spoofing) to deceive a GPS receiver could cause significant problems for smart cities.

As well as spoofing to fake driving records, or even cheat on Pokemon Go (and potentially interfere with vital emergency, AV, or other smart city satellite signals), spoofing ‘vessels in’ locations could cause a billion-dollar maritime headache. Supercorrelation determines that any signal that is used, comes from the right place.

The world’s governments are waking up to how a connected urban environment can benefit their economy and the wellbeing of their citizens. However, until the fundamental issues of accuracy and integrity of GNSS is resolved, it will be hard for smart cities to deliver more than a chaotic, expensive, and potentially hazardous future.
Space sector recruitment amidst pandemic

COVID-19 has altered the landscape for organisations globally and affected the workforce in a number of different ways. Lockdown restrictions have meant staff have been working from home; redundancies have ensued; candidates previously open to the opportunity of a new career have hunkered down in symmetry with many of their employing organisations and those that have made the leap to a new career have had to interview and onboard remotely. But how has this impacted the space sector and specifically the recruitment requirements at this time?

Adele Fox, Head of Marketing, EVONA

EVONA is a specialist space recruiter, working exclusively with downstream and upstream organisations all over the world, and can positively report that they have witnessed a 20 percent year-on-year growth in all sectors over the period March–May, albeit at varying degrees of pace. February was a hard month as the impact of COVID threatened to result in slower contracting in the upcoming quarter and the impact on revenue targets was unknown. Many of the companies EVONA was working with at this time withdrew their jobs from the market feeling it ‘just wasn’t the time to hire.’

Happily, however, EVONA reports that this seemed relatively short-lived and by late March, those jobs returned, and companies began hiring once more. This was a quicker turn around than expected, but possibly testament to the resilience and adaption of the sector. From April to May, EVONA saw the most noticeable growth within the Launch sector. 43 percent of placements in that eight-week period were with launch and propulsion companies, mainly placing Mission Managers, Project Leads and Engineers. A further 21 percent of placements from April–May were within the Hardware, Robotics and build sector, placing predominately Embedded Software and Electrical Engineers.

The hire of engineers across all divisions seemed consistent with previous periods and their skills are as in demand as ever. Individuals with an engineering background accounted for 67 percent of the total hires within the three months of COVID, which is consistent with demand in the same period of 2019, according to EVONA’s data.

Whilst upstream placements seem to have accounted for the majority of placements EVONA has made during COVID, they have reported that downstream job placement numbers have been high. 17 percent of placements between April and May was within the Communications and Internet sector, placing Program Managers and Software Engineers. A further 15 percent of placements have been with GIS, EO and Research companies, placing as you would expect, Data Scientists, Analysts and Engineers.

EVONA felt that the continued pace of recruitment into the sector was largely down to space companies experiencing elevated risk to their survival with funds tied to deliverables and completion of contracts. Strategically pulling back on the recruiting effort would hamper the delivery of those contracts so many forged on with recruitment plans put on hold in early March in order to meet deadlines.

The quality of the hire is always important, but EVONA noted that at this time clients were even more strict in acquiring the right hire into their organisation. Quality hires have directly result in the extension of contracts and the perceived ability of the organisation. With a 60 percent reduction reported in the number of job seekers, reaching candidates was a new challenge.

EVONA also noted a shift in candidate mindset that was perhaps more difficult to overcome. There was a general reluctance to leave a current position or pursue an opening at such a risky time. Their response, however, was a simple one: The number of redundancies in the sector will naturally create an influx of very high-quality candidates into the market and increase the competition for roles. EVONA urged those offered a position that met requirements to make the move. Waiting is likely to delay career goals, restrict future movements and tie the candidate to their current role longer than anticipated.

What will the future bring?
From the observations EVONA has reported, the future of the space sector is certainly secure - if that were ever in
doubt. Two years ago, the Bank of America predicted that the sector would be worth 2.7 trillion in 20 years’ time and there’s no reason to question that prediction now. After all, despite a global pandemic, we’ve just experienced the first crewed mission to the ISS from US soil for 11 years; a mission made possible by the increased commercialisation of the sector. Surely that’s as good an indication as any of the resilience of the space industry.

