

Flat Panel Antennas Market

by **Bernardo Schneiderman**

The market for Flat Panel Satellite Antennas (FPA) has been experiencing growing in the last five years and manufacturers are planning to compete for the multi-orbital antenna market. As we observed during the Satellite 2024 Exhibition and conference in Washington, D.C. held last month, we found more than 20 companies showing flat panel satellite antennas in the show floor for the major markets

that include aeronautical, terrestrial and maritime and broadband for mobility/fix applications

and focus in the end user market, enterprise and government and military.

With the advent of Non-Geostationary Orbit (NGSO) satellite constellations such as Starlink/SpaceX, Project Kuiper/Amazon) and multi-orbital satellite operators such as SES/O3Bmpower, Eutelsat/OneWeb, Telesat/Lightspeed the market has the potential to grow exponentially in the next 5-10 years.

NSR (An Analysis Mason company) published a new report on the

“Flat Panel Satellite Antenna Market” covering four keys markets: Mobility, Government & Military, Consumer Broadband, and Enterprise markets showing the key trends in each market.

According to NSR the Mobility, Government and Military are the major revenue growth areas but broadband for end user and enterprise is also showing potential for exponential growth with the low-cost price of terminal.

As an example Starlink terminal is range from US\$ 599 - 2,500 and announced that has

more than 2 million subscribers worldwide and has entered the maritime market since early 2023 and announced plans to expand to the aeronautical market. Project Kuiper announced last year March 2023 a low-cost terminal for less than US\$ 500 when their constellation will be operational during 2025-2026 but has two satellite in test mode during 2024.

Among the major manufacturers in the FPA market include Alcan, Auden, Ball, C-COM, Cesium, CPI,

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The Changing Video Market



This month we head again to the National Association of Broadcasters' show (NAB) in Las Vegas where we will have a booth as usual at the new West Hall of the sprawling Las Convention Center. There has been many changes to the NAB and the broadcast industry, specifically as it relates to satellite since I first attend the NAB in 1996 when I was a marketing manager for a teleport based in Singapore. The NAB is the largest broadcasting show in the world attracting over 100,000 attendees from all over the world.

While much has been said of the diminishing role of satellite for broadcasting, video remains a vital part of the industry. What's changed is that the solutions offered by the satellite service providers are more hybrid in nature and requires a multichannel approach, if you like. Our Associate Editor, Elisabeth Tweedie whose been following broadcast trends very carefully, sums it up succinctly in the article on Hybrid Solutions for the broadcast on page 10 of this issue. She observes that the rise of streaming does not mean the end for satellite.

We also have a good overview of the Flat Panel Antenna market featuring some of the leading companies in that space as our cover story.

If you will be at the NAB, come visit us at West Hall booth number W3828. We look forward to seeing you there.

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Flat Panel Antennas... ...from page 1

Getsat, Gilat, Global Konet, Intellian, Hanwa-Phasor, Hughes, Kymeta, Mi-Wave, Revgo Group, SatCube, Satixfy, Satpro, Starlink, Starwin, Sunwave and Thinkom, among others, and the majority of them showcased their current antennas offerings at Satellite 2024.

For this article the Satellite Executive Briefing (SEB) invited FPA manufacturers for a virtual roundtable and we got the feedback from the following executives: **Bilal Awada**, Chief Technology Officer, **C-COM**; **Hagay Katz**, Chief Product and Marketing Officer, **Gilat**; **Youn Gon Kim**, CEO, **Global Konet**; **Dave Seeman**, Director of Business Development & Marketing, **Revgo Global**; **Lukas Nyström**, Chief Technology Officer, **Satcube**; and **Greg Otto**, VP of Sales & Marketing, **ThinKom**.

Excerpts of the virtual roundtable discussion follows:

Satellite Executive Briefing (SEB): *Please provide a brief profile of your company and a current status of your flat panel antenna (FPA) offerings?*

C-COM: C-COM offers a wide range of Communications on the Pause (COTP) auto-pointing satellite antenna covering Ka-, Ku- and C-bands. Over 10,000 of our antenna systems have been deployed world-

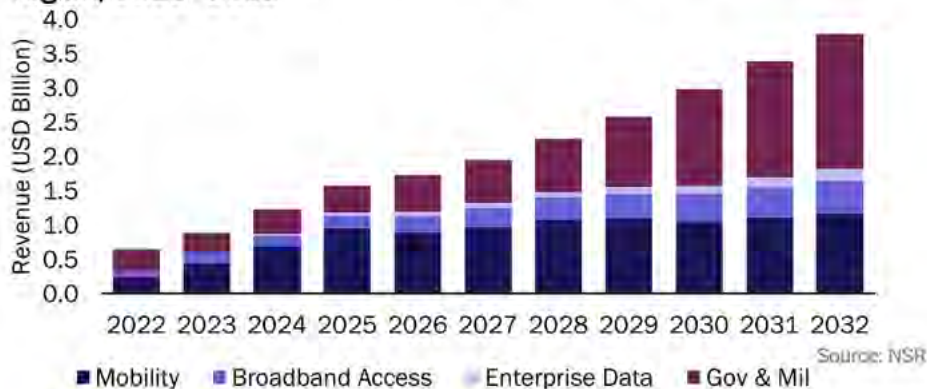
"...According to NSR the Mobility, Government and Military are the major revenue growth areas for FPAs but broadband for end users and enterprise is also showing potential for exponential growth..."

wide and are compliant with most satellite service providers in the industry. The new Electronically-Steered Phased-Array 4K element Flat Panel Antenna, under validation testing, will operate in Ka-band over GEO, MEO, and LEO satellite constellations targeting land mobility applications. The developed antenna technology can be extended for use in other markets such

in-class link performance down to 20-degree elevation. Its flat design and light weight minimize drag and fuel consumption and the efficient SWaP enables passive cooling and minimal load on aircraft resources. Smart transmission power management guarantees adherence to relevant emission standards.

Gilat is at the forefront of ESA technology, working with key service providers and aircraft manufacturers to customize the technology to fit the antenna to various aircraft types and missions.

Figure 5: Total Flat Panel Antennas equipment revenue by region, 2022–2032



as maritime and airborne.

Gilat: Gilat has developed a breakthrough Electronically Steered Antenna (ESA) system for SATCOM-on-the-move connectivity. This ESA system has been proven in flight and has demonstrated remarkable performance. The ESA system is based on Gilat's innovative Ku & Ka-band active phased array technology. It was designed for Very High Throughput Satellites (VHTS) over both GEO and NGSO constellations and is compatible across all existing GEO IFC networks while providing best-

Global Konet: With the commercialization of low earth orbit (LEO) satellite services, satellite communication has solved the shortcomings of existing GEO satellites with new technology. The KONET antenna, which is light and highly mobile and can easily and automatically track satellites with a flat antenna to provide Internet services anywhere, can overcome the stereotype of a satellite terminal with limited functionality and difficult operation.

The way you think about life communication through space communication is Global Konet's (GK) goal. We protect the safety of our

Gateway and Flat Panel RF Solutions

LEO / MEO / GEO



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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

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C-COM Flat Panel Antenna

customers in the event of natural disasters, earthquakes, forest fires, wars, etc. that may occur in living spaces. In order to request rescue and diffuse the situation, GK established and provides “a company that provides a space communication environment.”

The characteristic of the KONET electronic beam steering ESA antenna is that “it can be connected anytime, anywhere.” It solves the limited service and installation difficulties of existing fixed satellites, and has a light weight that exceeds the laws of physics, suitable for low-Earth-orbit (LEO) satellites with a fast beam tracking speed.

We provide antennas suitable for vehicles, ships, and man packs in various environments. Currently, GK FPA antennas are being produced and sold. It is exported to Asia and Israel, and is also used in Korea. Customers are using it on vehicles as OTM, and are planning to use it on ships starting this year.

RevGo Global: RevGo Global is a U.S. based manufacturer and designer, specializing in low profile, multi-band, multi-orbit RF transmission and reception modules such as BUCs, LNBs and Transceivers. These modules are integrated into flat panel

antennas, also active and passive array systems by the manufacturers.

