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Industry Trends, News Analysis, Market Intelligence and Opportunities

The Multi-Orbit Challenge for Broadband Communications

by **Bruce Elbert**

The primary benefit of multi-orbit interoperability is to be able to guarantee the connection to the network under any circumstances, including user location, motion and timing of demand for service. Also, the immediate choice of satellite or orbit may be based on the cost of the connection and data transfer. Herein, we identify alternatives to achieve multi-orbit networks and rate them as to their capability, feasibility and costs. While many new technologies, like AI, facilitate integration, the physical link and the ability to hold and transfer to alternatives are central to how well such schemes will work in practice. Most certainly, multi-orbit integration is possible, but at what cost and complexity? We take a communications perspective rather than a pure technology orientation.

Characteristics of LEO, MEO and GEO

Multi-orbit Multi-network integration can occur with respect to the Space Segment, User Terminal, Gateway, or even the Terrestrial network. Illustrated in Figure 1 are six elements



Image courtesy of Stockcake

to provide a satellite communications service. That left-most element, the Control Plane, can be provided by a manual or automated system with or

without human operators. There would be various degrees of integration between these blocks to support different users and services.

The key characteristics of these orbit regimes from basic properties are given in Table 1. Low Earth Orbit (LEO) High requires fewer satellites and provides somewhat better coverage of the earth than LEO Low. But, LEO Low has become popular

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A Multi-Orbit World



Veterans in the industry can harken back to the good ol' days when the Geostationary Orbit (GEO) dominated the market. That luxury of focusing on just one orbit is now gone with the influx of many new constellations in Medium Earth Orbit (MEO) and especially Low Earth Orbit (LEO) are flooding the market. The new multi-orbit environment has brought much more complexity and challenges.

To help us navigate through the changes and prospects in a multi-orbit world is our cover story by Bruce Elbert, a seasoned executive, consultant and author with over 50 years experience in the satellite industry. We also have a report from our Associate Editor, Elisabeth Tweedie on the World Satellite Business Week held in Paris, where much of the discussion focused on this subject. Some down-to-earth solutions for the multi-orbit environment was also showcased in a company event by WORK Microwave, which we featured on page 15.

Enjoy this issue.

Virgil Labrador

Virgil Labrador
Editor-in-Chief



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:

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Europe:

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Bruce Elbert, President
Application Technology Strategy LLC
123 Dan Moody Trail
Georgetown, TX 78633 USA
+1-310-918-1728
bruce@applicationstrategy.com
www.applicationstrategy.com



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1418 South Azusa Ave.
Suite # 4174
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Phone: +1-626-931-6395
Fax +1-425-969-2654
E-mail:
info@satellitemarkets.com

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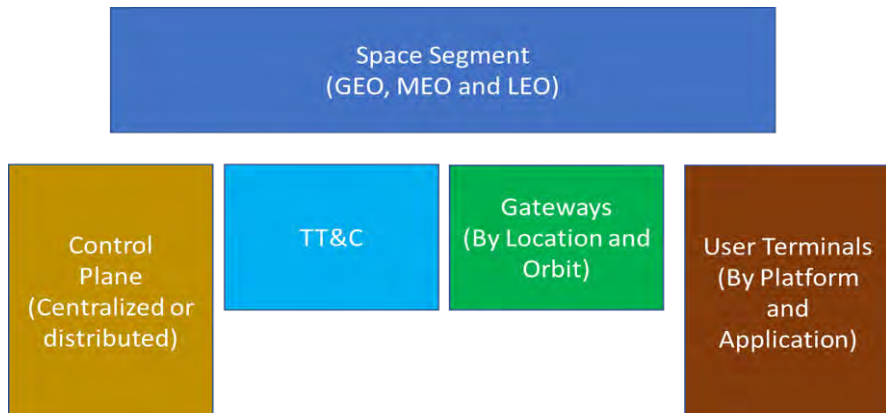


Figure 1. High-level architecture of a broadband satellite system. Interconnections depend on the data and control plane structure.

because of reduced free-space loss and that inactive spacecraft will re-enter without removal through on-board propulsion or external means. Max Range is measured from either the transmitting or receiving earth station (whichever is farther) and the satellite. Time delay is for a single hop (round trip is double this value) for the longest path between the earth transmit site, the satellite, and the earth receive site. This delay is only for propagation and does not include processing (ground or space) or for multiple hops and possibly intersatellite links. Service simplicity is a qualitative indication of the way users are served by the space segment. Terminal properties considers the antenna size, transmitter power and orbital considerations like radio frequency interference. Small terminals are preferred to reduce costs and exposure to the elements. Lastly, terrain blockage is caused by local obstacles like buildings, trees and hills that diminish service availability, based on motion of satellites and user terminals.

One obvious approach for a given application is to select the best orbit constellation and provider. GEO HTS (Geostationary Orbit, High Throughput Satellite) can compete well with MEO (Medium Earth Orbit) and LEO but the subtleties can impose

Orbit Regime	GEO	MEO	LEO High	LEO Low
Altitude, km	36,000	8,000	1,200	450
Max Range, ground to space, km	42,000	10,000	2,500	1,500
Earth coverage	Global except above 80° Latitude	Global coverage up to 50° Latitude	Polar orbit provides global coverage.	Depends on orbit inclination. Polar orbits planned.
Time Delay (single hop), msec	270	75	8	7
Service Simplicity	Very simple	Moderately simple	Moderately complex	Moderately complex
Terminal Properties	Simplest for a fixed terminal (small aperture); moderately complex for CoTM	Requires two motion antennas for continuous service (medium aperture). Smaller terminals for ships and aircraft.	Requires two motion antennas for continuous service (small aperture)	Requires two motion antennas for continuous service (small aperture)
Terrain blockage	Easily avoidable for fixed terminal; mobile terminal can experience brief blockage.	Moderately avoidable since satellites move slowly and terminals are fixed.	Blockage arises frequently, only avoided with a path to a different satellite.	More satellites available makes blockage less frequent.

Table 1. Characteristics and orbital range based on basic properties that affect the service.

challenges in terms of a massive investment and risk of failure in a single launch. The maritime market, particularly cruise ships, began with GEO. This was a reasonable fit since most cruises operate in the lower latitudes. MEO was successfully introduced to this market around 2020 and owing to reduced latency was rapidly adopted. But, the LEO constellation has become a good competitor, mainly in terms of price. The economic aspects of these orbits are presented next.

Economics of Orbit Regimes

We assess the economics of these orbits in Table 2 for hypothetical constellations at different altitudes. These systems present increasing capacity by a factor of 100 as the quantity of satellites increases by up to 1,000. Note

Orbit application	GEO	MEO	LEO High	LEO Low
Coverage	Hemisphere	Region	State/Province	Metro area
Mass, kg	5,000	2,500	500	300
Power, kw	15	3	0.5	0.3
Capacity, Gbps	1,000	400	100	100
Quanta	3	12	1,000	3,000
Spacecraft cost, \$M	300	100	5	2
Launch, \$M	70	20	2	1
Total first cost, \$M	1,110	1,440	7,000	7,500
Total capacity, Gbps	3,000	4,800	100,000	300,000
Utility	100%	70%	20%	15%
Useful capacity, Gbps	3,000	3,360	20,000	45,000
Cost per Gbps, \$K	370	429	350	167

Table 2. Estimated cost of the broadband space segment across the three orbit regimes.

the utility of LEO satellites wherein a small fraction are able to provide payable service due to wastage of capacity over oceans and uninhabited regions.