Candidate tips for success from EVONA

Take the job: As we’ve just mentioned, waiting to take a role or pursue a new position will only delay your career goals. After COVID-19 the competition for positions will increase. Accepting offered positions will enhance your career potential.

Prepare for interviews: Perhaps the largest change for the workforce has been the need to get to grips with remote interactions, and the most noticeable concern amongst the job seekers: The video interview.

Preparing for a video interview isn’t necessarily any different from meeting with the employer in person; in fact, it can work to your advantage. We encourage anyone to prepare for an interview thoroughly by researching the company and have notes on hand.

You should present yourself in the same way you would a personal interview, considering body language and dress. Test your systems before dialling in but remain calm if the worst does happen; we’ve all had a bad tech day.

Utilise technology to work from home: Working for home and onboarding into a new organisation is absolutely possible, even during lockdown. At EVONA we have hired four people during the pandemic, all onboarding and becoming part of the team utilising video conferencing, instant messenger services and email.

Hiring company tips for success

Hire now: Despite initial trepidation, companies looking to hire to reach objectives prior to the outbreak haven’t stopped. It is our view that it will be these companies that will be able to pick up where they left off and make advances on the market whilst others halting recruitment may stagnate. Offering suitable candidates an offer in principle will secure the talent, enable time to familiarise them with organisational procedures and provide security for the candidate.

Utilise technology: Interviewing through video conferencing has never been more necessary. Adopting this method has always shown innovation; it reduces the necessity to travel, allows instant connections, frees up tight schedules of hiring managers, streamlines the recruiting effort, is cost effective and crucially, can currently keep us all safe at the moment whilst not hampering growth.

Embrace remote working: Flexible working conditions are not only generating a happier, more productive workforce, they are also a valuable incentive that employers are using to attract new applicants. Many of the job seekers we speak to are searching for greater work-life balance and broader choices in terms of where and how they work. A recent study revealed that allowing employees the flexibility to work from home also increased loyalty. The space sector workforce is highly skilled and not easily reconstituted; it takes considerable time and effort to reconstruct the talent required to restore full operational capabilities. Considering remote working will retain the skilled employees within an organisation.

The requirement to be able to work from home was on the rise before COVID-19; it’ll be even more popular now and employers need to tool up to be able to satisfy this requirement.
A critical year for small satellites

Small satellites are everywhere these days; in the commercial segment, government and military, scientific exploration, and even among academic institutions such as schools. With the miniaturisation of satellite technology, access to space has never been more achievable.

As an industry with less than 100 years of history, the satellite sector continues to innovate. Moving on from massive, multi-million-dollar communications satellites, each one carefully crafted over years of planning, construction, and testing, we’re now entering an era where smaller, assembly-line satellites are all the rage.

Mini (100kg-500kg), micro (10kg-100kg), nano (1kg-10kg), pico (0.1kg-1kg) and femto (<100g) satellites are attracting consumers from all walks of life, with benefits including cost effective payloads and launches, rapid production and launch cycles, lower latencies as a result of lower orbits, and a much lower overall barrier to entry.

The potential marketplace for space and satellite technology is wide open for anyone bold enough to make a move.

Technology is good, but demand is better

It’s all well and good having this incredible new technology in place, but technology for the sake of technology, without demand and solid well-thought out applications is doomed to failure (remember the 3D TVs of the noughties, anyone?). Fortunately, that’s not the case where small satellites are concerned, with market research companies across the globe – as well as a simple Google search which divulges success stories aplenty – all in fervent agreement on the booming future for small satellites.

ResearchAndMarket.com’s ‘Small Satellite Market – Growth, Trends, and Forecast (2019-2024)’ report expects a small satellite market CAGR of more than 17 percent in 2019-2024, with massive investments by venture companies, growing demand for low-cost satellites and Earth observation applications all propelling the growth of the sector. The company highlights power-related limitations and launch regulations as potential barriers for the market growth during the forecast period. However, technological advancements, particularly the miniaturization of electronic components, 3D printing, advanced material technology, artificial intelligence and machine learning are expected to help manufacturers overcome some of the barriers and develop advanced small systems capable of performing multiple missions. On a similar note, Mart Research expects the US$3.53 billion small satellite segment of 2018 to grow at a CAGR of 20.83 percent in 2019-2026, citing that small satellites are ‘more useful than their larger counterparts in purposes like gathering scientific data and radio relay.’ Vastly reduced mission costs are also highlighted as a key demand driver.

