Satellite Executive BRIEFING
Vol. 17 No. 5 July-August 2024
SATELLITE Markets & Research
Industry Trends, News Analysis, Market Intelligence and Opportunities

How is Space Technology Different?

by Bruce Elbert

Space may be the final frontier, but the principles of its exploitation have not changed since Russia and the US launched the first artificial satellites before 1960. Our best approach is to view space as a complex technical domain where objects made by humans arere launched in earth orbit (and potentially beyond) by vehicles that burn chemical fuel to coexist with an environment very different from what we find on our planet (or any other planet for that matter). Like airplanes that wing their way in our atmosphere or submarines that travel under the seas, spacecraft are constructed to survive and operate in the inhospitable environment of space. Lastly, those spacecraft are designed and manufactured for a specific purpose (e.g., communications, earth observation, navigation, security and protection, etc.) and have features (functionality and specifications) that are readily understood and verifiable before launch; all must be proven out for that space environment before launch lest they fail in their respective missions. It makes no sense to place an airplane or submarine in space, likewise for a spacecraft in flight or submersed in the sea. Having such a platform at a distance from earth affords excellent coverage for communications at radio frequency, laser link potential, and ability to observe the earth. The trend in radio signal usage follows the increasing range of the spectrum and today at millimeter wavelengths. Therefore, space technology combines with modern ground-based resources that give us more capability and potential for human progress.

Image: ESA

Long-term Trends in Space Technology

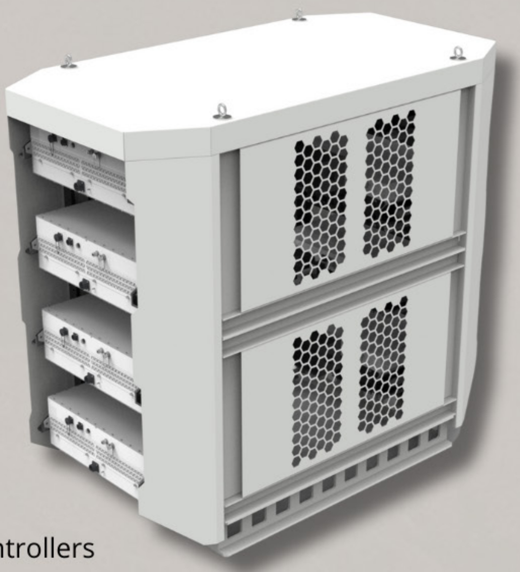
Past decades have seen extensive development of the use of earth orbit for communications, earth observation, navigation science, and delivery beyond. This is primarily unmanned,

Continued on page 4

What's Inside

Summit III

Introducing Summit III C - the latest generation of our popular Summit high-power SSPA systems. Utilizing the Genesis-HP amplifier as its building block, up to 8 modules can be combined into a single amplifier system capable of delivering extremely high levels of RF output power. Summit III C systems are populated with 400W or 500W C-band Genesis-HP SSPAs with Gallium Arsenide (GaAs) device technology necessary to accommodate wideband, multi-carrier applications with superior linearity over comparable Gallium Nitride (GaN) base architectures.



Features

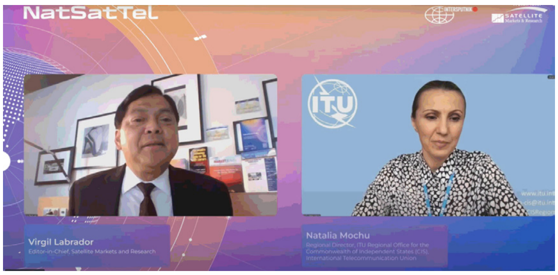
- Soft-fail Redundancy
- SSPA or SSPB option
- Modular design for scalable systems
- CANbus architecture for advanced troubleshooting
- Single point for Customer Interface
- Single Point-of-Control M&C, eliminating external controllers
- System Level RMS RF Power Detection
- Secure SNMPv3 Interface
- Advanced Web Interface for entire system monitor and control
- Automatic Gain Adjust to compensate for loss of amplifiers

EDITORIAL

The Latest Market Trends in 3 hours, No Travel Required

Last month, Satellite Markets and Research in cooperation with leading international satellite organizations including the International Telecommunications Union (ITU), among others, successfully held the virtual NatSatTel conference online. We had many distinguished speakers including opening and closing keynotes from major research companies Analysys Mason (formerly NSR) and Novaspace (formerly Euroconsult). Companies from the space and ground segments also presented the latest trends and developments in the industry.

Perhaps, one of the highlights of the conference was the dynamic panel on women in the inudstry moderated by Natalia Mochu, regional director of the ITU. The panel consisted of various women executives representing major companies as well as government officials. The conference had several panels , all compressed in a compact three hour program. For those who were among the hundreds that attended online, it was probably the best spent 3 hours where they were able to catch highlights of the key trends in the major sectors of the industry, without leaving their desks.



In case you missed the online NatSatTel conference, videos of the proceedings can be viewed for free at https://www.natsattel.com/videos/ NatSatTel is an annual event held usually in the middle of the year, so we look forward to having you next year.