GEO and MEO are the low investment leaders while both LEO categories represent substantially larger commitments. On the other hand, the capacity thus provided is so much larger with LEO so that the bottom line becomes nearly a wash as far as

cost per Gbps. However, the cost per Gbps is highly sensitive to the assumed utility percentage, especially for LEO. The similarity of cost per Gbps of the space segment would mean that the overall cost differences relate primarily to the terminal itself. Going to multi-orbit introduces requirements for multiple antenna beams and pointing requirements, as well as differences in specific frequency, waveform and RF power.

Multi-orbit Integration Requirements and Tools

Some of the key applications likely to demand Multi-orbit integration are presented in Table 3. The requirements have not been met by a single orbit regime, hence their need for more resources. This sets us up to consider tools that can be applied to close the gap.

	Maritime	Aeronautical	Emergency	Casual
Connectivity	100%	In flight 100%	When needed 100%	Nearly 100%
Low latency	Critical for commercial use	Critical for commercial use	Depending on application	Depending on application
High bandwidth	Large demand	Medium demand	Variable demand	Individually medium to high
Global coverage	Normal latitudes	Depending on flight path	Not normally	Depending on market
Reliable service	Strong	Strong	Depending on situation	Commercial grade
Simple terminal	Industrial system	Industrial system	Commercial system	Consumer
Cost of service	Moderate	Moderate	Moderate	Low


Table 3. Requirements and expectations for current services delivered from any orbit.

The Multi-orbit integration tools available today rely on the respective integration and management features of the underlying constellations and systems. A good example is Aalyria SPACETIME, a cloud-based scheme that creates a digital twin of the respective systems and provides a means of supporting users who need access to be best available resources. Also, Hughes Echostar offers solutions across both GEO and LEO through their well-integrated ground segment architecture. A detailed review and analysis of these and other products and suppliers is beyond the scope of this article. Some of solutions can be tried on an experimental basis with the support of the associated supplier. This would be a way to gain deeper knowledge about the capabilities as it may be able to address a specific

need. Some solutions require widespread adoption and a long-term commitment.

Future Prospects for Multi-orbit Multi-network Integration

The architecture and system design need to be described in sufficient detail so that this kind of study can be performed in a meaningful way. We cover how to anticipate challenges,

based on past experience, and we suggest some solutions currently available. In the end, the engineer has to examine and address the details in the interfaces and integration challenges. One not identified and addressed early enough can render the system or service unusable or unacceptable in some manner. On the other hand, a thorough systems engineering process with verification will always work. 



Bruce Elbert is the Founder and President of **Application Technology 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 can be reached at: bruce@applicationstrategy.com

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World Satellite Business Week Portends Headwinds Facing the Industry

by Elisabeth Tweedie

Nathan de Ruiter, Partner and Managing Director Novaspace, opened this year's World Space Business Week (WSBW), held as usual in Paris, with an interesting analogy. He compared Starlink to Apple, and the rest of the industry to Android. Not only is it an interesting analogy, it is one that cropped up many times, during WSBW and also during Strategies in Satellite Ground Systems (SSGS), sometimes explicitly and other times indirectly.

In common with Apple, Starlink is vertically integrated with just one hardware vendor and a closed operating system. After just four years, Starlink accounts for 64% of satellite consumer broadband subscribers and 39% of the maritime market. Globally, Android has a 70% market share, but Apple earns 68% of global app revenue.

Looking ahead, Novaspace projects that by 2030 Starlink will supply 208 Tbps of global capacity, whereas combined, the other 50+ operators will only be responsible for ~ 65 Tbps. This is also very interesting, as by 2030, Amazon Kuiper, another closed system, should be in service.

The challenge therefore, is for those other operators to find ways to work together, to increase, or at least maintain their market share. Not an easy task, given that these others work in multiple, orbits and frequencies, address different markets, and many of them still have proprietary ground systems.

Given this opening, it was therefore not surprising that the subjects of cooperation, partnerships, standardization and virtualization were recurring themes throughout the conference. Don Claussen, CEO, ST Engineering iDirect, even came up with a new term to describe these moves: "diagonalization." During a panel entitled "Ground System Developers and Integrators Supporting New Architectures," Robert Bell, Executive Director, World Teleport Association, made the comment: "There is a divide in the industry between those who want to go it alone and those who want to partner. It tends to be new entrants who want to go it alone, which is what we used to do. They will have



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to learn the lessons that we did". Given how successful Starlink has been, I do wonder about the veracity of that last statement.

In other panels there was a clear admission that this new era of competition was largely a defensive move, as operators lose market share, not only to Starlink, but also to 5G. One area of partnerships that is booming, is that between satellite operators and mobile network operators (MNOs). At SSGS, held in London in September, Alex Sinclair, CTO, GSMA mentioned that following the release of 5G New Radio, Non-Terrestrial-Networks (NTN) in 3GPP Release 17, there are now 91 mobile network operators (MNOs) (between them representing 60% of global mobile subscribers), which have formed partnerships with satellite operators.

Partnerships are also important for landing rights. These can be difficult and time consuming to obtain, most particularly for LEO operators hoping to offer a global service, as there is no blanket authorization. Landing rights need to be obtained on a country-by-country basis. De Ruiter showed an interesting chart showing that in many areas, most particularly in Africa and Asia, Starlink planned to offer service, but did not yet have the necessary permissions to do so.

During WSBW, David Wajsgas, CEO, Intelsat alluded to an agreement with an MNO which would be announced shortly. In fact, the partnership with Vodafone was announced the following week, so presumably there are now at least 92 partnerships. This agreement focuses on Intelsat's Flex portfolio, which Vodafone will use to

provide two types of secure and easy-to-use satellite connectivity products; one for Communications-on-the-move (COTM) and the other for Communications-on-the-Pause (COTP). The former will use a vehicle-mounted antenna and the latter a compact VSAT. The service will be targeted to Vodafone's private and public sectors around the world.

During the same session, Wajsgas also announced a new agreement with Softbank. This one is focused on developing a seamless, "Ubiquitous Network" allowing users to stay to connected wherever they are. Unlike some of the other MNO-Satellite agreements, this one is based on the

"...Novaspace projects that by 2030 Starlink will supply 208 Tbps of global capacity, whereas combined, the other 50+ operators will only be responsible for ~ 65 Tbps. ..."

by the Viasat-Inmarsat merger, which has now passed the necessary regulatory hurdles, as has the Eutelsat-OneWeb merger, and the pending SES-Intelsat merger. In fact these are all acquisitions, but obviously result in a pooling of assets. However, it is the moves being made by Intelsat that strike me as the most interesting. If all goes according to plan, the company will soon be part of SES, another GEO operator, but also owner of O3b and O3b mPOWER, the



current standard cellular roaming architecture, interfaces and processes, that enable roaming between different operators as a user moves around the world. Initially existing satellite terminals will be used for this new service, but new terminals based on the 3GPP 5G N2N standard that can be used anywhere in the world will be developed for future use. Target markets for this service are land mobile, maritime and disaster recovery.