Notably, ResearchAndMarkets.com reports that the military held the largest share of the end user of small satellites in 2018, utilising the satellites to augment communications capabilities. The draw of small satellites reportedly stems from the risk to large communications...
satellites from newly developed anti-satellite weaponry. However, the commercial segment is expected to experience the highest CAGR during 2019-2024, with heavy investments and many start-ups being launched.

ResearchAndMarkets.com and Mart Research, among others, both reported that North America held the largest market share in the small satellite segment in 2018, mainly due to the number of small satellite launches by the USA for both commercial companies and NASA. However, the Asia Pacific region is expected to grow at the largest CAGR during 2019-2024, with China, Japan and South Korea actively developing and launching their own small satellites.

Interestingly, while much of the space sector is currently undergoing market consolidation, the small satellite segment is in fact becoming quite fragmented due to the aforementioned start-up companies as well as existing satellite manufacturing companies branching out into small satellites. Additionally, due to the simpler designs, quite a number of schools and universities are also producing their own small satellites for launch.

Small satellites = Big business
The applications of small satellites are so varied that educations and research institutions, small businesses, militaries, governments, and commercial entities alike want in on the action. Naturally, it’s the big-name constellations which are drawing the most attention, as the race to stay ahead of the curve is well and truly underway.

O3b Networks has continued to build out its O3b network of MEO satellites, completing its first-generation small satellite constellation in April 2019, bringing the total to 20 satellites. Now the company is working on its O3b mPOWER constellation in cooperation with Isotropic Systems, ALCAN and Viasat. The new constellation will be based around seven ‘super-powered’ MEO satellites, with more than 30,000 dynamic, electronically generated fully-shapeable and steerable beams that can be shifted and switched in real time. Delivering multiple Terabits of throughput globally, the Boeing-built fleet is scheduled for launch next year via SpaceX and is scalable to multiple terabits of throughput globally, providing coverage to an area of nearly 400 million square kilometres. A total of 22 O3b mPOWER satellites have been approved.

SpaceX, which launched its first demonstration satellites Tintin A and Tintin B back in 2018, is making huge strides towards its Starlink constellation, which will ultimately feature 12,000 small satellites utilizing inter-satellite links and operating in Ka and Ku-bands. The company kicked off 2020 with the January launch of another 60 Starlink satellites, and combined with subsequent launches this year, has brought the current Starlink constellation total to 360 (or 362 including the demonstrator satellites) at the time of writing. This latest launch makes SpaceX the owner of the largest commercial fleet in orbit; indeed, one of the significant benefits of operating your own launch company seems to be a much speedier than usual constellation build-out. As many as 18 more missions are planned for this year.

Another constellation contender, OneWeb Satellites, has been in the news for all the wrong reasons this year. Things were moving along quite nicely, with the first major launch of 34 of its LEO satellites successfully launched in February. Prior to this, an initial six satellites were launched back in February 2019, and provided examples of impressive capabilities in the following months. However, in March the company announced it had filed for Chapter 11 after several investors pulled out due to the pandemic. However, it is not all bad news as on July 3rd it was announced that a consortium of the UK Government and Bharti Global Limited
had committed to provide more than US$1 billion to acquire OneWeb and fund the full restart of its business operations. Canada’s Telesat is also gearing up for a not too distant small satellite constellation launch. The LEO constellation has 300 planned satellites, although may ultimately grow to 500, and will be launched on board Blue Origin’s New Glenn rocket, which has its maiden flight planned for next year. Following highly successful prototype satellite tests in orbit and a lucrative partnership with the Government of Canada – expected to generate CAD$1.2 billion for Telesat over 10 years, and an additional CAD$85 million contribution through the Government’s Strategic Innovation Fund - the future is looking bright indeed.

July 2018 saw the announcement that Facebook is planning its own constellation of LEO satellites. Indeed, the planned Athena constellation is designed to provide broadband Internet connectivity, particularly to rural regions. The FCC has approved the Facebook subsidiary PointView’s constellation plans; however, more details are few and far between.