Virgil Labrador

Satellite Executive BRIEFING
Industry Trends, News Analysis, Market Intelligence and Opportunities

EDITORIAL

Virgil Labrador
Editor-in-Chief
virgil@satellitemarkets.com

Peter I. Galace
Elisabeth Tweedie
Associate Editors

Contributing Editors:

North America:
Robert Bell,
Bruce Elbert,
Lou Zacharilla
Latin America:
Bernardo Schneiderman
Europe:
Omkar Nikam *(Strassbourg)*
Hub Urlings (*Amsterdam)*
Roxana Dunnette (*Geneva)*
Asia-Pacific:
Blaine Curcio (*Hong Kong)*,
Naoakira Kamiya (*Tokyo)*,
Riaz Lamak *(India)*

ADVERTISING

For Advertising enquiries send an e-mail to:
info@satellitemarkets.com

Satellite Executive Briefing
is published monthly by
Synthesis Publications LLC
and is available for free at
www.satellitemarkets.com
SYNTHESIS PUBLICATIONS LLC
1418 South Azusa Ave.
Suite # 4174
West Covina CA 91791 USA
Phone: +1-626-931-6395
Fax +1-425-969-2654
E-mail:
info@satellitemarkets.com

Space Technology...
...from page 1

at least commercially, but the government sector has supported manned space particularly for the space station. The orbits employed were primarily GEO and LEO with a lot of solid experience with very good performance in terms of useful payloads in orbit that meet demands. Leading commercial operators like Intelsat, SES, Eutelsat, JSAT and Telesat grew and new entrants like DIRECTV, DISH, Iridium, Arabsat and Viasat expanded market opportunities. The launch services side of the industry changed little over this period, with US rockets like the Delta, Atlas and Titan carrying the bulk of the mass to orbit, but Europe built up Ariane to the point of near dominance after loss of the Space Shuttle.

As a vehicle designed to operate in vacuum without much in the way of external forces (other than gravity), a spacecraft will always be composed of certain elements. These are the electrical power system, the propulsion system, a control system to maintain its orientation and flight path, and a structural system that contains and protects these systems from radiation, heat and cold, and low levels of bombardment. Taken together, this is the spacecraft bus that carries and supports the payload that provides the business end of the overall vehicle. Communications payloads will contain analog components that produce the most power and bandwidth, and digital processors are available to add dynamic beam forming and other forms of flexibility.

The approach is to design a spacecraft for the particular purpose, choose proven components and assembly techniques, and to extend beyond this base only if absolutely necessary for a particular application. The 1980s, 1990s and through around 2010 were decades of incremental innovation and increasing investment to exploit markets and remain competitive among the companies that built and operated space systems for earthly use. Major aerospace companies like Boeing (né Hughes Aircraft), Lockheed Martin, Northrup Grumman, Loral, Airbus and Thales Alenia dominated the industry and appeared to hold onto all major projects and supply chains. This approach minimized risk but it is claimed that it held us back in terms of applying more scale and innovation in space technology.

"...The methodologies of space technology development are based on attention to detail, because literally any component or association of components can cause poor performance or failure of part or all of a space system..."

The methodologies of space technology development are based on attention to detail, because literally any component or association of components can cause poor performance or failure of part or all of a space system. This emphasis starts with the architecture of the system and its ability to address the specific need or needs, and then proceeds through a detailed design process which emphasizes performance, reliability, cost and time to market. The components need to be proven well before they are incorporated, including testing in simulated space environment and demonstration of lifetime sufficient to satisfy the mission. GEO satellites are central points in the system and were well understood by all participants. But going to a LEO system crossed a Rubicon in the sense that whole batches of identical satellites would be produced and launched at reduced cost per satellite. Motorola's Iridium constellation, originally launched in 1998, experienced a high degree of early failures due to the non-redundant design as well as the accelerated test program on the ground. They caught themselves early and increased testing to eliminate infant mortality.

If the mission involves humans in space, then normal care and validation increases substantially to what Elon Musk described as a "ridiculous amount of testing" before launch. His use of the word "ridiculous" is actually to the point as it was the British interpretation, meaning "a whole lot". Often ignored until later is the approach to the ground segment needed to establish and operate the space segment and to provide communications, observation, or other services to the user community. The criticality of space technology is matched by the proper positioning and management of the ground segment.

All of this said, space technology is dependent on the careful application of proven processes, materials, and systems. Launching spacecraft from earth, controlling them in spaceflight, delivering applications or even people, still demand this type of care and attention to detail. Launching more vehicles does not overcome the known

RevGo

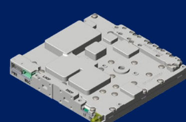
Outperforms and Outlasts

Gateway and Flat Panel RF Solutions

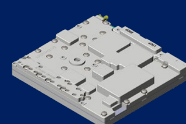
LEO / MEO / GEO

Low Profile Ka/Ku Dual Channel

20mm Height



BUC



LNB

Ka-band (27.5-31GHz)

- 300W / 160W
- 80W / 40W / 20W / 10W / 6W
- 3-20W Transceivers

Ku-band (12.75-14.5GHz)

- 400W / 250W
- 100W / 80W / 60W / 40W
- 6 - 40W BUC & Transceivers

C-band

- 1000W / 800W
- 400W / 200W
- 10 - 100W

Come see us at...