SatCube: Satcube is a fast-growing technology company in the satellite communications industry with a focus on developing game-changing terminals and services to enable high-speed broadband anywhere - quickly, and cost-effectively. The European innovator employs a world-class research and development team, harnessing proven academic and professional track records. Satcube actively collaborates with leading Scandinavian and European universities on ground-breaking projects sponsored by European Space Agency and Vinnova. Satcube’s headquarters are based in Gothenburg, Sweden, and its production facility is located in Karlstad, Sweden. We are currently providing a state-of-the-art passive flat panel, suitable for GEO applications with mechanical pointing. Said antenna is based on advanced low loss technologies to ensure the highest possible gain from the small aperture. In addition, we are currently developing active phased array antennas suitable for NGSO applications. These antennas are optimized for improved performance at low elevation angles.

ThinKom: ThinKom just celebrated our 24-year anniversary and are proud that our flat panel VICTS phased array antennas represent the benchmark satcom solution in the commercial inflight connectivity (IFC) market and continue to gain new adoptions. Our latest commercial IFC product, the ThinAir Ka1717, was selected by Delta Airlines to outfit their entire regional jet fleet. The Ka1717 is the lowest-drag solution in the market and is optimized for regional jets, preserving valuable in-cabin space and reducing weight without sacrificing performance. The ThinAir Ku3030 systems, white labeled by Intelsat as “2Ku”, have been flying since 2015, have over 1,250 active installations and are seeing continued new adoptions. The ThinAir Ka2517 continues to serve as the backbone of Thales’ Fly-LIVE service on Spirit Airlines, which is turning heads with its high throughput capability. The Ka2517 also has an impressive and quickly growing number of adoptions on the Airbus Linefit HBC+ program and will soon be offerable for Boeing Linefit on the 737, 777X and 787 aircraft.

On the government side of airborne, we recently announced our ThinAir GT line of products. These were engineered to operate in the most demanding EMI, EMC, and EMP environments, while maintaining ThinKom’s proven reliability. The ThinAir GT 2517 is in operation on a number of intelligence, surveillance and reconnaissance (ISR) missions and was selected as the satcom terminal for the Athena-S program with Sierra Nevada. The GT product line sweeps in the extended Ka-Band for operation on government networks like WGS and SDA. We are also in full production

of a program on which 17” VICTS antennas are embedded beneath the fuselage skin, adding critical mission satcom capability without impacting the platform visual signature & time on station.

In other markets, our ThinWave Gateway Array has been delivered to a number of key government customers and we anticipate commercial contracts this year.

Our ThinSpace satellite payload antennas have recently passed a battery of qualification testing, with anticipated flight testing later this year. The ThinSpace antenna serves as a much more robust intersatellite link with similar data rates to lasers. ThinSpace products are more compact, lighter weight and require much lower prime power than optical inter-satellite links. Perhaps our most important advantage is our ability to instantly point/acquire/track off of ephemeris data without any lengthy and uncertain spiral searches - as is the case with lasers due to the extremely narrow beam widths.

SEB: Which applications are you focusing on, if any?

C-COM: As mentioned previously, C-COM will be targeting land mobility applications which can be served by our new flat panel antenna technology over the Ka-band services offered by GEO, MEO, and LEO satellites. C-COM will be working with partners to take the new antenna technology to other applications such as maritime and avionic.

Gilat: Gilat has been investing in ESA technology development over the past 5 years to address commer-

cial, business, government, and defense aviation market segments, with breakthrough ESA demonstrations for in-flight connectivity. These technology demonstrations confirmed the feasibility of ESA technology for the aviation market including multi-orbit operations supporting satellites in GEO and LEO orbit.

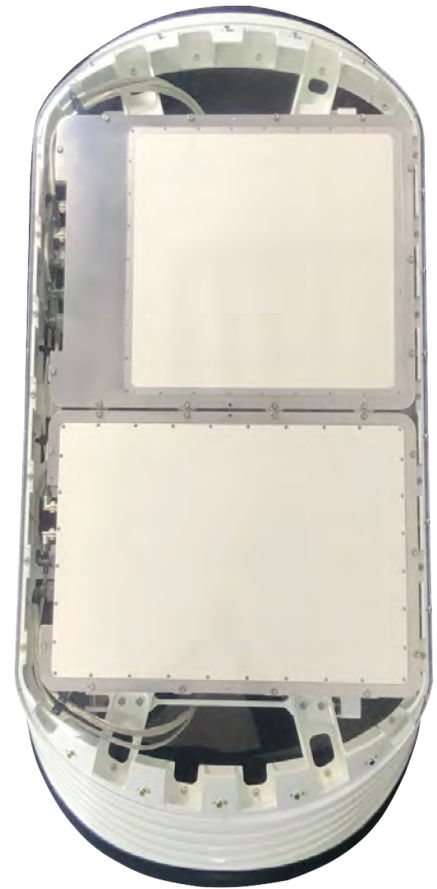
Gilat is uniquely qualified to provide the next generation of ESA aero terminals based on its technology leadership in the In-Flight Connectivity market delivering thousands of aviation-grade modems and solid-state power amplifiers for its worldwide customers over the past 7 years. The ruggedized ESA terminal adheres to strict aviation quality standards, including safety of flight standards.

Global Konet: We focus on On the Move (OTM) antennas and man-pack antennas, and Business services such as internet and intranet video conferencing.

Applications that require short switch times between bands and orbits as in Comms-on-the-move, Comms-on-the-pause and In-Flight Connectivity (IFC) supporting applications that will be used with connectivity combination of LEO, MEO and GEO.

RevGo Global: Applications that require short switch times between bands and orbits as in Comms-on-the-move, Comms-on-the-pause and In-Flight Connectivity (IFC) supporting applications that will be used with connectivity combination of LEO, MEO and GEO.

SatCube: We focus on comms-on-the-pause (COTP) and comms-



Gilat ESA Antenna

on-the-move (COTM) for the ground segment. i.e. land applications for groups such as emergency responders, NGOs, broadcast, and governments for both COTP and COTMs, and more specifically lightweight and easy-to-use terminals for trucks, busses, larger cars, etc.

ThinKom: We are always looking to expand our leadership position in the commercial IFC industry, but we view a number of other satcom applications as key additional avenues for growth. The ThinAir GT line, as an example, was recently introduced as an upgraded and expanded line of aero antennas for special mission operations. The extended performance increases flexibility and resiliency for



ThinKom's ThinAir Ka2517 terminal

reliable, efficient communication on a range of aircraft types. Similar to the ThinAir product line, the GT products support multi-orbit, multi-constellation, agnostic operation which are a key requirement for government ISR missions.

Our Gateway Array is the only commercially viable phased array approach to replace parabolic dishes for satellite ground stations, and we are continuing to invest heavily to expand this product beyond government adoptions into the commercial sector. Key to the success of our technology in this market is the antenna efficiency, low power and commercial viability. The Gateway Array is also software-defined, reconfigurable, supports multi-beam, and performs digitally beam-forming.

SEB: What vertical markets will the FPA be used for?

C-COM: The new COTM FPA antenna will be used for different vertical markets including SNG, First Responders, Trains and Public/Private Transport vehicles which can benefit

from the always-on broadband connectivity while vehicle in-motion.

Global Konet: Our main customers are government agencies and the military.

RevGo Global: Mobility offerings such as maritime, comms-on-the-move, aeronautical, agricultural, IoT, Mil/Gov and First Responders.

SatCube: We work mainly with the following verticals: Emergency response groups, such as Humanitarian aid organizations, first responders or intergovernmental organizations such as the United Nations for example. We also work closely with Media companies and broadcasters, like CBS, ABC News, etc. And finally, we also support governments around the world.

ThinKom: Most of our antennas are designed for satcom use cases, and we have antennas represented in almost the entire ecosystem from ground mobile, to airborne, to satellite payload, to teleports. However, we are looking at new markets in need of

disruption. Our antennas are capable of handling incredibly high peak powers, well in excess of what would be possible with an electronically scanned array (ESA). Therefore, we are very active in the Electronic Warfare and High Power Microwave markets where we have very strong competitive discriminators. We are in the early stages of this exploration and recently executed a CRADA with a US government agency through which we will demonstrate the high-power handling capabilities of our antennas, including multi-megawatt input powers

SEB: What differentiates your company and your offerings from your competitors?