In more recent news, Amazon has decided to get in on the action, with a planned 3,236 strong constellation of small satellites in LEO for broadband Internet connectivity. Kuiper Systems will call for three layers of satellites, 784 at 590km, 1,156 at 630km and 1,296 at 610km. The news makes sense given that Amazon owner Jeff Bezos also owns launch company Blue Origin, making the operational ideals more and more similar to SpaceX’s Elon Musk.

Elsewhere, LeoSat Enterprises had planned a unique constellation of 78 small satellites featuring inter-satellite links, comprising 13 satellites (12 functioning and one spare) in six polar orbits. However, in November 2019 it was announced that operations had been suspended and all employees laid off after Hispasat and SKY Perfect JSAT failed to complete LeoSat’s US$50 million Series A investments as pledged.

2020: A big year for small launchers

The influx of small satellite projects has created fantastic opportunities for launch providers. Existing providers have developed new launch vehicles with a much greater emphasis on rideshare capabilities, while more than a handful of startups have been created solely dedicated to small satellite launch technologies. Indeed, Frost & Sullivan expects a total of 20,425 satellites to be launched in 2019-2033, with high demand taking the small satellite launch market beyond US$28 billion by 2030. “Serial production and rapid manufacturing will play a pivotal role in meeting market demands. To ensure the success of the industry, it’s imperative that launch frequency, inventory and manufacturing capability are optimized,” said Prachi Kawade, Research Analyst, Space, Frost & Sullivan.

Small satellite launch provider Rocket Lab closed out 2019 with the official opening of its new US launch site, Launch Complex 2, at the Mid-Atlantic Regional Spaceport. Rocket Lab’s Launch Complex 1 on the Mahia Peninsula of New Zealand had achieved 10 flights of the Electron launcher by this time, including six in 2019. Launched Complex 2 is expected to open up new markets, including government customers and national security applications, with up to 12 missions per year. The first mission will deliver the US Air Force’s Space Test Program 27RM, which will deliver the Monolith microsatellite into orbit, in the spring of this year. This is the latest in a long line of impressive 2019 news for Rocket Lab, which also announced its new Photon spacecraft for missions to the Moon and beyond and began testing its Electron rocket boosters for reusability.

Looking ahead, 2020 is expected to be huge for small satellite launch specialists.

One of my personal favourite small satellite launchers Virgin Orbit launched an orbital rocket for the first time in May. LauncherOne was carried into high altitude onboard the Cosmic Girl aircraft prior to successful in-air separation; however, while details remain murky, LauncherOne failed to continue to its target orbit. Virgin Orbit is also looking for new launch sites and destinations this year, with the UK Space Agency having recently awarded the company £7.35 million to enable LauncherOne missions from Spaceport Cornwall, with the first launch expected not before 2022. Virgin Orbit is also collaborating with SatRevolution and Polish universities for up to three launches delivering small spacecraft to Mars, with the first launch due no earlier than 2022.

Meanwhile, newcomer FireFly Aerospace is preparing for the inaugural launch of its Alpha rocket in the first quarter of the year from Vandenberg Air Force Base in California. FireFly has partnered with Aerojet Rocketdyne to gain expertise on 3D printing for its Reaver engine production (each Alpha launcher contains four Reaver engines), as well as collaborating on its upcoming Orbital Transfer Vehicle and a larger Beta launch vehicle. FireFly has also partnered with Israel Aerospace Industries to cooperate on lunar landing technology, Genesis, which will be used for mission contracts under NASA’s Commercial Lunar Payload Services program; the first flight is expected to take place in 2021.

Beyond the US, Taiwan Innovative Space Inc. (TISPACe) is looking forward to achieving its first small satellite launch on board its Hapith launcher at the end of the year. The company spent 2019 increasing the efficiency of its hybrid rocket engines to meet NASA’s Class-I rocket propulsion status while also keeping costs lower than competitors. TISPACe is presently negotiating leasing launch facilities in other countries, plans to create a California office to access US commercial space, and ultimately build a satellite technology industrial park.
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Check out the entries on the following pages. If an item is of interest, click on the links to request more information or to visit the company’s website.