Satellite Asia 2024
Booth 5H1-12

RevGoGlobal.com - 703.348.9933 - Reston, VA USA

challenges of the space environment; it may reduce the criticality of individual elements if the overall system offers diversity sufficient to the purpose. Computers and software began to play a key role through the design of critical elements like antennas and control systems, as well as innovation by Hewlett Packard to automate in the factory testing and calibration, and finally on orbit to simplify operations using canned procedures and improved graphical displays. Spacecraft were hand made by experienced technicians, typically one at a time. Then, partly completed subsystems and final assembly required manual transfer from one area to another. But the innovation of the true assembly line and the use of robots would have to wait until the principles of automobile manufacture (read Tesla) were transferred to the spacecraft factory (à la Starlink).

What Changed Around 2015

They called it "New Space" or "Space 2.0" in remembrance of the year 2000 Internet "dot com" boom. The New Space paradigm became all the buzz when Silicon Valley recognized startups like SpaceX and Rocket Lab which challenged the assumption that launches were the domain of NASA, the DoD and the largest commercial satellite operators. Its cult nature is shown in the hope for, "Services that Could End World Problems ." Hundreds of VC-funded startups appeared with interesting concepts like Internet of Things (IoT), Direct to Device (D2D) for service to cellphones, cheap rockets to launch small payloads, and manufacturing in space (an old concept tried by NASA over 20 years ago). Interest in space travel for leisure and the return to the Moon as well as flight to Mars became the rage. But the most successful New Space startup to date has to be the StarLink LEO broadband constellation from SpaceX. Amazon's founder, Jeff Bezos, picked up on the SpaceX Starlink theme and is in the process of creating his own broadband LEO enterprise named Kuiper.

SpaceX did some things differently in their innovative reusable boosters and mass production of small LEO spacecraft. They are also the first to put optical intersatellite links into commercial use for trans-oceanic data transfer. As innovative and inventive as SpaceX is, they follow many traditional approaches of employing space technology in a practical scheme to perform earthly functions. The first satellites were also in LEO having been placed there with similar chemical rockets and employing line-of-sight communication by electromagnetic means.

Spacecraft have journeyed far outside of earth orbit as far back as 1962. Mariner 2 became the first successful mission to another planet when it flew by Venus on December 14 . And Surveyor 1 (May 30, 1966), was the first of a series of seven robotic spacecraft sent to the moon to gather data in preparation for NASA's Apollo missions. It was the first spacecraft to make a true soft landing on the moon . In those days, critical calculations were performed using slide rules rather than advanced computer systems. Of course, today we have the cloud and AI to optimize everything about the space vehicle and its mission. But, the hardware is not substantially different and must undergo the same detailed process of design and test.

I suggest that people involved in New Space on the one hand and the classical development of big systems on the other will still look at things in much the same way as space technology pioneers of the 1960s and 1970s. We have digital tools that we could only imagine 20 years ago, and they afford things in the factory, launch pad, and in space once vehicles are in motion. Also, the ground segment is much more adaptable and functional to exploit the Internet in all its forms,


MISSION MICROWAVE TECHNOLOGIES LLC
10 YEAR
ANNIVERSARY
2014-2024
MISSION
MICROWAVE
Family of X-, Ku- and Ka-Band BUCs
from 10-1000 Watts
STINGER
JAVELIN
TITAN
25 W Ka-Band
50/100 W Ka-Band
200 W Ka-Band
55 W Ku-Band
100 W Ku-Band
200 W Ku-Band
50/80/100 W X-Band
THE SHAPE OF SOLID STATE™
Available with Full Ka-Band Coverage for
LEO/MEO/GEO Terminals and Gateways

Link JONSA Antenna

- Cover Your Life -

The best-selling product in Jonsa includes:

0.6M/0.9M Auto and Manual Flyaway

- ◆ Ring focus antenna with 8 segments reflector
- ◆ Support Ku and Ka band as an option
- ◆ Carbon fiber reflector with light weight, high strength and one person can finish the installation within 3 minutes.

VSAT (E74/97/120) antenna

- ◆ Customized VSAT antenna products
- ◆ Correspond with electronic devices, such as integrated LNB and Feedhorn
- ◆ Support Ku and Ka band as an option

0.6M/0.9M Ka and Ku band Maritime with radome

- ◆ One-touch commissioning
- ◆ High gain and carbon fiber antenna
- ◆ Support beacon receiver, DVB, and digital tracking system

WIRELESS IS UNLIMITED.

+886-49-2260666 | saccount@jonsa.com.tw | https://www.jonsa.com.tw
No. 206 Cheng Kung 3 Rd., Nan Kang Industrial Park, Nantou City, Taiwan

JONSA

including Software Define Wide Area Networks (SD-WAN) and AI. The software schemes are now much improved with digital twins of the entire spacecraft before it is constructed; digital twins are extended through the operation of the entire constellation, network or complex deep space mission. One still needs a clear vision of what is intended, an architecture that makes sense both now and in the future, and solid engineering processes straight through development and start of service.