Apart from partnering with MNOs, satellite operators are also merging with each other – as clearly demonstrated

only commercial Medium Earth Orbit (MEO) constellations. It also has an agreement with Eutelsat-OneWeb, and, as just mentioned also with Starlink. Obviously, this gives Intelsat (or SES, if the takeover is approved), the ability to create a true multi-orbit offering, so makes perfect sense, but nevertheless I find the effective collaboration of four of the industry “giants” very interesting, and something I doubt would have happened without the entry of Starlink into the market, forcing the GEO operators to rethink their strategies. As Mark Dankberg, CEO Viasat stated during

the Operators Panel, “the industry is going through a period of quantum change,” unlike anything he has seen in the last 40 years. Phil Carrai, President, Space, Training and Cyber Division, Kratos Defense and Security Solutions, put it even more bluntly: “SpaceX and Starlink have shocked the industry like it’s never been shocked before!”

Other “tools” that have the potential to help the traditional operators defend their market share, include software defined satellites (SDS) and a virtualized ground system. According to Novaspace, there have been 14 SDS geostationary (GEOs) orders placed in the last five years, six of which were by Intelsat and SES, and three by Viasat, although the only Viasat one that has been launched, suffered an antenna failure, and is working at reduced capacity.

Unfortunately, SDS are not the panacea they were once thought to be. Initially it was assumed that standardization would lead to shorter delivery times compared to traditional GEOs, but this has not turned out to be the case, and they are currently subject to both production delays and price inflation.

A virtualized ground system is comprised of several elements: multi-orbit terminals, cloud integration and a network management system (NMS), all built on open standards. The latter being of paramount importance, as they facilitate integrating satellite into the telecom ecosystem. During the Ground Systems Panel, Claussen pointed to the added difficulty of working with customers who don’t own all the space assets that they are using. Integrating systems from different operators who not only are using different orbits, may also be using different and sometimes proprietary standards adds an extra layer of complexity for the ground service providers who are now working – in many cases together – to provide a seamless network management system.

Growth in the satellite industry is clearly going to come from fixed broadband, mobility and defense. Novaspace are projecting that the total market from these three sectors will grow to US\$53 billion by 2033, up from US\$19 billion last year.



Elisabeth Tweedie is Associate Editor of the Satellite Executive Briefing has over 20 years experience at the cutting edge of new communications entertainment technologies. She is the founder and President of Definitive Direction (www.definitivedirection.com), a consultancy that focuses on researching and evaluating the long-term potential for new ventures, initiating their development, and identifying and developing appropriate alliances. She can be reached at: etweedie@definitivedirection.com

"...Growth in the satellite industry is clearly going to come from fixed broadband, mobility and defense. Novaspace is projecting that the total market from these three sectors will grow to US\$53 billion by 2033, up from US\$19 billion last year..."

Fixed broadband, accounts for US\$37 billion of that total. Video is clearly declining, no one disputes that. However, it is important to note, that nevertheless, Novaspace are projecting that in 2033, the video market will be US\$63 billion, i.e. it will still be the largest income generator for the industry. This is borne out, by the number of panelist and participants in the World Broadcasting Unions, International Media Connectivity Group’s (WBU-IMCG) conference, held in Boston this October, who spoke out about the importance of satellite to their business.

Overall, I would describe the mood in Paris as subdued, not despondent, but not optimistic either. The legacy players are coming to terms with the new competitors, as clearly evidenced by the numbers of takeovers, mergers and partnerships, but remain uncertain about the future. It will be particularly interesting to see the situation in two years time, when Kuiper is likely to have started full commercial operations.





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Exploring the Significance of Regulatory Sandboxes for Satellite and Emerging Technologies

by Matthew Evans

The satellite industry is experiencing an unprecedented surge in innovation and activity, with new satellite technologies being developed and launched at a record pace. As a result, regulators face significant challenges in keeping up.

Traditional regulatory frameworks often struggle to accommodate these fast-evolving technologies. Updating existing rules can take many months, if not years. This has prompted a global shift towards more agile and adaptable approaches. One such innovative method is the 'sandbox' approach – a flexible regulatory environment designed to test and refine new technologies before they reach the market.

The Sandbox Concept: a New Paradigm for Regulation

The regulatory sandbox concept, initially popularised in the Middle East, has gained more traction globally. This approach allows regulators to engage with emerging technologies in their developmental stages, rather than waiting for official launches.

By providing a controlled environment for testing new concepts locally, sandboxes enable regulators to dynamically customise licensing exemptions, market access conditions, and other regulatory aspects, such as access to radio spectrum. This mechanism also allows innovators to explore and evaluate their ideas without the immediate constraints of traditional regulations, facilitating a faster and more efficient path to market.

Regulators in a number of Middle Eastern countries have been at the forefront of the regulatory sandbox movement within the communications and technology sectors. The success of earlier sandboxes, particularly in the area of fintech, has now inspired regulators to expand the concept into other areas.

Global Adoption of the Sandbox Approach

In 2021, the Telecommunications Regulatory Authority of Oman (TRA) issued “Guidelines of Regulatory Sandbox Rules for Telecommunications”, and in 2022, Saudi Arabia’s Communications Space, & Technology Commission (CST) launched its own “Emerging Technologies Regulatory Sandbox”. In line with Saudi Arabia’s “Vision 2030”, the latter aimed to support investors and companies interested in the country’s tech industry. Alongside a range of technologies, space services were at the centre, with several satellite players taking part.

While not focusing solely on satellite, these types of initiatives have served as valuable models for other regions, demonstrating how flexible regulation can coexist with consumer protection and economic stability.

Looking beyond the Middle East, Brazil’s National Telecommunications Agency (ANATEL) introduced its own regulatory sandbox earlier this year to support the development of satellite direct-to-device (D2D) applications. This enables satellites to connect directly with mobile handset devices without relying on ground infrastructure. Because of the sandbox, ANATEL can authorise temporary use of certain spectrum bands for D2D, and for longer than the existing regulations allow. By providing a controlled environment for testing these innovative applications, ANATEL hopes to accelerate their deployment and ensure they meet regulatory standards.

In March 2024, the Government of Mongolia announced its plans to establish a regulatory sandbox in order to support its burgeoning domestic space sector. As Mongolia seeks to expand its space capabilities and attract investment, the sandbox will play a crucial role in facilitating the development and testing of new satellite technologies.

The Telecom Regulatory Authority of India (TRAI) has also recently embraced the sandbox concept. In April



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2024, TRAI released its recommendations on "Encouraging Innovative Technologies, Services, Use Cases, and Business Models through Regulatory Sandbox in the Digital Communication Sector", which demonstrated its commitment to fostering innovation while balancing regulatory oversight. This adoption, which followed a consultation process launched in June 2023, was particularly ground-breaking given India's traditionally stringent regulatory environment.

The Impact of Sandboxes on Satellite Innovation

The sandbox approach offers several key benefits for satellite innovators. It provides a controlled yet flexible environment where foreign operators can more easily test their products and services with the local market, allowing real-time evaluation and adjustment while doing so. This setting helps innovators gain valuable insights into consumer preferences and technology performance, ultimately reducing the time to market and potentially lowering costs. Additionally, the sandbox framework is instrumental in identifying and addressing user protection issues early in the development process, ensuring that new technologies are both safe and reliable.

The approach also serves to promote cross-sector collaboration by offering a single window for obtaining clearances and encouraging cooperation between various ministries and departments. Under normal regulatory procedures different bodies can be involved which adds complexity to the timeline. This integrated model fosters a more cohesive and innovative ecosystem, driving progress and efficiency in the sector.