C-COM: C-COM has been in the SatCom markets for more than 26 years and has built a great reputation for its iNetVu brand and the quality & support offered to its product line. We have sold well over 10,000 antennas in 100+ countries. The products are highly reliable and durable and have been proven under different climate conditions. We are a one-stop shop for mobile terminal development where we design the hardware, develop the software, and provide full support of the product. Our customers expect this high level of quality and support to continue with the new COTM ESA antenna offerings.

Gilat: Gilat's ESAs are fully integrated across a wide variety of IFC MODMANs, which enables smooth integration with most commercial modems and dual modem support. This facilitates exceptional network flexibility for service providers, inte-

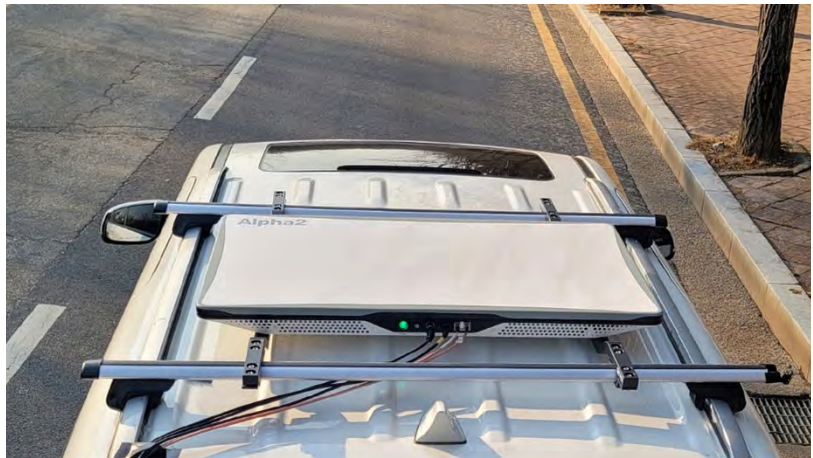
grators and aircraft manufacturers.

Gilat's ESAs also offer dual transmit and dual receive operations which empower GEO/MEO/LEO transitions of various options, including make-before-break and GEO/LEO simultaneous operations achieving the best possible global IFC coverage on GEOs and NGSOs combined. Advanced tracking algorithms and RF design provide for best-in-class elevation and skew compensation, improving antenna performance in real-world conditions.

Global Konet: Our advantage is low power consumption by optimizing the panel and MMIC chips. One of the few FPA antennas that has been commercialized and used in practice

RevGo Global: Our development teams feature highly experienced RF Engineers, Mechanical Engineers and Software Engineers who design custom solutions for our customer's unique products and systems. In addition, our Automated Test Stations provides a systematic approach which lowers costs of manufacturing and allows for industry leading short delivery times to our customers. Lastly, our industry proven technical expertise in lower output back off requirements, enables a higher data throughput with more efficient use of bandwidth and power, resulting in a lower total cost of ownership.

SatCube: Our main differentiators are that our terminals are optimized for SWaP and operations at low elevation angles. They are ruggedized to withstand all environments (IP65/67) and have a best-in-class UX for ease-of-use, in order to be able



Global Konet's On the Move Antenna

to be setup and online within one minute, no matter the user's technical background.

Thinkom: ThinKom's VICTS antennas are incredibly efficient compared to any other flat panel antenna on the market. To achieve the same RF performance, our competitors would need much larger antennas, typically 4x to 5x larger. Today's ESAs of comparable size to the VICTS are only suitable for LEO-only operation. GEO satellites are 30x further away from the surface of the Earth, so much higher antenna performance levels are required, particularly to close links at high scan angles (in Northern latitudes) or to maintain links during normal aircraft maneuvering. Another major differentiator is the power consumption. Our antennas use passive RF components which significantly reduces the power consumption. Other flat panel antennas, such as ESAs, consume KW's of power - whereas our antennas only consume tens of watts. The low power allows for gate-to-gate operation on the tarmac during very high ambient conditions and solar

loading. Another benefit of the VICTS technology is the reliability. Electronics are will know to be the least reliable component of any commercial IFC installation, and an ESA is based on thousands of individual electronic components which are sensitive to the extreme environmental conditions on top of an aircraft. The VICTS antenna reliability has been proven with over 40M hours of operation, allowing us to provide the highest industry guaranteed MTBF.

SEB: Anything else you would like to add?

Gilat: Gilat was selected by Satcom Direct as the driving force behind the technology that will deliver the highest possible bandwidth to business aviation customers utilizing OneWeb's Low Earth Orbit (LEO) constellation. The ESA antenna will be mounted on the aircraft fuselage and connected to Satcom Direct management and WiFi systems inside the cabin. The ESA terminal will enable Satcom Direct to deliver an unparalleled internet connectivity user experience and the

highest data transfer capabilities.

Global Konet: We are developing a broadband IOT terminal and aero model that can be used for drones and aviation, and are developing antennas tailored to customer needs.

RevGo Global: RevGo has released 20 semi-custom flat panel RF solutions with over 7,000 units shipped. These RF products range from single to dual-constellation solutions, 1 to 40W output power, and stand-alone TX/RX to transceivers. We are able to leverage our core designs to quickly commercialize products for our flat panel integrators.

SatCube: There is a big market push for phased array FPA solutions, for good reasons. Low profile and no moving parts is a big selling

point. However, it is important to remember that this is not a jack-of-all-trades technology that is suitable for all applications. The main deficit of phased arrays today is the significant performance degradation at low elevation angles. Current technology works well for >45degree elevation, but it becomes impractical for lower elevations. To compensate for this performance reduction, the vendor needs to significantly oversize the terminal (lack of performance can be countered by adding more antenna area). This makes it unfit for COTM on GEO, especially at high latitudes and on small vehicles with limited available real estate on the roof. This deficit is less severe for NGSO applications where the nominal position of the satellite is at zenith.



Satcube Portable Terminal



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Satellite Service Providers Turn to Hybrid Solutions for Broadcast

by Elisabeth Tweedie

It would appear that whichever way you look, the outlook for traditional consumer Pay TV, is pretty bad. According to Ampere Analysis, in the US, this year is predicted to be the crossover year. The year in which streaming revenue (from subscription video-on-demand (SVoD) and hybrid subscription/advertising services) finally overtakes revenue from traditional pay TV subscriptions. In terms of actual numbers of subscribers, the crossover occurred in 2016, but since the average revenue per user (ARPU) for streaming services is so much lower than that for satellite or cable bundles, it has taken longer for the revenue crossover to occur. Ampere is projecting the crossover will happen in the second quarter of this year, with revenues of around US\$17 billion for both streaming and traditional services.

When streaming services first came online, one of their big attractions, was the fact that the services were ad free. Now, many of them are offering ad-supported options, which are proving to be popular. Options vary, from totally free linear channels, known as FAST (free advertising supported TV), to paying a reduced subscription in return for a limited number of advertisements on a traditional video on demand channel. In the US revenue from ad supported tiers is predicted to be over US\$9 billion, this year and according to Variety, in the US, FAST will overtake traditional streamed services as the preferred viewing method by 2030. Whilst increasing in popularity in the US, the growth in streamed FAST viewing pales into insignificance compared to the growth in Asia Pacific and Latin America. Data from Amagi indicates that year-on-year growth (Q4 2022 to Q4 2023) in hours of viewing of FAST channels increased 5% in the US and ad impressions 13% over the same period, in Asia Pacific and Latin America the corresponding figures were 130% and 352% and 64% and 173% respectively. Europe is growing at a similar rate to Latin America, and seems poised to continue that growth. On March 27th, Sony announced that it was launching 54

FAST channels across Europe.

Traditional TV Revenue Decline

This drop in traditional TV revenue is not unique to the US. In the UK, ITV (the commercial broadcaster) saw its linear advertising revenue fall 15%, whilst digital streaming revenues increased 19%.