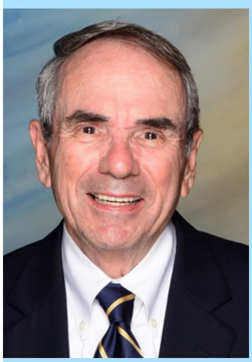
Success in the Next Decade

Success depends on innovation as we see SpaceX and Rocket Lab accomplished. One of their more interesting and rather incredible innovations was booking a launch on the Internet. The legacy method was to engage in a very lengthy and involved interface and integration process where the launch provider and buyer gain sufficient understanding of each other. The new players deliver so many launches at rather reasonable prices and so cannot afford traditional courting. You design to their interface and they put your spacecraft in the desired trajectory or orbit.

Today's software tools and launching systems are so much better than what was available in years past. That combined with the will to pursue useful goals will continue to allow space technology to be a force for prosperity on earth. The sky was the limit; now, space is an active part of our future as long as future generations of practitioners follow the rules learned over the past 60 years. Innovation is a constant in space technology because we are dealing with the complex interaction of physical objects with numerous subsystems that are under control of networks of ground and other space facilities. A relatively small improvement in capability, such as electric propulsion and real-time assessment of link performance, brings with it more in the way of service potential and reduced cost and risk.

What I would like to see from here is better definition of what the actual use will be of a given space solution, how much it will cost, and how it will operate in coming years. We cannot afford experiences like the original Iridium LEO constellation which went bankrupt after only one or two years of operation. The tools exist today to understand what and how, but the bigger issue is why are we employing space technology and how will it perform. Engineers and scientists are great at the how, but the vision needs to be clear and definite. Its interesting that successes like GPSS, DIRECTV and Starlink have in common the right backing and vision of application. These give me confidence in where space technology will shine brightly in the future. Does today's Tesla bare any resemblance to Henry Ford's Model T? It still has four wheels, a drive train and steering wheel, seating and a power plant (all be it electric motors versus a combustion engine). Hey, I learned about both in my engineering courses back in the early 60s. I also learned to program a computer (a very big and slow one, by today's standards). Nothing new under the sun – only what humans can do with space technology from our earthly perspective, imagination and resolve.

Manufacturing of large constellations is highly industrial, relying more on vertical integration of the enterprise than employing components produced by others. Single spacecraft manufacture could be accomplished in the past like house construction, but even here improved design, test and verification processes can reduce cost and improve product reliability. More functions and better calibration bode well for commercial as well as scientific missions into space. Advancing the state of the art of RF and optical power generation and signal processing, coupled with intelligent overall network operation, likely will continue to improve the delivery of network services from space and reward those who practice this well.



Bruce Elbert is the Founder and President of **Application Strategy LLC.** He is a satellite industry expert, communications engineer, project leader and consultant with over 50 years experience in communications and space-based systems in the public and private sectors. Areas of expertise include space segment design and operation in all orbit domains, systems architecture and engineering, ground segment systems engineering, development and operation, overall system performance improvement, and organizational development. He has been an expert witness in legal proceedings related to radio communication system performance, patents, construction contracts, service agreements, RFI identification and resolution, and taxation. He can be reached at: bruce@applicationstrategy.com

SHOW REPORT

The New Age of Satcom: Choppy Waters in a Rising Tide

by Blaine Curcio

The Asia-Pacific region has long been one of the most dynamic and forward-looking regions for satcom. From the first satellite launched for an Asian country (Palapa-1 in the 1970s) to one of the first commercial high-throughput satellites in IPSTAR (2004), APAC has, in many ways, been more of a leader than a follower as it relates to satcom trends.

So it should come as no surprise that, after attending conferences in Singapore and Australia in late May and early June, your correspondent came away with new perspectives and ideas about how the satcom industry, and the space sector more broadly, is evolving.

As with any good list, I've whittled 2 weeks down to 3 key takeaways: 1) selling raw bandwidth remains a tough business, especially with a capacity glut in certain markets, but operators continue to adapt. 2) sovereignty is becoming more and more the name of the game. 3) satcom is growing, and a rising tide must lift more than one boat.

Raw Bandwidth Remains a Tough Business

During the Asia Satellite Business Week (ASBW) in Singapore and Australasia Satellite Forum (ASF) in Sydney, the topic du jour was unquestionably the impact of Starlink. Whether in maritime or village Wi-Fi, most satellite operators were clear that Starlink is impacting their business, typically by taking customers.

As a result of the relentless pricing pressure and broader bandwidth commoditization, satellite operators are now, more so than ever, needing to vertically integrate. Nowhere was this clearer than at the Kacific booth during ASBW. The Singapore-based company operates a single HTS, Kacific-1, and sells bulk bandwidth into markets such as Indonesia, Philippines, and Papua New Guinea.