For companies like River Advisers, which specialise in international spectrum regulation and market access, the sandbox approach allows for close engagement with regulatory developments as they happen locally, helping stakeholders to get their new products and technologies to market faster.

The Future of Satellite Regulation

The global trend towards regulatory sandboxes represents a significant shift towards more adaptive and collaborative regulatory practices. Regulators are developing more intricate mechanisms in the wake of unprecedented technological progress, particularly in the area of "Non-Ter-

"...The regulatory sandbox concept, initially popularised in the Middle East, has gained more traction globally. This approach allows regulators to engage with emerging technologies in their developmental stages, rather than waiting for official launches..."

restrial Networks" (NTN) that is driving the seamless integration of satellite connectivity into terrestrial systems across direct-to-device and IoT ecosystems.

The sandbox approach offers regulators a balanced solution to effectively manage new technology risks, and implement necessary safeguards, while also creating an environment conducive to innovation and growth. The traditional lag between innovation and regulation is greatly reduced as a result. The success stories from the Middle East, and more widely, highlight the merits of this approach, with early adopters of this regulatory innovation paving the way for technological progress. It can be expected that many other countries will follow suit.



Matthew Evans, Director of Regulatory Affairs at **River Advisers** (www.riveradvisers.com), has over 10 years' global market access experience in the satellite industry, including several years licensing the world's first hybrid satellite/ terrestrial, pan-continental aviation connectivity network, and the industry's largest European licensing initiative of the last two decades, involving multiple stakeholders and national regulators. He can be reached at: mevans@riveradvisers.com

WORK Microwave

WORK Microwave, one of the leading manufacturers of advanced satellite communications and RF equipment held their customer event last September at their headquarters in Holzkirchen, Germany, a picturesque town wedged between the Bavarian Alps and Munich. The two-day event featured presentations, product demos, panel discussions, a tour of their facilities and plenty of networking activities. Over 50 participants, representing WORK Microwave's customers and partners came from as far as North America, Africa and Asia and of course, all from over Europe and the Middle East.

The event showcased cutting-edge technical developments such as Optical Communications, Virtual Ground Stations and Direct RF where WORK Microwave has invested in the development of innovative products and solutions. "Our customer event was an oppor-



WORK Microwave executive Thomas Wiesner leading a group tour of their facilities.

tunity for us to highlight our latest offerings not just in satellite communications but in defense electronics and industrial sensors and measurement, among others. Specifically for the satcom market, we see digitalization and virtualization as key drivers

and we aim to maintain our leading position in these key segments with products compliant with the new Digital IF (DIFI) standards," said Thomas Fröhlich, CEO of WORK Microwave.

WORK Microwave showcased



The WORK Microwave company event featured among others, a panel discussion on "Future Technology and Market Trends in Civil and Military Satcom" moderated by Virgil Labrador, Editor-in-Chief of Satelltie Markets and Research and panelists from left: Marke Clinger of Kratos Defense and Security, Rainer Wansch of Fraunhofer Institute, Richard Denny of Kacific and Thomas Fröhlich, CEO of WORK Microwave.

its Virtual Ground Station solution based on a modular design which provides end-to-end virtualization of ground station infrastructure featuring conversion of received RF signals in all possible frequency bands into a digital signal compliant with DIFI standards, separation of digitized channels and cloud-based wideband signal processing using virtualized software modem.

Another innovative solution presented at the event is Direct to RF, which directly digitizes/de-digitizes the actual RF signal without an analogue frequency converter. This eliminates the need for Block Up-converters (BUCs). This approach provides higher flexibility and less hardware variants will be needed, enable scaling effects, decreasing overall costs as soon as Direct RF market share increases said Josef Lex, Vice-President of Engineering at WORK Microwave.

Several presentations were devoted to Optical or Laser Communications featuring the German Space Agency-DLR and companies such as ASA and TESAT Satcom. Speakers extolled the benefits and advantages of optical communications which include high data rates of 1 Gbps to

"...for the satcom market, we see digitalization and virtualization as key drivers and we aim to maintain our leading position in these key segments with products compliant with the new Digital IF (DIFI) standards..."

-Thomas Fröhlich, CEO of WORK Microwave



potentially up to 1 Tbps, excellent power efficiency and high data security, among others.

A panel discussion on "Future Technology and Market Trends in Civil and Military Satcom" moderated by Virgil Labrador, Editor-in-Chief of Satellite Markets and Research which included Mark Clinger of Kratos Defense and Security, Rainer Wansch of Fraunhofer Institute, Richard Denny of Kacific and Thomas Fröhlich, CEO of WORK Microwave.

The panelists were generally bullish about the prospects for the future of the satellite industry.

They identified the key trends that will be driving the industry in the next few years including, as already presented and in previous sessions, such as Virtualization, Digitalization, Software-Defined Satellites, Cloud-based Services, Artificial Intelligence (AI) and the growing influence of the telecom industry in satellites. The panel also identified some key challenges posed by the new Low Earth Orbit (LEO) constellations disrupting the market. Despite the challenges ahead, the panel ended on a positive note with the influx of many innovations coming to market, some of which were highlighted in the presentations demos during the event, and the recognition of the resilience that the industry has demonstrated time and again in previous crises.



A group photo with key WORK Microwave employees and their customers and partners in front of the company headquarters and main facility in Holzkirchen, Germany near Munich.

The Golden Crown, the Chicago White Sox & the Collapse of Starlink

by Lou Zacharilla

"...A slave stood behind the conqueror, holding a golden crown, and whispering in his ear a warning: that all glory is fleeting..."

– Voiceover from the film, Patton (1970)

SpaceX and its founder, whose innovations transformed the commercial Space business from a slumber deeper than even the makers of Melatonin promise, will surpass four million subscribers for its Starlink satellite broadband service by the time you finish this article. The leader of the Digital Age's Ford Motors with thrusters has, according to its president, Industry Hall of Fame inductee Gwynne Shotwell (<https://tinyurl.com/nhc9nb6s>), also produced one million terminals in less than 365 days at a facility deep in the heart of Texas.

According to SpaceIntelReport editor Peter b. De Selding, Shotwell told the Texas House of Representatives Appropriations Committee that the company's massive Bastrop, Texas production site "will be the largest printed circuit board manufacturing facility in the United States." An X-size claim. She added another X for good measure, saying she was "pretty sure" it will beat Southeast Asia in efficiency in producing those printed circuit boards.

I'm pretty sure I love that swagger. Talking big and walking tall plays well in Texas. The hearing she attended was to highlight the newly created Texas Space Commission, which has \$150 million in funds to support startup space ventures. SSPI's New York Space Business Roundtable had the Commission's Executive Director as a guest in September at our live event at Cornell University. For sure, said Norman R. Garza, Jr., this Commission plans to leverage the presence of the industry in Texas to do more than kick tumbleweed and put a few more astronauts up there. It's thinking bigger. It's thinking economic development at scale.

For sure, Starlink rocks in Texas and is on a roll. Its very presence is a boost.

The decision by Air France and United Airlines to move their in-flight-connectivity service to Mr. Musk's company next year offers further proof that Starlink is in the hunt to offer in-flight connectivity that, to refer to a recent Wall Street Journal article, "doesn't stink."

While the media descended on Texas for this event, it was also covering an event in Chicago where a business that is also a crown jewel of the city's pride was about to achieve ignominy. The Chicago White Sox baseball team broke a record too. This one, though, was Major League Baseball's 62-year-old record for the most losses (121) in one season. Things change, Kundun. A mere three years ago the team won the Division title. Now, it was unable to stick a landing and close out a ninth inning.