Advantech announces technology partnership
Advantech Wireless Technologies has signed a sales and distribution agreement with TXMission, a designer and manufacturer of high performance SmallSat modems for the NewSpace Industry. The companies will together develop a comprehensive suite of SmallSat, Airborne and Comms-On-The-Move (COTM) communication products for markets requiring versatile, extremely low size, weight and power (SWaP) products that provide leading-edge performance. The range of fully integrated SmallSat and UAV/Airborne products to be developed will include advanced RF transceivers, multi-gigabit modems for onboard and ground segment applications, low SWaP satellite terminals, antennas, network management systems and 5G technology solutions.

AvL Technologies’ new 1.35m Flexible Integrated Terminal (FIT)
AvL Technologies’ new 1.35m Flexible Integrated Terminal (FIT) offers a flexible, user-defined terminal platform with a 12-piece reflector and an integral tripod for a small pack-up in two IATA-compliant checkable cases. The manual-point version operates with manual point assist software and can be upgraded to motorized operation with AvL’s AAQ antenna control system. The terminals operate in X, Ku and Ka-band with new bayonet-style feeds and feed kits for quick RF changes. The terminals have a built-in tuner and beacon receiver, are scalable with 75cm, 98cm and 1.35m reflectors, and are flexible with modem, BUC and LNB options and an AvL ARSTRAT-compliant ODU.

Isotropic Systems has cracked the code for next-gen connectivity
Isotropic Systems’ transformational terminals feature patented optics and beamforming technologies capable of unleashing the full potential of new satellite constellations set to come online in the next two years. The roadmap features a converged antenna that operates in multiple frequencies and multiple beams, meaning commercial and government users of the platform can completely arbitrage all the capacity in space through a single terminal. Isotropic Systems’ first-generation multi-beam terminal is a Ka-band platform set to serve Non-Geostationary Orbit (NGSO) constellations. The company has contracts with SES and Inmarsat, as well as US Defense organizations ready to leverage the breakthrough terminal.
Intellian’s next-generation tri-band maritime antenna earns type approval from SES

Intellian’s recently launched 2.4m v240MT Gen-II antenna has achieved type approval from SES, the leader in global content connectivity solutions. Intellian’s v240MT Gen-I was the world’s first 2.4m tri-band and multi-orbit antenna.

The v240MT Gen-II delivers enhanced performance across C, Ku and Ka-bands, providing customers with access to higher throughput and offering improved network efficiency to the operator. These advances were proven in partnership with SES, with the new system producing exceptional results during testing and sea trials.

MDI has introduced two products specifically designed for NewSpace SmallSats

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Engineering, design and custom development
Sematron, a Milexia Company, manufacture and supply systems for use by DSNG operators, governments, international media organisations, oil and gas industries, medical applications and the disaster recovery sector. Sematron offer engineering, design and custom development in all areas of the business. It has the ability to design a solution around commercial off-the-shelf (COTS) products, combined with its own in-house developed subsystems, allowing it to meet customer requirements across a broad spectrum of markets.

ND SATCOM Flyaway Terminal
Severe Storms, Gale-Force Winds – Ready To Communicate Anytime!
Send and receive where other systems have already given up. Discover the new ND SATCOM FLY AWAY terminal with integrated SKYWAN technology, which is revolutionizing the market with its unique robust design. Whether you are experiencing severe storms or gale conditions, this terminal is extremely reliable, ready for immediate action, and raises the bar worldwide in terms of communication security. Plus, its light and durable components enable easy transport and a long product life. Stay tuned to learn more about our new Flyaway terminal launching soon!