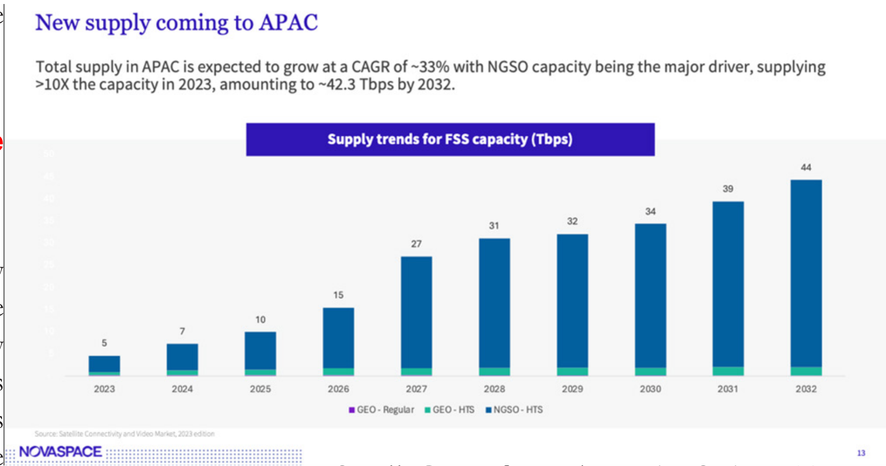
For some time, the company has differentiated itself by getting closer to the end users: local subsidiaries in major markets and a management that takes the time to attend far-off conferences in far-off places. And for some time, this has involved developing their own equipment. But the company's booth at ASBW showcased a pretty remarkable transformation: at the very front of the booth was a large 4G backhaul tower.

While the company continues to primarily be a satellite operator, there is a clear shift going on: Kacific (and others) are going downstream and becoming network integrators, providing connectivity over GEO satellites, microwave, other terrestrial infrastructure, and probably one day MEOs and/or LEOs. At the end of the day, with all these new and flexible options being put into orbit, companies that have up to now owned their own satellite assets are likely to get by on a combination of owning + renting, while slightly shifting their core value proposition away from simply "operating a satellite".

Going back to the Kacific example, the company has for a few years been considering a follow-on Kacific-2 satellite. The business case for such a project is tough: 15 years of on-orbit lifetime (at least), plus a few years at the front-end for construction, and you spend a few hundred million dollars. Given that we have Terabits per second of Starlink capacity already on-orbit, alongside Terabits more expected to come from Kuiper, Telesat, and others, it begs the question: why commit to owning GEO assets?

For most operators, this mindset is likely to take hold eventually in one form or another, though for others, manufacturers are giving them a lot more reasons to still own GEO assets, largely through more flexible and cost-effective satellites. Very High Throughput Satellites (VHTS, defined as a GEO satellite with several hundred Gbps of capacity or more) are revolutionizing the economics of GEO, while flexible HTS payloads are allowing satellite operators to commit to GEO assets without committing to a business plan that spans 2 decades. Some countries and operators want to maintain sovereignty and bolster their internal capabilities, and for them there is a whole new world out there in GEO.

Sovereignty is the Name of the Game



In this paradigm of capacity glut>wider adoption of satellite>more investment into satellite>more capacity >wider adoption, one thing is clear: as satellite becomes more important, nations do not want to have all their eggs in one satcom basket. All the technology changes that have led to the above-mentioned supply glut are also giving nations better options for their own sovereign satcom capabilities.

To take one example, during the ASF, there was some discussion about the two SkyMuster satellites, launched in 2015 and 2016 as part of the National Broadband Network (NBN) program. From the word on the ground in Sydney, these two satellites have not been the greatest commercial success. With a price tag of some AUD$2B in total, the satellites served at their peak somewhat more than 100,000 rural subscribers, meaning that the satellites cost some AUD$20,000 per subscriber. With a total throughput between the two of them of ~160 Gbps, the CAPEX efficiency is also poor compared to modern satellites.

During ASF, there was discussion of "what to do when the two SkyMuster satellites inevitable reach end of life?". Starlink has taken a big chunk of the Australian satellite broadband market, which makes the business case for replacement satellites tricky. But, compared to ~10-15 years ago, the economics of GEO satellites have improved enormously. Some quick math:

Two SkyMuster satellites: AU$2B price tag (approx. US$1.6B at mid-2010s exchange rate), 160 Gbps of combined capacity ≈US$10M per Gbps. For older satellites, this was a reasonable price to pay, but in the age of high throughput satellites and large constellations, it is impossible. Luckily for Australia, there are a lot of different options:

Replacement options in 2024 for 160 Gbps of capacity

- Large GEO from any major prime: ~$300-500M, several hundred Gbps of capacity, e.g. ≈US$1M per Gbps
- Small GEO from Astranis, Swissto12, etc.: <$100M paid over the lifetime of the satellite, several tens of Gbps, e.g. ≈US$5M per Gbps but payment much deferred
- Condosat/hosted payload on large GEO: ~<$200M for 50-100+ Gbps, e.g. ≈US$2-4M per Gbps
- Bulk leasing capacity from NGSO constellations: flexible leasing terms but very limited sovereignty

In a country like Australia which has had a mixed relationship with Big Tech (see recent actions by the ACCC against Meta, as well as a recent call to more closely examine the internet search market), no one seems to be jumping for joy at the idea of replacing SkyMuster with Starlink and only Starlink: it's too much concentration of risk, Elon Musk is too volatile, and Australia wants to maintain its sovereignty. And lucky for them, there are now a whole lot more options to do that.