What's my point? Two-fold.

Starlink, like SpaceX, has transformed the commercial Space industry in ways that were unimaginable not long ago. They are winners by any measure. Their revenue picture is enviable and their dominance uncontested. It strikes fear in boardrooms and joy among entrepreneurs who enjoy cheaper launch services and broadband connectivity, which allows more imaginations to be unleashed. It has helped create new services and business models. It has given the industry cache.

But wherever there is the light, darkness must fall. Wherever there is victory, defeat also looms.

On October 16 at the monthly New York Space Business Roundtable explored how things can go "South" in this industry – as it does in human affairs – in ways no one can imagine. There is a swagger in SpaceX's step that fits a set of big guy cowboy boots and it is justified. As a New Yorker I'm down with that. There

is also a trickle – or perhaps a gush - of arrogance that reminds me that a company which has the phrase, “Made by humans” printed on circuit boards that make up the antenna array for the Starlink dish need be mindful of the fact that human beings also made the story of Icarus, whose father was a great inventor of things like wax wings. But dad was more humble than his kid. Icarus could not resist. Had he only waited for the Parker Solar Probe....

Humans also insisted on the slave’s warning to Roman conquerors, noted by the great conqueror of Nazis, General George Patton. “All glory is fleeting.”

For the moment, Starlink has followed the Better Satellite World prescription. It for sure has made the world better, more connected and opens imaginations almost as fast as it produces terminals. And if you are

Suni Williams and Butch Wilmore you understand how transformative this monstrously innovative company is.

Mars awaits. But with these kind of wings, can we ever refuse the lure of the Sun?



Lou Zacharilla is the Director of Innovation for the Space & Satellite Professionals International (SSPI) www.sspi.org and host of The Better Satellite World podcast every Monday. He can be reached at: LZacharilla@sspi.org



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DIRECTV Acquires EchoStar's Video Distribution Business

DIRECTV and EchoStar (NASDAQ: SATS) announced that they have entered into a definitive agreement under which DIRECTV will acquire EchoStar's video distribution business DISH DBS, including DISH TV and Sling TV, through a debt exchange transaction. The transaction will provide consumers with compelling video options while separately improving EchoStar's financial profile as it continues to enhance and further deploy its nationwide 5G Open RAN wireless network.

"DIRECTV operates in a highly competitive video distribution industry," said Bill Morrow, Chief Executive Officer, DIRECTV.

"With greater scale, we expect a combined DIRECTV and DISH will be better able to work with programmers to realize our vision for the future of TV, which is to aggregate, curate, and distribute content tailored to customers' interests, and to be better positioned to realize operating efficiencies while creating value for customers through additional investment."

"This agreement is in the best interests of EchoStar's customers, shareholders, bondholders, employees, and partners," said Hamid Akhavan, President and Chief Executive Officer, EchoStar. "With an improved financial profile, we will be better positioned to continue enhancing and deploying our nationwide 5G Open RAN wireless network. This will provide U.S. wireless consumers with more choices and help to drive innovation at a faster pace. We expect DISH and EchoStar bondholders to benefit from two companies with stronger financial profiles and more sustainable capital structures," he added.

"DIRECTV was founded 30 years ago to give consumers greater choices than incumbent cable companies for video content, and the Company's acquisition of DISH TV and Sling TV positions it to again provide more choices and better value in an industry currently dominated by large streaming platforms," said David Trujillo and John Flynn, Partners at TPG. "Our ability to execute these transactions, alongside our proposed acquisition of AT&T's 70% stake in DIRECTV announced earlier today, exemplifies the unique capabilities of the TPG platform and our experienced sector-focused investment approach as we support

DIRECTV's continued investment in innovating the next generation of video services that benefit consumers."

Highly Competitive Industry

The video distribution industry has undergone a massive transformation and is

highly competitive, now dominated by streaming services owned by large tech companies and programmers.

Streaming services owned by large tech companies and programmers now have subscription numbers that far exceed those of pay TV distributors.

Content that was historically the mainstay of traditional pay TV – news, sports, and entertainment – is now available exclusively or first-run on direct-to-consumer streaming services.

The vast majority of consumers who leave satellite video are "cutting the cord" for streaming services – wherever they live.

Combined, DIRECTV and DISH have collectively



lost 63% of their satellite customers since 2016.

Traditional pay TV penetration in U.S. households is now less than 50%.

The transaction is expected to strengthen the financial profiles of DIRECTV and EchoStar, creating opportunities for additional investment.

Upon transaction close, DIRECTV expects to have a leverage position just over 2.0x, and plans to reduce to under 2.0x within 12 months, consistent with its stated 1.5x – 2.0x financial policy on a pro forma basis. As a result, DIRECTV will have one of the best leverage profiles in the pay TV industry.

DIRECTV estimates that the combination of DIRECTV and DISH has the potential to generate cost synergies of at least \$1 billion per annum. These synergies are expected to be achieved by the third anniversary of closing, assuming the closing is in late 2025.

The transaction will provide EchoStar with greater financial flexibility by improving its access to capital and reducing overall refinancing needs.

At close, EchoStar will have reduced its total consolidated debt (excluding financing leases and other notes payable) by approximately US\$ 11.7 billion and reduced its consolidated refinancing needs through 2026 by approximately US\$ 6.7 billion (excluding financing leases and other notes payable).

Transaction Details

Under the terms of the purchase agreement, DIRECTV will acquire EchoStar's video distribution business, including DISH TV and Sling TV, in

exchange for a nominal consideration of US\$ 1 plus the assumption of DISH DBS net debt. DISH Network will also benefit from the releases of a substantial amount of intercompany receivables, including spectrum, but will have contractually limited access to the cash flow generated by its business between signing and closing. DISH DBS and DIRECTV have commenced the Exchange Offer for five different series of DISH DBS notes with a total face value of approximately US\$ 9.75 billion, including seeking certain consents from the holders of such notes to facilitate the acquisition. The indentures governing the new DISH DBS notes will provide for an amendment without the consent of holders of the new DISH DBS notes to allow for the mandatory exchange of such notes following receipt of certain regulatory approvals and provided the acquisition has been or will be consummated before the outside date described in the purchase agreement, into a reduced principal amount of DIRECTV debt which will have terms and collateral that mirror DIRECTV's existing secured debt. Such mandatory exchange is conditioned, amongst other things, on an aggregate reduction in the principal amount of DISH DBS' notes in such exchange of at least \$1.568 billion. If noteholders do not accept the Exchange Offer on terms satisfactory to DIRECTV, including to the extent the above mentioned minimum principal reduction is not achieved, it has the right to terminate the acquisition without closing.

The transaction is subject to various closing conditions, including, but not limited to, a requisite amount of the outstanding DISH DBS notes being tendered into the Exchange

Offer, completion of a pre-closing reorganization, and receipt of required regulatory approvals.

In addition, TPG Angelo Gordon and certain of its Co-Investors, as well as DIRECTV, provided US\$ 2.5 billion of financing to fully refinance DISH DBS' November 2024 debt maturity. The proceeds of the funding will be distributed to DISH DBS via a secured intercompany loan to fully repay DISH DBS' November 2024 debt maturity and for general corporate purposes. The financing can be exchanged or refinanced into DIRECTV debt at the closing of the acquisition.

