chapter 5 Satcoms

Martin Jarrold, vice president, international programme development, GVF

GVF's foundational mission direction focused heavily on regulatory matters through its Regulatory Working Group (RWG). The Group focuses on dialogue with government policy and regulatory administrations, and with inter-governmental organisations, to improve the regulatory and market access conditions that facilitate a cost-effective operating environment for affordable satellite-based services. The RWG works to develop consensus-based satellite regulatory guidance for governments, liaising directly with administrations to facilitate implementation of effective Earth station/VSAT licensing, satellite landing rights, licensing fees, and other elements of regulatory conditions applied to the industry and its customers.

The RWG continues to leverage its global experience with satellite regulation to provide guidance to regulators on best practices for fair, transparent, and efficient satellite licensing policies, urging regulators to adopt streamlined licensing requirements, fair fees, and blanket licensing or registration wherever possible, and continuing its advocacy for a global Open Skies policy.

GVF has successfully brought together facets of its regulatory-related work with its training and capacity building initiatives. In late-2018 we collaborated with the ITU in introducing a value-added capacity building element to the World Radiocommunication Seminar (WRS), delivering a symposium focused on capacity building for national regulators. Delivered at ITU HQ in Geneva, the objective of the Symposium programme was to inform national regulatory authorities about the latest technology innovations in satellite communications, creating a greater level of understanding of the nature of the rapid mobilisation of satellite-based communication links, and providing an understanding of methodologies and approaches to reducing and mitigating the causes of satellite interference.

During the Symposium, WRS2018 delegates from around the world had the opportunity to advance their understanding of the latest satellite communications systems and service trends, as well as of regulatory, policy and spectrum coordination issues. Other Symposium sessions addressed the coexistence of small satellite constellations in low Earth orbit (LEO)/non-geostationary orbit (NGSO) with existing systems in geostationary orbit, related regulatory issues and new solutions on space monitoring.

World Radiocommunication Conference

More recently, GVF's Secretary General attended the latest (2019) quadrennial gathering of the ITU's Sector R (the Radiocommunication Bureau), known as the World Radiocommunication Conference (WRC). Telecommunications regulators and industry representatives gathered to discuss competing claims for spectrum among different radiocommunications services. As at previous WRCs, the 2019 Conference was an opportunity to determine spectrum allocations between the satellite and other sectors such as the International Mobile Telecommunications (IMT) industry, and an opportunity to create new spectrum rights for satellite and provide operational flexibility. These opportunities were largely successful.

The agenda item receiving the most attention from the satellite industry proposed allocation of over 33GHz of spectrum to IMT. A little over half of that which was being sought was ultimately identified for IMT (i.e., 17.25GHz), and important protections for key satellite spectrum in the C, Ku, and Ka-bands was secured.

Another agenda item of significant interest for much of the satellite industry that saw a positive outcome concerning identification of spectrum for mobile uses via satellite, providing high bandwidth services in transportation. ESIM-based ('Earth Stations in Motion') satellite services are enjoying a growth cycle which is forecast to continue. WRC-19 increased the spectrum for ESIM services in the 28GHz band and harmonised the international framework for authorising ESIM services. The Conference also decided to have a study performed for WRC-23 to define the conditions for communications of ESIMs with geostationary satellites.

A further positive outcome for the satellite industry was the decision to allocate spectrum, 51.4GHz to 52.4GHz, for uplinks for fixed satellite service (FSS) gateways. This will improve services to end-users by freeing up Ka-band spectrum for user uplinks which can be used to provide new services such as 5G.

Also established were new rules regarding NGSO satellites which mitigate the risk of signal interference between the NGSOs and the GSOs sharing the same frequency bands. Protection of GSO satellites from NGSO satellites at C-band frequencies was maintained and a framework for NGSO satellites to operate in the Q/V-bands (40GHz to 50GHz) was established.

In relation to the building of the NGSO mega-constellations, rules were adopted requiring these systems to adhere to a specified milestones schedule, with failure to meet deadline targets leading to possible loss of assigned spectrum.