Other countries that appear interested in maintaining their satcom industry sovereignty include Thailand, with the local satellite operator Thaicom making big commitments recently for two new GEO-HTS, namely Thaicom-9 (small GEO built by Astranis to be launched in H2 2024) and Thaicom-10 (large GEO to be built by Airbus, launched in ~2027, and split with Eutelsat-OneWeb). As is the case with all Thaicom satellites, the Thai Government will receive a free 400 Mbps per satellite for the orbital concessions, which Thaicom hopes will whet the appetite for major government bandwidth users.

To the south and east of Thailand, Indonesia continues to discuss sovereignty, despite Starlink's recent market entry into the country. The largest satcom market in the region by far, Indonesia already has substantial domestic GEO satcom assets, namely the Satria-1 satellite (150 Gbps GEO launched in 2023), and multiple domestic satellite operators.

Over the past few years, Indonesian regulators have gone back-and-forth about follow-on Satria GEO satellites. As of late 2023, the prevailing sentiment was that additional GEO satellites were too expensive, and that NGSO was going to offer more flexible options.

This reversed just a few months ago, with Indonesia's telecoms regulator KOMINFO announcing plans to build a 300 Gbps Satria-2 satellite, funded entirely by foreign investment. The project seems to be in early stages, but nonetheless represents a change of direction by the Indonesian regulators towards a more sovereignty-based approach.

How Many Boats Can a Rising Tide Lift?

Despite all the disruption, satcom is unquestionably growing: look no further than Australia, where Starlink already has a few times more subscribers than the SkyMuster satellites ever had. Not great for SkyMuster, but broadly speaking pretty good for satellite.

Walking down the street in central Sydney the night before the conference, a Telstra billboard caught my eye (below). Wearing a funny-looking hat, we had a Tim Burton-esque figure telling us all about Telstra's new satellite home internet packages, from space to your place. In the satcom industry of 15 years ago, this would have been unimaginable.

And with that being the case, it begs the question: how many boats can this rising satcom tide lift? Looking at Novaspace figures, we expect a ~10x increase in satcom traffic in the APAC region between 2023-2032, with total demand growing from ~900 Gbps to ~3 Tbps during that period. Much of this growth will be driven by universal broadband access, defense, and other verticals that have some degree of preference for domestic, sovereign suppliers. Admittedly, an equally sizable chunk of the demand will be represented by consumer broadband, where the end user is typically looking for the lowest-price option with limited consideration for sovereignty.

With pricing expected to continue its decline, the ~10x increase in demand will lead to a comparatively smaller increase in revenues, but growth is still expected to be decent, with data service revenues in particular seeing rapid growth from ~$4.5B in APAC in 2023 to nearly $13B by 2032. In short, satcom data is likely to see a 10x increase in demand and a 3x increase in revenues in APAC over the next 10 years.

Interestingly, this demand looks surprisingly familiar. During an ASBW panel, a speaker from Malaysian satellite operator Measat was describing the company's ConnectME community Wi-Fi program. With several thousand sites in the field connecting 500,000 Malaysians, ConnectME is an impressive success story of a relatively new satellite vertical, village Wi-Fi hotspots. And yet, according to Measat, 80% of the bandwidth consumed on ConnectME sites is video content. This is a particularly promising development given the massive demand elasticity that exists with mobile video content.

Conclusion

It's a tired adage, but in 2024 we really do find ourselves in a new world for satcom. Many markets have shifted towards a state of capacity abundance, and the number of options available to end users is continuing to multiply, leading to a rising satcom tide.

And while the rising tide will be choppy, it will lead to opportunities across a wide swath of the sector. From satellite operators that can leverage their fleet experience to play on the abundance of capacity, to service providers who parlay their local knowhow to bridge the gap between space assets and remote villages, the opportunities are substantial. With its combination of massive population, relative wealth, and diverse variety of countries, perhaps no region worldwide is as primed for this growth as Asia-Pacific.

Blaine Curcio is a contributing Editor of the Satellite Executive Briefing and the Founder of **Orbital Gateway Consulting.** He's an expert on the commercial space and satellite industries with a focus on the Asia-Pacific region. He is also an Affiliate Senior Consultant for Euroconsult. Since joining Euroconsult in 2018, he has contributed to a wide range of consulting missions and research reports, primarily covering the satcom sector globally, and broader space industry in China. He can be reached at:
blaine@orbitalgatewayconsulting.com

iKOMG

WE ARE THE *Speedboat* OF BROADCASTING SERVICES

SERVICE

GLOBAL DISTRIBUTION

We can help your content reach everywhere from anywhere you want.

CLOUD SERVICES

We offer a complete set of cloud services, including EPG, DR, BMS, Playout and more.

VIEWERS EXPERIENCE

We believe in engaging audiences through multi-screen approaches that seamlessly blend content, interactivity & social connectivity.

ABOUT US

Boost Your Content Exposure & Viewership with us. Steering like a swift speedboat, we rapidly enhance your project's visibility, ensuring greater audience engagement overnight.

WHY CHOOSE US ?

Our strength lies in our streamlined team, minimal bureaucracy, and readiness to execute swiftly, backed by global connections. Beyond services, we offer guidance and consultation in all areas, supporting your success at every turn.