Upon closing of this transaction, DIRECTV will be led by a proven management team that reflects the strengths and capabilities of both organizations. DIRECTV will continue to be led by Bill Morrow, DIRECTV's Chief Executive Officer, and Ray Carpenter, DIRECTV's Chief Financial Officer. The combined company will be headquartered in El Segundo, California.

The transaction, which the boards of directors of both companies have unanimously approved, is expected to close in the fourth quarter of 2025, subject to the receipt of regulatory approvals, the successful closing of the Exchange Offer, and the satisfaction of other customary closing conditions.

PJT Partners is acting as lead financial advisor to DIRECTV. Barclays is acting as lead financial advisor to TPG. J.P. Morgan is acting as lead financial advisor to EchoStar. BofA Securities, Evercore, LionTree and Morgan Stanley also provided financial advice to DIRECTV and TPG



World Teleport Association Names Randall Barney as Deputy Executive Director

New York, NY, October 1, 2024 – The World Teleport Association (WTA) has appointed **Randall Barney** as Deputy Executive Director effective October 1, 2024. In his new role, he will have primary responsibility for the association's fundraising, member and industry service programs, events and partnerships.

Randall joined WTA in 2006 as membership administrator after serving in administrative positions with other nonprofit associations. Under his administration, WTA launched a streamlined teleport directory, global teleports map and WTA's Executive Dialogue Series. Advancing to membership director, he expanded the association's membership and took the lead role in growing WTA's successful



Randall Barney

Teleport Certification program, which has certified more than 60 teleports around the world based on transparent, independently verified standards of quality in facilities, technology and operating procedures.

“Randall has become a well-known figure in the teleport and satellite industry,” said executive director Robert Bell. “He represents WTA and leads discussion panels at dozens of conferences and trade shows each year and has built outstanding relationships with teleport and satellite executives. This appointment acknowledges the leadership role he has developed with our members and Board of Directors.”

Broadcast Solutions Appoints Maximilian Breder as COO

Bingen, Germany, September 3, 2024 - Broadcast Solutions, one of Europe's largest media systems integration groups, has appointed **Maximilian Breder** as COO of its German HQ operations. Breder brings a fresh perspective and a track record of innovative thinking and extensive experience to the role.

“Thanks to my uncle, as a boy I went to a Broadcast Solutions open house event and got the chance to stand inside an outside broadcast truck,” Breder recalled. “I knew then that this was where I wanted to be.”

While at school he obtained work experience with the broadcaster SWR in Mainz, and with Broadcast Solutions where he got involved in everything from accounts to wiring. This led him to an academic and integrated apprenticeship programme in conjunction with Hochschule Mainz, with four days a week working across all departments of Broadcast Solutions and two days at university, a gruelling

programme which led to his BSc in business administration, which he is now following with a masters degree in management.

Joining Broadcast Solutions full time, he gained in-depth experience



Maximilian Breder

not only of the technical and commercial goals of the business but its internal culture. In 2023 he was appointed Officer of the Management, which gave him the opportunity to develop cross-company strategic projects and to develop his ideas of devolved decision-making in each operational and administrative area of the business. He now takes overall operational responsibility.

KenCast Appoints new CEO

Norwalk, CT, September 2, 2024 – Advanced digital content delivery solutions company KenCast is ushering in a new era of leadership with the announcement of **Dr. Henrik Axelsson** as its CEO.

Dr. Axelsson takes over as the company marks a significant milestone, celebrating the retirement of its founder and former CEO Dr. William E. Steele.

EXEC MOVES

Dr. Axelsson will advance KenCast towards a new generation of product enhancements to provide a “complete content distribution system”, where Fazzt™ software will be further refined with built-in automation to support optimal delivery decisions.

“I envision KenCast as a powerhouse of complete data delivery technology. We will build upon our commitment to assure data delivery anywhere, anytime with next-level adaptive, dynamic smart solutions that not only flawlessly solve transmission errors but also seamlessly send data over the optimal communications pathways” said Dr. Axelsson. “I am deeply honored to step into the role and build upon the remarkable foundation established by Dr. Steele. KenCast’s commitment to innovation and excellence in data delivery remains unwavering.”



Dr. Henrik Axelsson

Dr. Axelsson's strategic vision for KenCast is centered on three main areas. The first is enhancing platform capabilities, aiming to improve hybrid delivery solutions for seamless content delivery, even with intermittent connectivity.

The next area is expanding market reach, by addressing the unique challenges of various verticals like aeronautics, maritime, defense, corporate

communications, NGOs, education, and digital cinema. A significant step in this effort is the rollout of KenCast's new patent, Smart FEC, which ensures that moving vehicles—whether in the air, at sea, or on land—can flawlessly receive content, even during extended outages and in or out of coverage areas.

The final key area is the development of next-generation solutions, innovating hybrid content delivery for terrestrial and satellite broadband, including Low Earth Orbit (LEO) satellites, and refining point-to-point algorithms for faster delivery.

Dr. Henrik Axelsson has been an integral part of KenCast since 2006. With a Ph.D. and M.S. in Electrical Engineering from the Georgia Institute of Technology, and an M.S. in Electrical Engineering from Chalmers University of Technology, Sweden, Dr. Axelsson has held multiple roles within KenCast, spanning software development, operations, business development, and management.

Qvest appoints Jonas Michaelis as Chief Strategy Officer

Cologne, Germany, September 2, 2024 - Qvest has appointed **Jonas Michaelis** as its new Chief Strategy Officer (CSO). His main responsibilities will be to implement the company's global strategy and to strengthen collaboration between Qvest's global offices in Europe, USA, Australia and the MENA region.

In the newly created role of CSO, Jonas Michaelis will work closely with Peter Nöthen (CEO), Thomas Müller

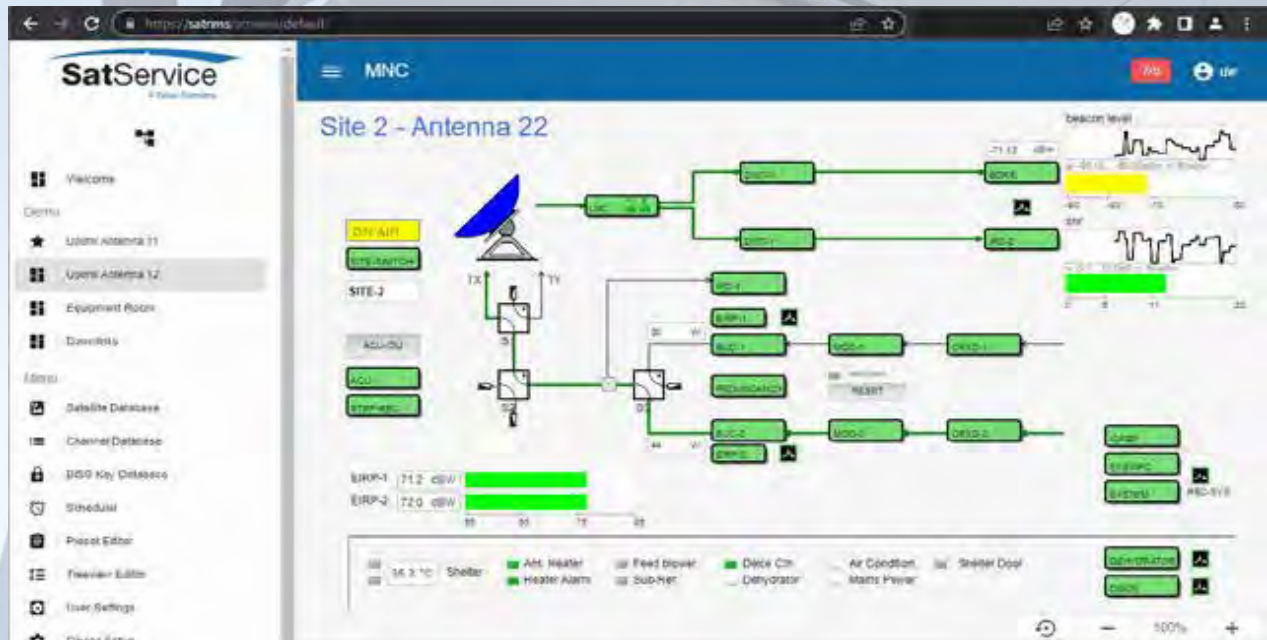
(CTO), Christian Boris Hönig (CFO) and the extended management of all Qvest Group companies to drive forward the implementation of strategic focus projects, such as the expansion of the global Artificial Intelligence and Managed Service Practices and the location in Saudi Arabia, as well as the further development and optimization of the organizational structure in the course of past and future acquisitions of the Qvest Group. As an expert in the development of new business areas, Jonas Michaelis has been leading the global development of the Qvest spin-off qibb, the low-code integration platform for media workflows, as CEO since the beginning of 2021. Michaelis will retain this role alongside his new position as CSO and will continue to be responsible for strategy and marketing at qibb. Prior to joining qibb, Michaelis worked at BCG and Picus Capital as a digital business model consultant. Michaelis holds BSc and MSc degrees in Business Administration and Finance, which he obtained in Mannheim, Hong Kong and Paris.