Consumers' appetite for streaming services of all kinds continues to grow. As of quarter three last year, Netflix had over 247 million global subscribers, an increase of 43 million from 2020. The market place is however getting crowded. In the US audiences have over 30,000 distinct channels (traditional and streaming) to choose from. As a result, a recent study found that 70% of consumers think that there are too many choices, and a Nielsen survey last year, found that viewers spent an average of ten and a half minutes searching for something to watch, and 20% of those surveyed admitted that on occasions they gave up and went and did something else instead. This proliferation of choice also means that viewers demonstrate little loyalty, and are prepared to drop a streaming service in favor of another, if that second service is showing a movie or series that they want to see. So, as has always been the case "Content is King."

streaming services have taken this to heart, as according to a January 2024 report from Collider the three most expensive series ever made, came from Amazon and Netflix; with Amazon leading the way at US\$50 million per episode for "Citadel," and US\$58 million per episode for "The Lord of the Rings: The Rings of Power." Netflix was third at US\$30 million per episode for "Stranger Things," this however, was made in 2016, whereas the two Amazon series were made in 2023 and 2022. Interestingly, in spite of these massive investments in original content, in 2023, 60% of content viewed on streaming channels, came from content that was first aired on traditional linear channels.



This doesn't signify a downturn in appetite for streaming, but does potentially point to an additional business model for those services, such as FAST channels, which are almost entirely content reruns introducing yet another way for providers to use back catalogs. This was summed up by a comment from Pete Wood, SVP, digital sales, distribution, at Sony Pictures Entertainment, when announcing the 54 new FAST channels for Europe: "Sony Pictures recognizes the potential of the free ad-supported television space to engage new viewers globally with our extensive feature film and TV series catalog spanning 100 years. Our entry into the FAST space in Europe reflects our dedication to making premium content accessible to audiences on new and important distribution channels."

The Rise of Streaming Does not Mean an End to Satellite

As I have mentioned many times in the past, this switch to streaming, does not mean the end of satellite.

Undoubtedly there is a significant decline in direct-to-home (DTH) satellite TV, and a decline, but not the end, of video overall, which will remain an important revenue source for many years to come. It must be remembered that whilst most customers in developed countries enjoy access to terrestrial broadband, this is not the case in many countries. And for a content creator or packager, as long as some of its customers remain out of reach of a reliable broadband connection, satellite remains an essential part of its distribution strategy. Eva Berneke, CEO Eutelsat reported in February that video still accounts for 52% of Eutelsat's revenue, hardly something to be dismissed lightly, even if it is slowly declining. In its latest *Satellite Monitor*, SES reported that it now delivers over 8,000 channels to 369 million TV households across the globe: three million more than the in 2022. Growth came from Europe (+6.3 million households) and Africa (+ 3 million households). This was offset by a decline of 5.4 million in North America.

Geostationary satellites' key advantage has always been the provision of point-to-multipoint distribution, and there are still many geographic areas and applications that rely on

that ability. For example, Sony has just renewed a distribution agreement with Intelsat for another five years. This agreement is to distribute 40 channels throughout India, to its ecosystem of service providers some of whom are located in areas with limited terrestrial connectivity.

Hybrid Solutions

Satellite operators and ground equipment and service providers are all adapting their business models so as to not only remain relevant in the face of changing consumer preferences, but also to continue to offer customers the best service. To that end “hybrid,” “flexible” and interoperability are terms that are heard more and more frequently. For example, International Datacasting’s MistiQ, service started life more as a backup to satellite, in the event of an outage. Now, its third generation is marketed as a hybrid service, offering both satellite and an internet cloud solution for broadcasters for secure multi-point distribution of radio and television network programming. As Diana Cantu, VP Marketing and Sales, commented: “Everyone is still figuring out the economics of getting off satellite, for many networks it just doesn’t make sense right now. Nevertheless, we’ve positioned ourselves for what customers want to do now and will need to do in the future. There are options available and we’re going to make sure that we’re able to offer those, and provide our customers with a flexible migration path.” Cantu also pointed out that the video market is fragmenting into more segments with distinct needs. For example, whilst most networks are focusing on the move to streaming and maybe dropping some broadcast channels, religious networks in the US are increasing the number of campuses that they operate from, and buying up broadcast stations.

Taking “hybrid” one step further, ST Engineering iDirect unveiled its new “Intuition” platform at Satellite 2024 in Washington DC, last month. This is designed to be a unifying migration platform for users of all of its hubs, whilst equally available to new customers without iDirect legacy systems. Tim Verschage, SVP Product Strategy and Development summed it up this way:

“...Satellite operators and ground equipment and service providers are all adapting their business models so as to not only remain relevant in the face of changing consumer preferences, but also to continue to offer customers the best service. To that end ‘hybrid,’ ‘flexible’ and interoperability are terms that are heard more and more frequently...”

“Intuition brings together the key technologies on the ground to interconnect space assets to dynamically move capacity where it’s needed, creating an optimum solution by unifying operations across networks.”

Intuition is an advanced satellite networking ground system, based on a cloud-native, multi-orbit architecture, using the latest standards-based technologies. Features include: end-to-end orchestration, the ability to integrate multi-orbit satellite networks into global networks whether these be terrestrial or satellite, a virtualized cloud-based architecture and flexible go-to-market models.

As already mentioned, advertising supported streaming channels are experiencing rapid growth, but even in the United States there are areas that lack the broadband connectivity needed to watch streaming video. WeDo TV, a global FAST channel provider, is solving this problem with satellite. It is bringing its channel “We do Big Stories,” to the US, utilizing Intelsat’s Galaxy 19. Essentially, this means providing a free DTH channel. Not quite full circle as this is an advertising supported linear channel delivered by satellite, rather than over-the air; nevertheless, it does have more than a whiff of déjà-vu about it. And, if others follow suit, who knows - could this signal a revival for the DTH market

Elisabeth Tweedie 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. During her 10 years at Hughes Electronics, she worked on every acquisition and new business that the company considered during her time there.



She can be reached at etweedie@definitivedirection.com



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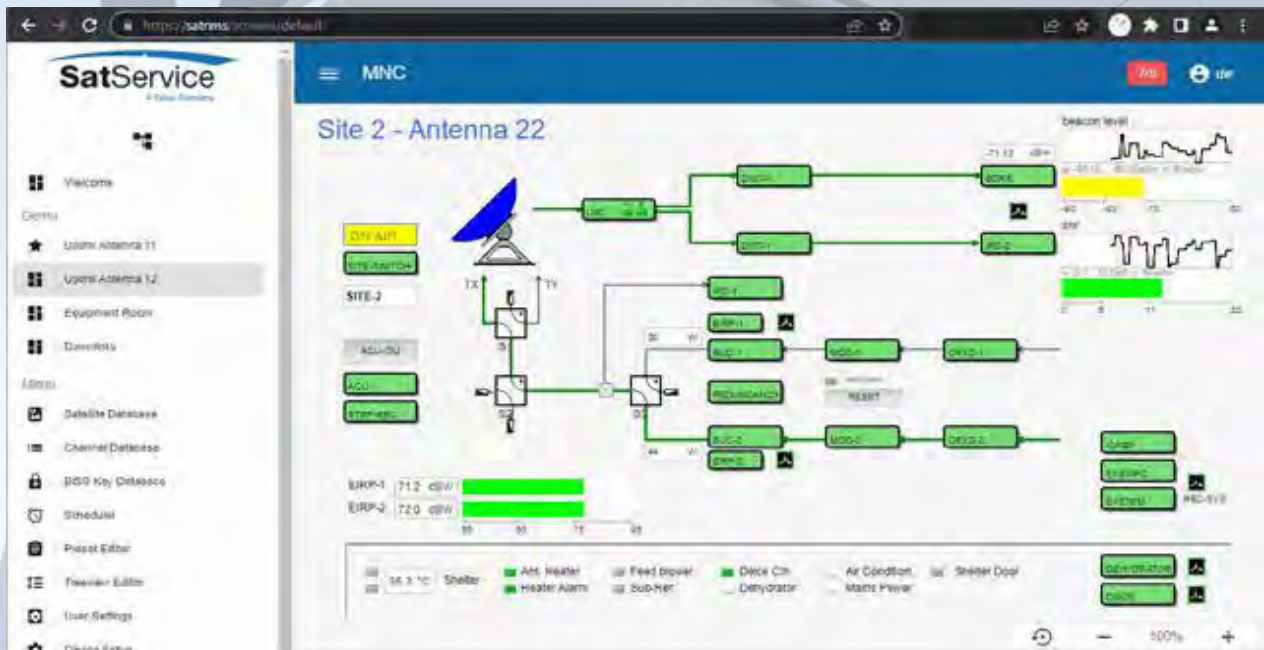
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Pivoting from Danger to Major Opportunity

by Robert Bell

The teleport business is nothing if not adaptable. Four decades ago, operators offered bare-bones uplink and downlink services for a small handful of geostationary (GEO) satellite operators. Today, they are increasingly providing multipath, multi-orbit connectivity to a variety of enterprise and government customers, from maritime, energy and mobility to ISPs and military customers.