SCAN HERE

Can Satellites Enable the Next Phase of Advanced Secure Networking?

by Michael Cubeddu

There were approximately 11,330 individual objects orbiting the earth in 2023, according to the United Nations Office for Outer Space Affairs Index of Objects Launched into Outer Space, with more than 8,370 active satellites in various Earth orbits at the beginning of 2024. These satellites are critical in providing global connectivity for the applications that power our everyday lives (GPS, wifi, banking, radio to name just a few) and will play a pivotal role in scaling advanced secure networks and the next phase of a more secure and versatile Internet beyond the constraints of terrestrial fiber networks.

Today's satellite communications consists of an uplink stage (where transmission from ground station to designated satellite occurs), a transponder stage (where the satellite does signal amplification and frequency change, and the downlink stage (when transmission goes back to the ground station or stations from the satellite). Different frequency bands, beam types and orbits are also used for different types of applications.The vast majority of today's satellite communication systems leverage the radio frequency band because it's more reliable and better for longer distances. Interest has been growing, though, in using free-space optical (FSO) communications for higher-bandwidth applications at short to mid-range distances, extending the reach of existing entanglement-based advanced secure networks. These applications could include modern secure communications, secure access to cloud and generative AI LLMs, data, and algorithms, and secure networking of quantum computers. By encoding quantum states into photons for communication, free-space quantum communication is achieved.

Advanced Secure Networks are based on entanglement making them inherently secure with the ability to replace the RSA public key exchange models and mitigate vulnerabilities presented from Harvest Now Decrypt Later (HNDL) and sophisticated man-in-the-middle attacks. These new networks enable an incremental upgrade to existing encrypted virtual private networks used to secure Enterprise, service provider, and government connections carrying an organization's most sensitive data, voice, and video information (i.e., customer information, financial details, intellectual property, private transactions, and nation secrets). Because these modern networks transmit information using qubits, not bits, they also support advanced applications such as quantum computers and sensors.

Use Cases for Satellite Entanglement-based Communications

New Advanced Secure Networks based on entanglement will use a combination of terrestrial networks on the ground and segments based in space, and can be used for applications like entanglement distribution, access to quantum computing, and networking of distributed quantum

sensors. For example, two satellites, each with an entangled photon pair source, can emit a pair of photons. They each send one photon to a ground station and another photon to the middle node (the terrestrial repeater node). This middle node captures the incoming photons, one photon from each pair emitted by the two satellites, and then performs entanglement swapping. This process effectively stitches together the entanglement from the first ground stations to the middle node with the entanglement from the last ground station to the middle node, creating long-range entanglement between the two ground stations. This is one method for delivering entanglement to very distant ground stations using satellite downlinks. Uplinks could also be used to emit the entangled photon pair to a satellite hosting a quantum repeater.

Applications, tolerance to latency, field of view, and organizational budgets will dictate the requirements for which architecture is chosen, as well as expected advancements in advanced secure network hardware and protocols.

Progress to date

There are a number of entanglement-based network satellite efforts currently taking place. The first demonstration of free-space entanglement distribution occurred in 2005, a terrestrial demonstration of entanglement distribution over 13 km. Since then, a number of projects including government agencies, private companies, satellite companies, startups, large corporations and universities, have kicked off.

QEYSSat (Quantum EncrYption and Science Satellite), driven by the Canadian Space Agency, plans to launch three Low Earth Orbit satellites to study, demonstrate, and validate space-based quantum secure communications. QKDSat (Quantum Key Distribution Satellite) launched in 2023 and aims to demonstrate how a space-based quantum infrastructure can be used to exchange sensitive information between several parties. China's Shenzhou 16 project launched in 2023 and plans to launch a Geostationary satellite in 2026. SpooQySats projects, led by the National University of Singapore Center for Quantum Technologies,

"...Free-space entanglement-based networking will scale small local area networks and metropolitan scale terrestrial networks to achieve a global entanglement-based Internet, and enable a host of new applications we haven't even dreamt of yet...."

in collaboration with a company called SpeQtral, launched in 2018 and 2020 to demonstrate entanglement generation on a satellite. The Deep Space Quantum Link project, led by NASA, aims to establish long-baseline quantum links between the Lunar Gateway moon-orbiting space station and nodes on, or near, the Earth. These examples are by no means exhaustive, but do demonstrate the breadth of interest and geographic scope.

Free-space entanglement-based networking will scale small local area networks and metropolitan scale terrestrial networks to achieve a global entanglement-based Internet, and enable a host of new applications we haven't even dreamt of yet.

Michael Cubeddu is the Co-Founder and VP of R&D at Aliro where he focuses on research, IP, and customer and partner relations. Michael is a published author in quantum research, and a co-inventor of several patents in quantum computing software, error correction, and quantum network protocols -- all driving deployment of commercial-grade product lines at Aliro. He is actively involved in the Quantum Economic Development Consortium. and serves as the liaison between the QED-C and the ITU-T for quantum key distribution standards development.