Jonas Michaelis, CSO of the Qvest Group: "Qvest has achieved remarkable global growth in recent years and I look forward to continuing this path together with our global team. In a dynamic industry, it is essential to have a forward-looking strategy. My goal is to network Qvest's diverse offerings and business areas even more closely and to create innovative synergies. In this way, we want to support our customers worldwide as a competent partner from strategy development to the implementation of technologically future-oriented projects."



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MARKET TRENDS

High Throughput Satellite Market: US\$ 58.5 Billion in 2032

A new report titled "High Throughput Satellite Market Size" from Adroit Research revealed that the High Throughput Satellite Market will be worth US\$ 58.5 Billion in 2032 at CAGR of 20.17%.

The high throughput satellite market is experiencing rapid expansion within the telecommunications field. These advanced satellites provide high-speed internet access and increased data capacity, facilitating the provision of services like broadband, video streaming, and data communication on a worldwide basis. Their importance stems from their capacity to narrow the digital gap, particularly in remote and underserved regions, by offering dependable and affordable internet connectivity. As the need for high-capacity applications grows and industries require seamless connectivity, it is anticipated that the global high-throughput satellite sector will see considerable growth in the foreseeable future.

A High Throughput Satellite (HTS) is a sophisticated

communication satellite engineered to deliver significantly greater data transfer speeds in comparison to conventional satellites. HTS leverages cutting-edge technology such as spot beams, frequency reuse, and multiple-spot beam technology to enhance the capacity and efficiency of data transmission. By employing numerous smaller beams that can target specific regions or areas with high demand, these satellites enable more precise and higher bandwidth communication services. The improved capabilities of HTS support quicker, more dependable, and cost-efficient internet connectivity, voice communication, video streaming, and other data-heavy applications. This aids in fostering global connectivity and reducing the digital gap.

In 2023, the market for high-throughput satellites reached a size of US\$ 15.3 billion. Adroit Market Research projects that the market will grow at a compound annual growth rate (CAGR) of 20.17% from 2024 to 2032, when it reaches US\$ 58.5 billion.



Low Earth Orbit Satellite Market

The Low Earth Orbit (LEO) Satellite Market grew from US\$ 14.33 billion in 2023 to US\$ 16.17 billion in 2024. It is expected to continue growing at a CAGR of 13.28%, reaching US\$ 34.33 billion by 2030 according to new research from Research and Markets.

This proximity to Earth allows

LEO satellites to provide lower latency communication and higher speeds, making them particularly advantageous for telecom services, earth observation, and various scientific endeavors. The expanding use of LEO satellites is largely driven by advancements in satellite miniaturization, re-

ducing launch costs, and increasing demand for high-speed internet access in remote areas. Furthermore, the global push for improved global connectivity and the need for real-time earth monitoring for climate and disaster management support this expansion.





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Small Satellite Market Global Forecast to 2029

The small satellite market is estimated to grow to US\$ 11.2 billion by 2029, from US\$ 5.2 billion in 2024, at a CAGR of 16.6% from 2024 to 2029. The anticipated number of small satellite launches from 2024 is expected to increase by around 1442 from 3220 units to reach 4,662 units in 2029 according to new research from Research and Markets.

This surge has been stimulated by increasing demand for commercial satellites boosting the launching of small satellites. They are widely accepted since they are affordable, have short developing periods and can serve various purposes such as telecommunication, earth observation, etc. The growing need for small satellites is fueled by technology advancements like innovative production methods, lighter materials and artificial intelligence integration. Such improvements make it easier to build advanced capable satellites which can do difficult tasks that were limited to larger ones in the past. Furthermore, greater miniaturization focus as well as high performance small devices construction facilitate design of more effective spacecrafts.

Government & Defence segment by end use is expected to hold the second highest market share in 2024

Based on end use, the small satellite market is categorized into commercial, government & defence, and dual use. The government & defence segment having second highest

market share of 9.1%. The government and defense segment of the small satellite market is driven by the critical need for enhanced communication, surveillance, and reconnaissance capabilities. Increasing geopolitical tensions and the necessity for stepped forward national safety features are key elements propelling

small satellites to offer valuable insights for climate research, resource management and government policy making. Public-private partnerships and investments from businesses also significantly drive this segment's growth thereby enhancing affordability and accessibility of Earth observation services.



Asia Pacific is expected to hold the second highest market share in 2024

The small satellite industry in Asia Pacific is booming, with more money flowing in from both established and up-and-coming space countries. New companies focusing on

ling the adoption of small satellites.

Earth observation & remote sensing segment by application is estimated to hold the second highest market share in 2024

Based on application, the market is further segmented into communication, earth observation, scientific research, technology and others. The Earth observation & remote sensing segment having second highest market share of 30.8%. Key players in the industry are actively working on developing advanced high resolution earth observation satellites to take advantage of new opportunities in this market. Advancements in satellite imaging technologies and data analysis capabilities have enabled

small satellite tech are popping up all over the region. These new organizations bring new ideas making the whole market stronger and more exciting. This growth is prompted by the need for better communication infrastructure particularly in remote and rural areas, as well as growing government's focus on managing disasters and environmental monitoring through satellite technology. In addition to that, the region has a strong collaboration between the countries and private companies that have improved innovation leading to deployment capabilities thus making Asia Pacific one of the dynamic players in global small satellite industry.



Silicon Valley Space Week Highlight Key Industry Trends

by Elisabeth Tweedie

Silicon Valley Space Week organized by Satnews Events and held in Silicon Valley, California at the end of October, covered a variety of topics, as would be expected, but for me the discussions around Direct-to-Device (D2D) were the ones that stood out the most.