New technologies and market trends are disrupting the industry as never before. Companies are rolling out low-latency services from nongeostationary orbit (NGSO) constellations, while the capacity and sophistication of GEO satellites have grown dramatically. One result is a major reduction in bandwidth prices, with no end in sight.

On the ground, software-defined wide area network (SD-WAN) and virtualization technologies are making operators far more agile and responsive, both in space and on the ground. Satellite-based services are becoming more closely integrated with the terrestrial grid: service providers are incorporating cloud processing into their services, while cloud providers are using satellites for backhaul. Mobile network operators (MNOs) continue to use satellites for cellular backhaul, and satellite direct-to-device services are becoming more widely available. How far this integration can go in the 5G world is the billion-dollar question facing the industry.

Rising Pressure on the Business Model

In a new report, *The Teleport Business Model in a Software-Driven World*, WTA examines how satellite and teleport operators, together with their tech vendors, are driving these changes and adapting to changes forced upon them. It paints a picture of the kind of “thriving on chaos” environment well-known to the tech sector but one that the satellite industry is still trying to get its arms around.

The story begins, of course, with the arrival of LEO broadband systems, led by Starlink. They are having the biggest disruptive impact on the industry, followed by the growing prevalence of software-defined satellites in GEO and medium Earth orbit (MEO). Together, developments are forcing ground segment operators to rethink their

costs and pricing, how network architectures can incorporate verticalized satellite services, and how to break down longstanding silos now viewed as impediments to the industry’s growth.

Contributors to this report were also nearly unanimous in

expecting a rising tide of consolidation among satellite operators. “It makes too much sense not to,” one teleport executive told us. This consolidation will involve satellites in all orbits, as well as ground-segment operators that resell satellite capacity, respondents said.

Adaptation in Progress

That’s the bad news part of the story. The good news is that, while LEO services are putting pressure on GEO operators, they are simultaneously opening up markets previously unavailable to satellite. Teleport operators are responding by expanding their offerings to include NGSO and terrestrial services, and in the process embracing software-defined networks, automation, and virtualization.

Value-Added Services

Amid the ongoing decline in bandwidth prices and other pressures, teleport operators are increasingly offering end-to-end turnkey solutions that include value-added services such as network monitoring, IT services, cloud integration and cybersecurity. In some cases, this is putting them in direct competition with the big satellite operators, who are similarly moving down the food chain.

Terrestrial Integration

The LEO-driven expansion of satellite into new markets, coupled with the shift by ground-segment operators to




software-defined networks and standards, will create new opportunities for integration with the terrestrial grid. Our respondents tended to differ, however, on the pace and extent of that integration, and some said the large telcos and MNOs will dictate how that plays out.

The Customer Was Always Right

For most of its history, satellite communications has been shaped by scarcity. Assets in space were vanishingly small compared to terrestrial alternatives. Capacity was highly limited and it took great ingenuity with frequencies and waveforms to expand it. Everything was custom-made to proprietary standards or no standard at all.

Scarcity fostered a “take it or leave” attitude by the industry. It forced satcom customers to adapt what they wanted to the satellite network’s limited capabilities. Contrast that the very different approach of Amazon and Blue Origin founder Jeff Bezos: “We’re customer obsessed. We start with what the customer needs and

we work backwards.”

The most exciting development revealed by this report is that, at long last, the satcom service business is beginning to offer customers what they have wanted all along: the quality of service they need, where they need it, without technical complexity (for them). That’s a business model with huge potential. It should encourage us all that, according to attendees at the latest Mobile World Congress, mobile operators are voicing concerns about satellite taking away their customers. Wouldn’t that be a thing? 



Robert Bell is the executive director of the World Teleport Association (www.worldteleport.org), which conducts research into the teleport and satellite industry, provides a unified voice for teleport operators and offers Teleport Certification programs to service providers. *The Teleport Business Model in a Software-Driven World* is available for free to members and for sale to non-members at <https://www.worldteleport.org/store/viewproduct.aspx?id=23264901>. He can be reached at: rbell@worldteleport.org



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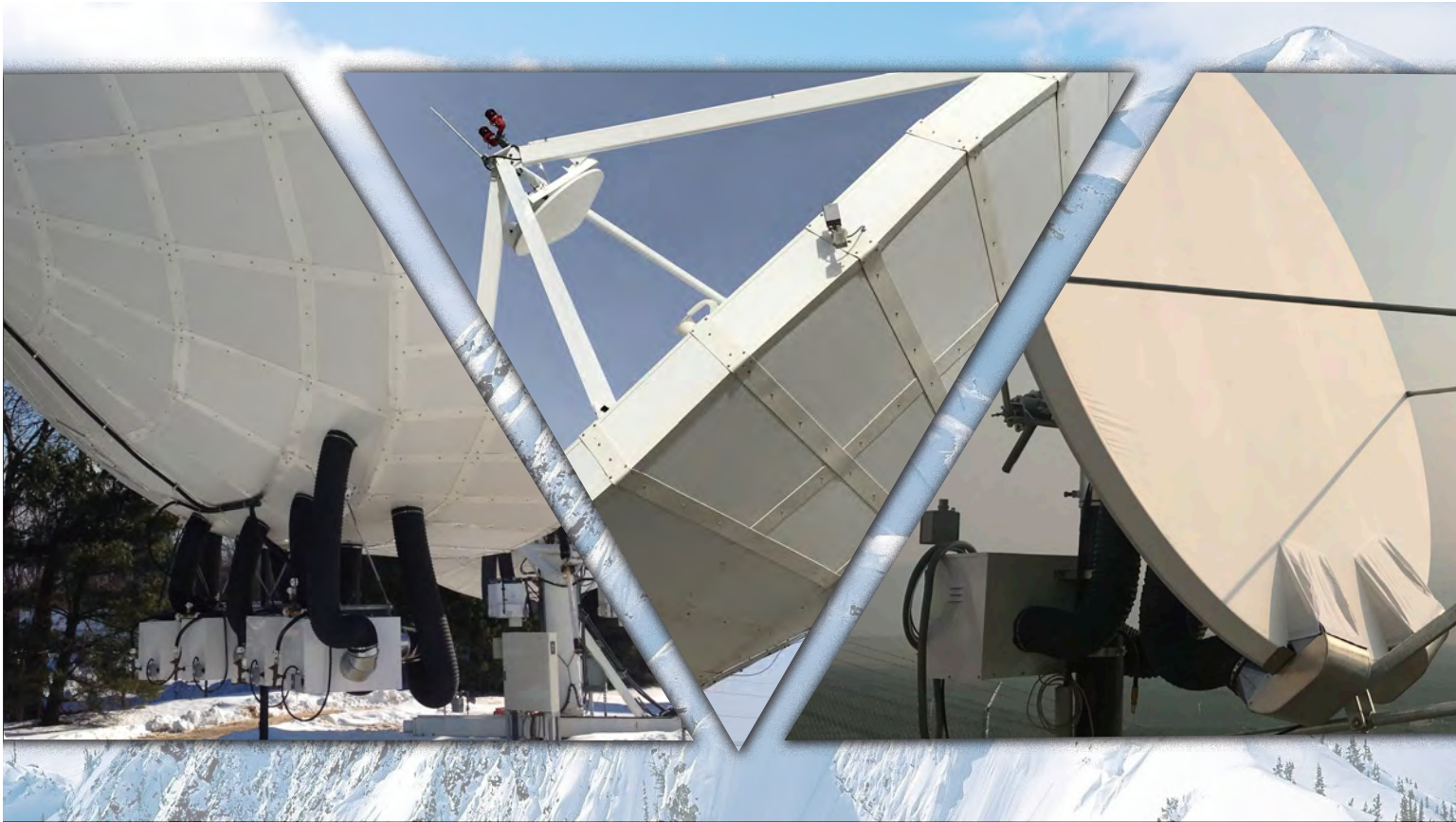
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Germany's First Private Rocket Launch has the Potential to Revolutionize Rocketry with Game-Changing Technology

by Virgil Labrador

In the heart of Germany, a rocket startup company, esteemed in the German tradition of excellence in rocketry and space technology, has been quietly making preparations for Germany's first private launch in the new space era with a launch window presumably starting at the end of April this year. The company, HyImpulse, founded six years ago by entrepreneurial aerospace engineers from the Stuttgart University, has been working diligently on their mission in a seemingly remote part in Southern Germany, nestled close to the rocket test center of the German Aerospace Center (DLR), which has proven advantageous for the company's research and development efforts.