TERRASAT
Communications, Inc.
Engineered to Endure

New Ka-Band IBUCs
Access Potential for Multi-Orbit Connectivity

Multi-Band Solutions

Wideband | **Tri-band** | **Dual-band** | **Single-band**

Selectable frequencies from 27.5 GHz to 31.0 GHz

- Multicarrier Application
- Units Individually Tested in Extreme Temperatures + 3 Year Warranty

30th ANNIVERSARY CABSAT **BOOTH 205**

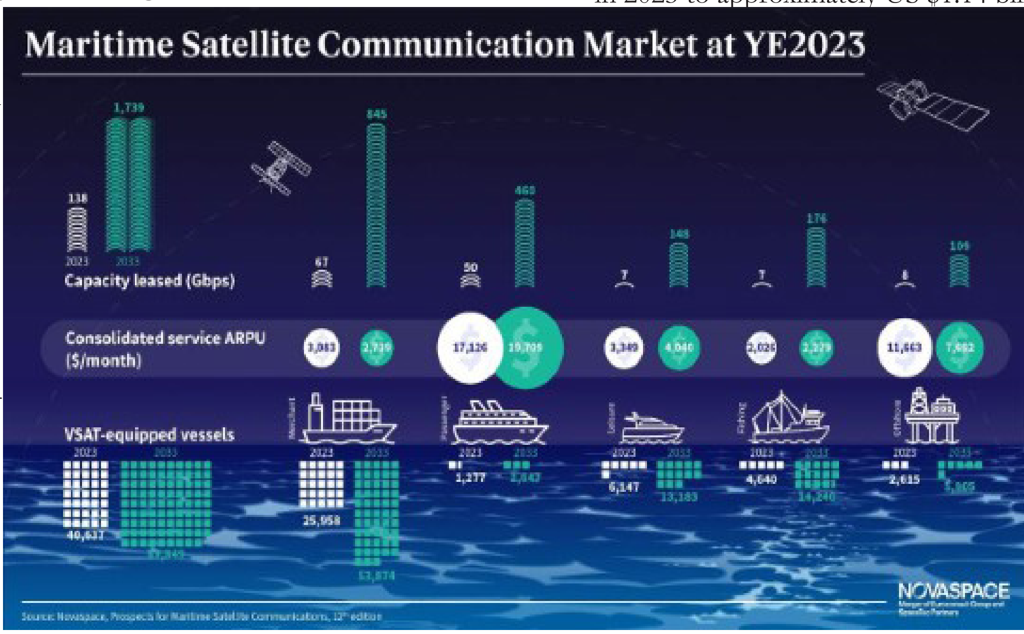
CommunicAsia **BOOTH 5I2-1**

www.terrasatinc.com
sales@terrasatinc.com
+1 408 782 5911

Global Martime Market

Paris, France, July 7, 2024 – The maritime satellite communication market experienced significant growth in 2023, primarily driven by Starlink's disruptive entry into the market following the official launch of its maritime service, which has rapidly gained traction and boosted the number of VSAT-equipped vessels according to Novaspace.

The latest release of Prospects for Maritime Satellite Communications from Novaspace, a merger between Euroconsult and SpaceTec Partners, reveals the market share of Non-Geostationary Orbit (NGSO) solutions as a primary maritime communications method is expected to surge from 20% in 2023 to 90% by 2033. It reveals the total number of vessels using at least one satellite communication service during 2023 reached 40,600, a number which is projected to more than double in 10 years, reaching approximately 90,000 vessels by 2033.



The Novaspace report also shows that while large vessel operators have been cautious about relying solely on NGSOs for connectivity, they are increasingly adopting a hybrid approach by using existing Geostationary Orbit (GEO) solutions as a companion to NGSO services. This strategy temporarily increased their overall satcom budget in 2023, but costs are anticipated to normalize as the ownership costs of satcom solutions decrease.

Bandwidth usage has doubled in the last year mainly due to Starlink's entry and is forecasted to grow exponentially from 138 Gbps in 2023 to 1.7 Tbps by 2033, a 13-fold increase. The reliance on GEO capacity as the primary communication means will decline as vessels transition to NGSO for their primary bandwidth needs. Consequently, NGSO capacity's market share is expected to rise from 66% in 2023 to 96% by 2033.

New-generation NGSO systems will also exert pressure on the current ecosystem, leading to decreased capacity prices. These advanced systems will exponentially increase capacity supply, enabling higher capacity usage and offsetting the price decrease. Operator revenues are projected to grow from just under $620 million in 2023 to approximately US $1.14 billion by 2033, with a 6% compound annual growth rate (CAGR) over the decade.

Additionally, service revenues for the maritime market are anticipated to rise from US$ 1.8 billion in 2023 to US$ 3 billion by 2033. This growth is attributed to the increasing number of VSAT-equipped vessels and higher average revenue per user (ARPU) in certain sub-verticals. The service revenue market share generated by NGSOs is expected to climb from 17% in 2023 to 87% by 2033.

"The maritime satcom market continued to be highly dynamic in 2023 with the impact of Starlink's market disruption was felt across the various sub-segments and expected to continue throughout 2024," said Vishal Patil, Novaspace consultant and the report's editor. "While many vessel operators now have first-hand experience with Starlink services, several other suppliers are set to follow, including OneWeb during 2024, which will further accelerate the global adoption of NGSO services."

ADVERTISERS' INDEX

Read the latest news, analysis, market trends, executive moves and many more at:

www.satellitemarkets.com