Teledyne launches new Hi-Power Limiter for military apps
Teledyne e2v HiRel has a new addition to its family of high power limiters, the TDLM202402, a quasi-active S-band SMT PIN Diode Limiter that offers "always on" high power CW and peak protection. Packaged in a small 8mm x 5mm form factor for demanding electronic warfare and radar applications, the TDLM202402 utilizes proven hybrid assembly technology. It has 50dBm (100W) CW power handling capability and 60dBm (1,000W) peak power from 2 to 4GHz (25µsec pulse width at 5% duty cycle). Parts are screened and qualified for high reliability applications. These power limiters have an operating temperature range of -65°C to 125°C.

mosaic-TTM, a highly secure and accurate GNSS timing module
Septentrio, a leader in high-precision GNSS positioning solutions, has announced an addition to its GNSS timing portfolio: mosaic-TTM is a high-end GPS/GNSS* receiver module built specifically for resilient and precise time and frequency synchronization under challenging conditions. Its multi-frequency multi-constellation GNSS technology together with AIM+ Advanced Interference Mitigation algorithms allows mosaic-TTM to achieve maximal availability even in the presence of GNSS jamming or spoofing. This compact surface-mount module is designed for automated assembly and high-volume production.
Innovator in the RF space
Terrasat Communications designs and manufactures innovative RF solutions for satellite communications systems. The ground-breaking IBUC - the Intelligent Block Up Converter - brings advanced features and performance to C-band, X-band, Ku-band, & Ka-band satellite earth terminals and VSATs. Terrasat Communications offers the IBUC (Intelligent Block Upconverter) brand RF solution for MILSATCOM terminals. Building on the company’s reputation as an innovator in the RF space, Terrasat has launched several IBUC models that play a key part in ruggedized tactical satellite terminals. All IBUCs are engineered and manufactured in the company’s modern Silicon Valley facility and are backed by a 3-year warranty.

Visit website  Request further information

Thuraya MarineStar
Thuraya’s newest maritime voice solution with tracking and monitoring capabilities is a bestseller due to its flexibility, affordability and reliability. As an entry-level solution, Thuraya MarineStar is built on the same successful voice platform that has sold more than one million Thuraya satellite voice devices. Since it enables tracking and monitoring, in addition to voice communications, vessel operators do not have to invest more in their tracking systems or a brand new tracking application. Thuraya MarineStar makes compliance with national and international fish catch reporting regulations simple. Moreover, it supports multiple languages, further cementing its appeal among regional users. Thuraya MarineStar enables fishing crews to remain connected on their local GSM numbers, even beyond the coastline. The terminal with its IP67 rated antenna can be deployed to perform condition based, on-board monitoring for maintenance activities.

Visit website  Request further information

Discover how to protect your Earth Station Antenna signals from the elements with WALTON DE-ICE
WALTON’s unique plenum HOT-AIR DE-ICE system delivers superior performance and efficiency for antennas 3.7 to 32m. Uniform surface heating minimizes reflector distortion, delivering the most powerful and cost-efficient de-icing on the market:

• Liquid Propane, Gas or Electric Heating to best suit your unique installation.
• Unmatched performance for the most demanding Ka-band antenna requirements.
• For 0.6 to 6.3m, SNOW SHIELD antenna covers offer heated/un-heated solutions.
• Adding ICE QUAKE to SNOW SHIELD sheds off snow before ice forms. Up to 100x energy savings.

The Walton PORTABLE RADOME protects GEO/LEO/MEO antennas from winds (to 85Mph), snow, ice, rain, sand storms, debris and more. Single-person-setup in under and hour. The Radome is also airline shippable.
If your focus is the global satellite industry - look no further! The Satellite Evolution Group, a division of DS Air Limited, is one of the leading print and digital marketing platforms for the industry. For over seventeen years we have served the global satellite market with information key to this evolving sector.

The portfolio including Satellite Evolution Asia, Satellite Evolution EMEA, NewSpace International, and Global Military Communications covers the entire spectrum of the industry from launch, ground segment and networks to space.

Enjoyed this issue of Satellite Evolution Asia? Well hold on to your hats, because there is much more to come!

Coming up in Satellite Evolution Asia - September/October

News
VSATs
IFC
Maritime
Flat Panel Antennas
Q&A Kymeta
IoT
Introducing New Families of SATCOM SSPAs & BUCs

**Puma™**
GaN SSPAs/BUCs
- Powerful & Efficient
- Ideal for Fixed & Transportable Applications

**Bobcat™**
SATCOM BUCs
- Compact
- Interchangeable Bands
- Ideal for Fixed & Man-Portable Applications

**Falcon™**
GaN SSPAs & BUCs
- DO-160 Certified
- Ku and Ka-Bands
- In-Cabin and Tail-Mount

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