While HyImpulse may have operated quietly thus far, their ambitions speak volumes and they seem to be on the right track to surpass their German competitors. If successful, their innovative new approach to space transport has the potential to make space exploration not only more economical but also more sustainable. Following in the footsteps of Germany's pioneering achievements in rocketry and space technology, HyImpulse aims to reinvigorate Europe's presence in the aerospace industry with innovative space transportation solutions reminiscent of the glory days of Ariane.

Hyimpulse's innovative SR75 single-stage rocket which will be launched at the Koonibba Test Range, Australia in late-April this year.

Led by a team that previously broke a world record with their first student rocket in 2016, HyImpulse has been developing a groundbreaking propulsion system – a hybrid engine that utilizes paraffin as its propellant, a substance akin to non-explosive candle wax—a common household item. The use of paraffin would present many benefits and advantages, not the least of which includes much lower cost, highest performance and safe and easy to use.

Hybrid rocket engines use a combination of both liquid and solid propulsion. Therefore, they offer the simplicity and safety of solid rockets together with the controllability of liquid rockets. This makes them easier to handle and store, and they have fewer parts than traditional engines.



Hyimpulse's innovative SR75 single-stage rocket which will be launched at the Koonibba Test Range, Australia in late-April this year.

By eliminating the need for costly components like high-performance turbo-pumps, HyImpulse's engine offers a much more cost-effective and efficient solution for launching payloads into space. Konstantin Tomilin, Chief Operating Officer of HyIm-



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Firing of the SR75 motor during a qualification test of the HyImpulse test facility in the Shetland Islands.

pulse, expressed his confidence in the technology, stating, "Our in house developed hybrid propulsion system will disrupt the current launch industry. It stands out for its ease of operation, unparalleled safety features, and rapid response capabilities, marking a new era of efficiency and technological advantages in launch."

HyImpulse's first version of its orbital Small Launcher, SL1, has a payload capacity above 600 kg to low earth orbit, while its SR75 is a single-stage rocket also powered by HyImpulse's rocket engine using a solid paraffin fuel and liquid oxygen. It carries payloads up to 250 kg and to fly up to an altitude of 300 km. The upcoming SR75 maiden launch is set to flight-qualify this new propulsion technology, a cornerstone in the development of their SL1 three stage orbital launcher.

HyImpulse CEO Mario Kobald says, 'Launching our first rocket from the Koonibba Test Range is a huge

milestone for our company and we are looking forward to the learnings that this launch will provide our team.' Co-CEO Christian Schmierer adds, 'Launching HyImpulse's first rocket from the other side of the globe, shows Southern Launch's and HyImpulse's capability of serving a global market in a rapid, efficient and responsive cooperation from anywhere around the world.'

The coming launch will be at the Koonibba Test Range, Australia's largest commercial rocket testing facility. The Koonibba Test Range specialises in suborbital launches. The Test Range with the Koonibba Aboriginal Community Corporation. The launch window will start at the end of April.

In parallel to the SR75 flight activities, the development of the SL1 orbital launcher, with ten clustered SR75 motors, is progressing well. Relationships are being established with potential subsystem suppliers

i.e. structures and electronics, with HyImpulse retaining full control on the propulsion system, the trademark of HyImpulse. At the same time, HyImpulse acts as system integrator for other subsystems that can be acquired commercially and very effectively from space and non-space industries. This approach reduces capital expenditure and ensures that subsystems using the latest technologies can be acquired in a competitive and timely manner from world class providers

The SR75 rocket will be a significant milestone in HyImpulse's drive towards global awareness of this new rocket technology and providing safe, reliable and lower cost launches. It's a company well worth watching. So watch this space for further developments.

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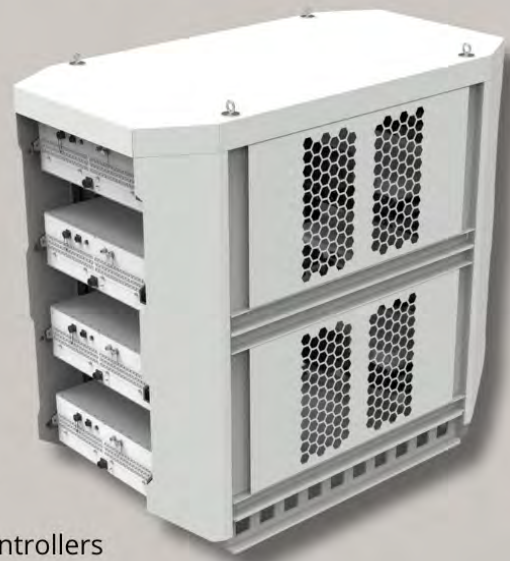


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MERGERS & ACQUISITIONS

AERKOMM and Nasdaq-Listed IX Acquisition Corp. Announce Merger Agreement

Silicon Valley, Calif., March 29, 2024 -- AERKOMM Inc. (Euronext: AKOM, OTCQX: AKOM), a satellite technology company providing multi-orbit broadband connectivity solutions, and IX Acquisition Corp (Nasdaq: IXAQU, "IXAQ"), a SPAC focused on the technology, media and telecommunications industries, have entered into a definitive Business Combination Agreement and raised US \$35 million in a private placement.

The combined business will be called AKOM Inc.) and its ordinary shares are expected to result in AERKOMM transferring its listing from Euronext/OTCQX to Nasdaq under the ticker "AKOM", following the closing of the business combination. It is the intention of the combined business to also maintain a secondary listing on Euronext.

Transaction highlights

- Adjusted enterprise value of AERKOMM is US \$200 million, as well as up to US \$200 million of earnout shares for the AERKOMM shareholders, if certain milestones are achieved.
- Transaction supported by a fundraise of US \$35 million common equity PIPE (Private Investment in Public Equity) subscribed concurrently with the signing of the BCA. The PIPE investors consist of new and current shareholders in AERKOMM. There may be more capital raised prior to the business combination, but there



A Space Tech Company

is no minimum cash condition for the transaction.

- Existing AERKOMM shareholders are anticipated to roll 100% of their equity and may own approximately two-thirds of the new combined pro forma AKOM, subject to final amounts of PIPE capital raised and of cash retained in IXAQ trust.
- The Nasdaq-listing is intended to enable AKOM to execute its strategy to provide carrier-neutral and software-defined infrastructure to deliver mission-critical, multi-orbit satellite broadband connectivity.
- Completion of the transaction is expected in Q3 2024, which is subject to SEC review, to approval by IXAQ and AERKOMM shareholders and to the satisfaction of certain other customary closing conditions.

AERKOMM is an innovative satellite technology company, providing carrier-neutral and software-defined infrastructure for multi-orbit, end-to-end satellite broadband connectivity, serving both public and private sectors, including Aerospace & Defense and Civilian Telecommunications. AERKOMM has a range of next-generation satellite technologies that offer broadband connectivity by collaborating with satellite partners and mobile network operators to link users and

platforms on the edge to core infrastructure hubs.