But, before touching on those it's worthwhile mentioning some key points from the opening session "Crafting Innovative Satellite Solutions for Customers," moderated by Kathryn Gizinski, CEO River Advisers. Brian G Miske, Partner, KPMG mentioned that in April

stant disruption therefore innovation, i.e. doing things differently, is a prerequisite to meet that number. Dr. Clare Martin, Executive Vice President, Astroscale, US, agreed, stating what was really important, was to educate the customer as to what could be achieved, rather than simply focusing on their immediate needs. She was referring in particular to in-orbit servicing Astroscale's primary business, but the same could be said for any satellite business.

Focusing on the falling launch costs, Dr. Annalisa Weigel, Director, Fairmont Consulting Group, went so



of this year McKinsey and the World Economic Forum, jointly projected that the satellite market would be worth US\$1.3 trillion by 2035, an acceleration of their previous forecast. He pointed out, that the industry is facing con-

far as to itemize four of the trends driving the 30x reduction in launch costs in the last 40 years. These are:

1. Miniaturization of electronics, leading to

decreased mass which in turn is driving down launch costs.

2. Improvements in manufacturing and use of Commercial-the-shelf (COTS) products.
3. Insights gained by use of artificial intelligence (AI) and machine learning (ML).
4. A change in the way governments were getting involved not only in the defense market, but also in the commercial market.

All of these, but the first three in particular, lower the cost, one of the key barriers to entry to the space business, so open the door to new entrants and innovation, as we have been seeing in recent years.

Moving on to D2D, whilst most of the industry is very bullish about this, despite the currently different standards and delivery mechanisms being used by the multiple companies working in this sphere, Greg Pelton, CTO, Iridium, issued a rather somber warning, indicating that this could be a race to the bottom. He went on to explain, that as the satellite operators, partner more closely with the mobile network operators (MNOs), this could lead to a market that looks more like the cellular market, with only a few, largely undifferentiated players in each market, so that competition is primarily based on price. Nevertheless, the GSMA has forecast an additional US\$30 billion revenue for the mobile market by 2035, as a result of D2D connectivity from satellite. This revenue is expected to come from the consumer, B2B/IOT and government markets. Of course, as with any partnership, this revenue will have to be split between the MNOs, satellite providers and possibly also the chipset manufacturers. Interestingly, whilst Starlink is already an active player in D2D, Amazon's Kuiper will not have this capability in the first generation.

Standards, is of course an important consideration for this market. Pelton explained that Iridium although initially based on 2G standards, had been proprietary for many years, but in a complete change of direction, joined 3GPP in December 2023, and stated that as a result of this, it was now working with a partner, to test standards that would be incorporated into 3GPP Release 19. Viasat, which is now a key player in the mobile market, as a result of its acquisition of Inmarsat, is also pushing open standards and is one of the founding members of Mobile Satellite Services Association (MSSA).


Mark Dankberg, Chairman of the Board, Chief Executive Officer and Co-founder, Viasat was a keynote speaker the next day, and chose to use his session to talk

"...Key to developing this global standard, is cooperation between the D2D players and most importantly interoperability between the players, in order to facilitate seamless global roaming within and across satellites and constellations..."

almost exclusively about the MSSA. He emphasized the need for a global standard for D2D, saying that the "MSSA members have pre-agreed some standards and ways of working which would enable a worldwide market to emerge without challenging national sovereignty." Viasat, as already mentioned, is one of the founding members of the MSSA and Dankberg is Chairman of the Board of the association. Other members include: Yahsat, Ligado Networks, Omnispace, Terrestar, Ericsson and MTN.

Key to developing this global standard, is cooperation between the D2D players and most importantly interoperability between the players, in order to facilitate seamless global roaming within and across satellites and constellations. As would be expected from the name, the MSSA is focused on using already licensed MSS spectrum, as opposed to using cellular standards, which some of the D2D operators are using.

The MSSA has multiple goals, these include: supporting the integration of space networks into national telecommunications infrastructure via trusted local partners and within sovereign regulatory and national security frameworks; providing a neutral forum for coordination of 3GPP Non-terrestrial Networks (NTN) and other international standards activities and achieving scale through improved coordination and cooperation mechanisms among MSS operators to maximize the utility of already available and licensed global MSS spectrum in nations desiring advanced NTN services.

As was pointed out in the D2D panel, success for the players in this industry depends on the business case. Creating seamless global roaming is a major challenge, no matter which spectrum you use, the key components of landing rights, distribution and service partners, and ubiquitous devices remain, not to mention how much extra consumers and businesses are willing to pay for guaranteed coverage everywhere. 

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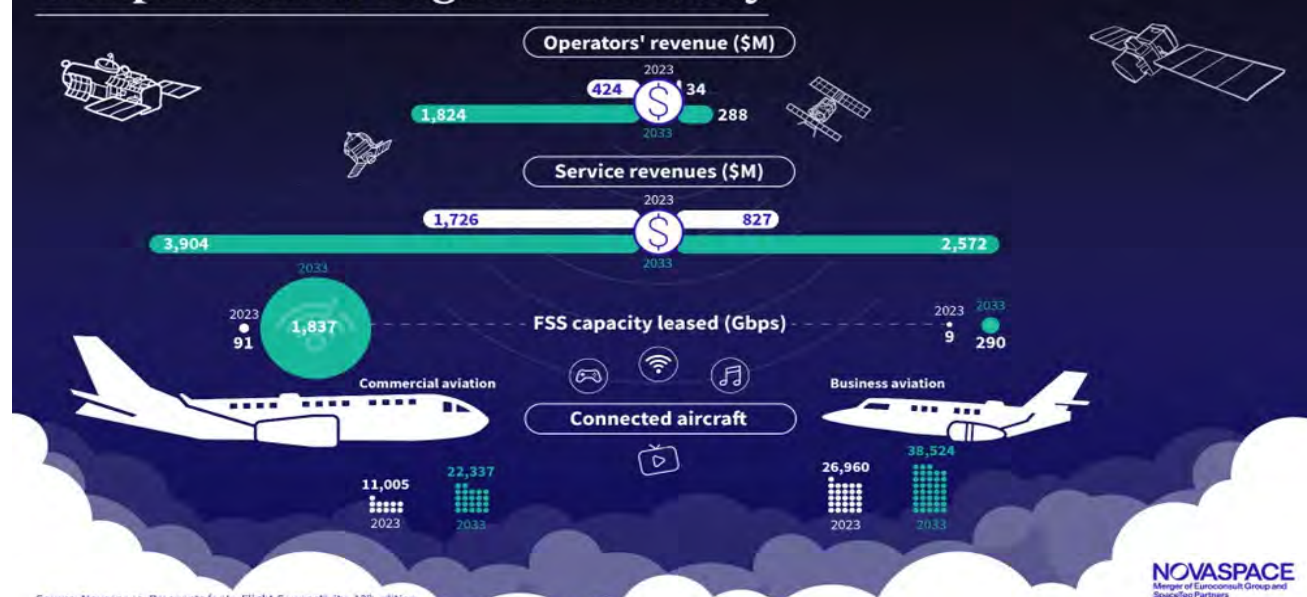


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VITAL STATS

Prospects for In-Flight Connectivity



The number of in-flight connected aircraft is projected to surpass 60,800 by 2033 with NGSO and multi-orbit solutions helping reshape the market as airlines transition from legacy systems according to Novaspac. Technical advances are fueling bandwidth growth by reducing costs leading to an over 20-fold increase in capacity leased.

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