AERKOMM has established a strong engagement with leading satellite constellation operators spanning multiple orbits, including low-earth orbit (LEO), medium-earth orbit (MEO), geostationary earth orbit (GEO) and highly elliptical orbit (HEO). Additionally, AERKOMM's technology is currently being implemented in the Aerospace & Defense market, having been tested live in selected defense assets.

AERKOMM is developing partnerships with both public and private sector clients that have increasing demands for multi-beam and multi-orbit satellite communications solutions.

AERKOMM holds a strong market position. Its target markets, Aerospace & Defense and Civilian Telecommunications, are expected to grow from c. \$20bn to c. \$60bn by 2030 (Sources: Fortune Business Insights, Boeing 2023 Annual Report, NSR Report, Teal Group).

AERKOMM has considerable technical expertise with executives and innovators drawn from semi-conductors, aerospace, defense, telecoms dual-use and satellite communications sectors, according to the company.





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Space Executive Clay Mowry Joins Vast as Advisor

Long Beach, Calif., March 28, 2024 - Vast, a pioneer in space habitation technologies, announced the appointment of **Clay Mowry** as its newest Advisor.

Mowry's career spans over two decades in the commercial launch, satellite, and space station sectors.

As President of the International Astronautical Federation (IAF), Mowry is a globally recognized leader in the space community, within industry and government alike.

In his role as Advisor, Mowry will provide guidance and counsel on the growth of Vast's commercial space station business.

Vast is executing its strategy to build a robust



Clay Mowry

pipeline of international commercial and government customers for Haven-1, the world's first commercial free-flying space station. Vast is equally committed to increasing opportunities to collaborate with NASA on Private Astronaut Missions, Commercial LEO Destinations (CLD), and other flight opportunities as its space station fleet evolves.

Mowry brings a wealth of experience to inform and help refine that execution. From his time at Voyager he has extensive expertise

in the CLD market, with a track record of building international partnerships, and from his time at Blue Origin he has unique experience pioneering sales in the human suborbital spaceflight market as well.

"We are delighted to welcome Clay Mowry to Vast as an Advisor," said Max Haot, CEO of Vast. "Clay's experience and insight will be instrumental as we continue to push the boundaries of what's possible in space habitation. His contribution will play a key role in supporting Vast's strategic direction and driving our mission forward."

Prior to joining Vast, Mowry held various leadership positions. In addition to the aforementioned Presidency of IAF, he was the Chief Revenue Officer at Voyager Space, Vice President for Global Sales at Blue Origin, and President and Chairman of Arianespace's U.S. subsidiary. His multifaceted career has established him as a respected leader in the space industry.

Comtech Names President of Terrestrial & Wireless Networks Business

Chandler, Ariz., March 21, 2024 – **Comtech** (NASDAQ: CMTL) today announced the appointment of telecommunications and public safety industry leader **Jeff Robertson** as the company's new President of its Terrestrial and Wireless Networks business segment.

Prior to joining Comtech, Robertson served as President & CEO of Intrado Life Safety, a company specializing in first responder technology in North America. Under his leadership,

Robertson enhanced Intrado Life Safety's operating structure, implemented critical

digital transformation initiatives, migrated legacy products to next-generation cloud-based infrastructures, improved employee retention, and strengthened key go-to-market partnerships in under four years. Intrado Life Safety was sold in 2023 for \$2.4 billion under Robertson's leadership.

Throughout his career, Robertson has held numerous leadership roles, including Senior Vice President of Public Safety for startup innovator RapidSOS, CEO of Airbus DS Communications North America, Vice President and General Manager of Intergraph's public safety software division, CEO of TCI – TelControl, and CML Emergency Services. He was also the founding executive director of the 9-1-1 Industry Alliance.

"Jeff will be instrumental in helping Comtech continue to grow and capitalize on core business objectives," said John Ratigan, Interim CEO of Comtech. "Jeff brings unique insights and deep industry expertise that are well aligned with our continued One Comtech journey, terrestrial and wireless technology developments, and long-term strategies in key markets."

As President of the Terrestrial & Wireless Networks segment, Robertson will have P&L responsibility



Jeff Robertson



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across the enterprise. Robertson will oversee all aspects of engineering, program management, operations, new product development, system design, strategic planning, and customer engagement for all Terrestrial & Wireless Networks areas of focus.

“I am thrilled to be a part of Comtech,” said Robertson. “Comtech already enjoys a leadership position in NG-911 solutions. I am excited to lead this business forward as we continue to help states and local governments around the world to provide the best possible public safety solutions for their communities. Comtech has the right people, products and culture to capture the opportunities ahead of us.”

Robertson has been involved in the field of public safety technology for over 25 years, serving as a sworn officer and deputy sheriff. He also has extensive experience in software development for the public safety sector and was awarded a U.S. Patent for Voice Over IP Delivery of 911 calls, which is widely used across the industry today.

Robertson graduated from the executive program at the Wharton School – University of Pennsylvania and received a degree in telecommunications from Toronto Metropolitan University.

Virtus Solis Appoints New Members to its Industry Advisory Board

Troy, MI, March 19, 2024--Virtus Solis CEO/Founder John Bucknell and CTO/Founder Dr. Ed Tate announce the appointment of the following distinguished new members to our Industry Advisory Board:

- **Chair, David Berger** - VST

IRTUS SOLIS

- Government and Industry Affairs Advisor
- **Bo Bejmuk** - NASA Advisory Council
- **Bill Gowan** – VST Program Management Advisor
- **JD Hammerly** - Co-founder GridWise Alliance Thomas (Tom) Jemison - Director Chemical Manufacturing
- **Francois Paul Lambert** - Space Attorney – Space Law
- **Graham Orr** - VST Technical Advisor Rocket Propulsion/ Computing
- **Peter Savagian** - SME: Power Electronics Industrialization
- **Eric Siverston** - CEO Quantum Trace
- Vern Steele - VST Launcher Advisor
- **Dr. Ed Tate** - VST Co-founder, Chief Technical Officer
- **Bryan Zetlen** - VST Space Operations, Launchers-Payloads

VST is building a diverse industry board and seeking 2 additional members. If you are interested in Board service, please contact:

- Chair, **David Berger** David@virtussolis.space
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clean solar energy 24 hours a day.

Virtus Solis Technologies (VST), established in 2019, is focused on commercializing space based solar power by the end of the decade. A winner of the NASA Watts on the Moon challenge, VST built 3 generations of long-distance wireless power hardware. In 2023 VST established the record for highest X-band rectenna efficiency and demonstrated the longest distance end-to-end wireless power transfer with electronic beam steering. In preparation for upcoming orbital demonstrations, Virtus Solis Technologies formed their Industry Advisor Board (IAB) with experts from aerospace, manufacturing, utilities, semiconductors, IT and government. We are excited to welcome these members for their industry expertise and knowledgeable perspectives in:

- space based solar power;
- energy markets and utilities;
- rocket, satellite, and high-volume electronics manufacturing;
- space operations;
- software, controls, and cyber-security; and
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For more information go to:

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Forecast to 2029 : Squeezed AVoD Platforms Turn to Subscriptions

Bristol, UK., April 3, 2024 - In a cruel twist of irony, subscriptions are becoming ever-more essential to the survival of AVoD platforms. The stalwarts of internet video are set to bring in over US\$ 546 billion in revenue over the next five years, but the ad-supported business model which many of these platforms pioneered is clearly serving them no longer according to Rethink TV.

A new forecast from Rethink TV finds that by 2029, subscription revenues will make up almost half of user-derived revenues for AVoD platforms, with advertising revenues holding a shrinking lead of just a few percent. In part this has been caused by the rise of SVoD-with-ads. In a bid to keep subscription fatigued users who are feeling the pinch of economic turbulence, basically every major SVoD platform (except for Apple TV) now offers some sort of discounted ad-supported tier.

Add to this the rise of FAST platforms like Tubi and Pluto TV, and suddenly the classic AVoD platforms are being slowly squeezed out of the OTT video advertising market. This has forced a strategy that is the mirror image of the SVoD story – AVoDs are now trying to double down on subscriptions.

The drive for paid subscribers has questionable merit – namely due to the subscription fatigue that most consumers feel – but an undeniable truth is that paid subs generate far more revenue than free users. By 2029, we predict that a free user on an AVoD platform will generate just US\$ 8 on average. By contrast, a paid sub will generate US\$ 39.

All of this means that the once-clear definitions surrounding OTT business models have almost blurred beyond distinction. While we still can, Rethink TV has chosen to examine SVoD, AVoD and FAST in distinct, separate reports. This is the first of three, all of which will arrive in the first half of the year.

Our SVoD forecast will include any of the large global platforms that arrived with Subscription-only models to begin – Amazon Prime Video, Apple TV+,

Comcast's Peacock, Disney+, ESPN+, Hulu, Netflix, Paramount+ and Warner Bros. Discovery Max.

In the ad-supported world, we decided to delineate an AVoD service as one that is focused on titles, while a FAST service is channel-focused. Both might feature live content, but FAST is distinct from giving the impression that it is a direct replacement for conventional broadcast TV, thanks to its linear channels.

The largest AVoD platform by any reasonable metric is YouTube. Google's flagship video service currently holds 44% of the world's AVoD MAUs, as well as an astonishing 62% of the global AVoD watch time. A natural follow-on from the market leader is the five Chinese AVoD platforms that collectively make up 40% of the global AVoD MAUs – Bilibili, iQIYI, Le.com, Tencent Video and Alibaba's Youku.

The two other AVoD platforms that are notable in their global footprint are Vivendi's Dailymotion, which is focused on news clips and UGC, and Indian video service MX Player, which is owned by Times Internet and serves premium assets. Aside from that, we have Sony's anime-focused video service Crunchyroll, Fandango At Home, which is Fandango Media's rebranding of Vudu, Rakuten-owned Viki, PCCW-owned Viu, and Viacom18's Voot platform, with the latter three largely APAC-based. All of these platforms focus on 'premium' content, with a market share of global AVoD MAUs hanging somewhere around 1%.

Rethink Technology Research is an analyst firm that has established itself over its 22-year history as a thought leader in 5G, and all forms of wireless; the entertainment ecosystem and streaming media; the Internet of Things; and has now embarked on the energy marketplace. Rethink TV is our video research team, producing market forecasts, technology white papers and tracking operator-technology vendor relationships in OTT video.

For more information go to:

<https://rethinkresearch.biz/report/avod-forecast/>

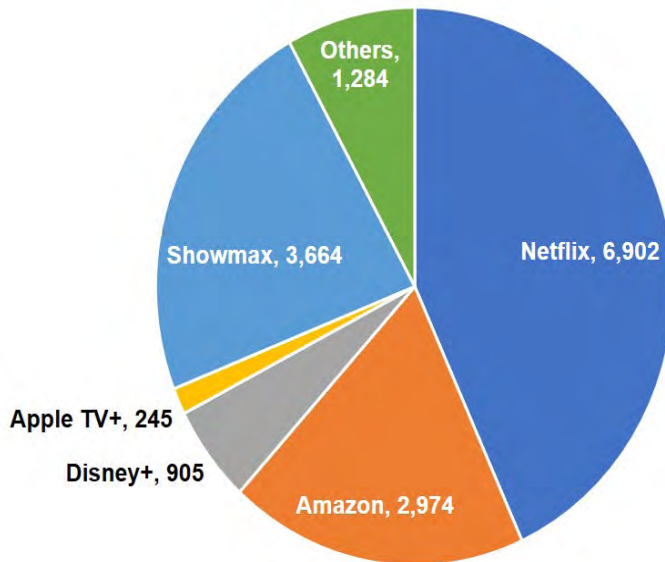


Africa SVOD to add 9 million subscriptions

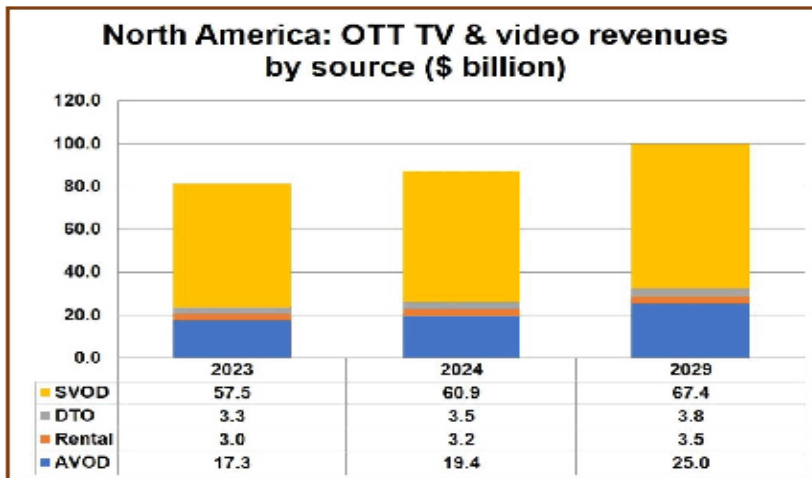
London, UK, February 10, 2024--Sub-Saharan Africa will have 16 million paying SVOD subscriptions by 2029, up from 7 million at end-2023. South Africa and Nigeria will supply 59% (9.4 million) of the region’s total. However, SVOD penetration will still be low by 2029, with only 7.1% of TV households paying for at least one subscription – although this is up from 4.7% at end-2023 according to Digital TV research.

Netflix will remain the SVOD market leader, with 6.9 million subscribers by 2029. Showmax will be the second largest platform with 3.7 million paying subscribers. With its roll-out expected to be limited to South Africa, Disney+ will only have 905,000 subscriptions by 2029.

Simon Murray, Principal Analyst at Digital TV Research, said: “SVOD is a battle between Netflix and regional player Showmax. Rich in local content and sports rights, Showmax now has access to NBCUniversal, Sony Pictures and HBO content. Showmax’s parent MultiChoice recently rejected a takeover bid from Canal Plus.”.



VITAL STATS



North American OTT TV episode and movie revenues will reach US\$ 100 billion in 2029; up from \$81 billion in 2023. The US will contribute \$16 billion from the \$19 billion additional revenues, with Canada supplying the rest. US revenues will be \$92 billion in 2029 according to new research from Digital TV Research.

Satellite Industry Forum

Tuesday 28 May 2024

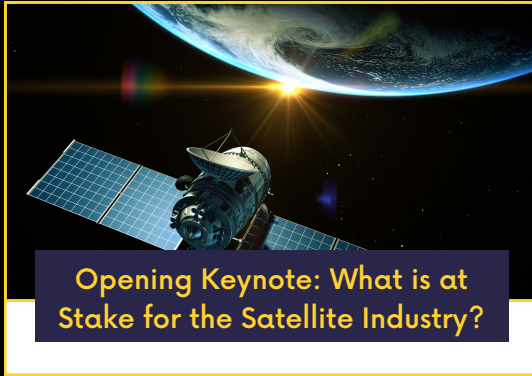
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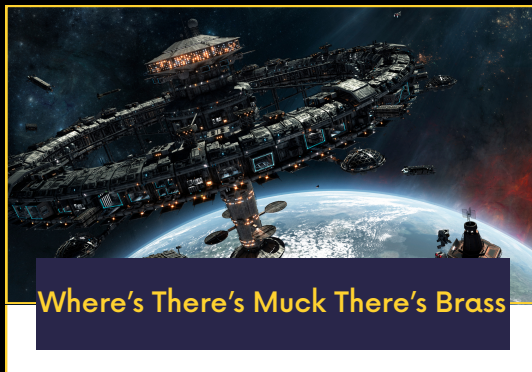
Looks like 2024 is going to be an exciting year for the satellite industry! Will the NSGOs take over from the geostationary players – or is that just a perception based on hyperbole and press releases? Is satellite-to-device the next “big deal” – but will we ever get much more than just messaging and low speed data? And those tens of thousands of satellites . . . with all the debris and junk. Looks like the world is waking up to the problem big time! Are software defined satellites living up to their claims and expectations – and to what extent is inflation and supply chain problems affecting the economics? And is linear TV finally on its last legs? How do all these questions link up?

All this, and more, at the **Satellite Industry Forum** in Singapore on **28th May**. Join us for a full day of riveting discussions with key industry leaders where we will explore all facets of the satellite sector in Asia-Pacific.



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