As with prior World Radiocommunication Conferences, WRC-19 carried the risk that the satellite industry would lose spectrum rights currently enjoyed by the industry as new technologies emerge and others develop. Advances in mobile telecommunications technology such as 5G, and the development of High-Altitude Pseudo Satellite (HAPS) platforms, also rely on spectrum and WRC-19 considered proposals that could have


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provided spectrum to enable these technologies at the expense of the satellite industry. Various decisions were taken which mitigated these risks.

Another area of keen interest for the IMT and satellite industries is the provision of services in the C-band. Satellite video and business services delivered via C-band are currently utilised by millions of customers worldwide. Billions of dollars have been invested by the satellite industry in providing infrastructure needed to deliver these services. This 'mid-band' spectrum is also attractive to IMT as it does not possess many of the shortcomings of the higher frequency millimetre wave bands. At WRC-19, the decision was taken to protect C-band downlinks in Africa and Asia using the 3.6GHz to 4.2GHz range and it will not be on the agenda for WRC-23.

Decisions taken at WRC-19 lay the groundwork for future spectrum battles. Studies initiated at WRC-19 create the possibility of battles with Mobile (not IMT) in the European region over primary status in the 3.6GHz to 3.8GHz. Similarly, a study to be completed for WRC-23 creates the possibility of a spectrum battle with IMT in the Americas region around the 3.3GHz to 3.4GHz and 3.6GHz to 3.8GHz bands. Another study initiated at WRC-19 for conclusion at WRC-23 is one that calls for studying the use of IMT for fixed wireless broadband in the frequency bands allocated to the fixed services on primary basis and identified for IMT.

While these studies carry risks for satellite that will be addressed at WRC-23, other decisions carry the potential of favourable decisions at WRC-23. WRC-23 will address an agenda item for both mobile and fixed satellite service spectrum along with ESIMs operating with GSO/NGSO in Ku- and Ka-band, respectively. Studies to be concluded prior to WRC-23 will also evaluate inter-satellite ('space-to-space') links which are important for global NGSO and hybrid NGSO-GSO networks.

Also important to the satellite industry is what is not on the WRC-23 agenda. Specifically, the C- (3.6GHz to 4.2GHz), Ka (particularly 28GHz), and Ku-Bands are all off the WRC-23 agenda and this should deter some of the initiatives launched by other telecommunications platforms to acquire spectrum at the expense of satellite communications.

Terminals type-approvals

Another core feature of GVF's mission has been development of a consensus-based framework to improve efficiency in satellite operators' terminals type-approval procedures. This initiative is manifested through the GVF Mutual Recognition Arrangement (MRA) administered by the GVF MRA Working Group (MRA-WG).

Using the framework, once a type approval is provided to a manufacturer by any one of the participating satellite operators, other operators may recognise the results of the tests conducted during the first operator's type-approval process, avoiding test repetition.

To achieve this, the MRA-WG created procedure GVF-101, which defines the standard tests that an antenna/Earth station manufacturer should perform to apply for type approval from any satellite operator. This not only improves the quality and completeness of test data but helps reduce the time and cost required to bring new ground-segment technology to market.

Ground terminal equipment serving the satellite service industry has to meet high performance standards to avoid causing interference to adjacent satellite operations. Minimum performance recommendations are defined by the ITU and operators are required to adhere to these but often increase the specification requirements to enhance the quality and reliability of the service provided to their customers. Compliance with ITU or satellite operator specifications can only be demonstrated by conducting thorough product testing.

These initiatives enhance the reliability of satellite communications services and reduce factors that cause interference to primary and adjacent satellite services. This work has resulted in the development of GVF's internationally recognised type approval test

JANUARY 2019

The Nigerian Communications Commission (NCC) developed commercial satellite communications guidelines for its local telecoms market. The guidelines now in force regulate commercial satellite services in all orbits in Nigeria. All commercial space segment providers with footprints covering the country as well as earth station operators are required to regularise their operations with the commission as specified in the guidelines on or before 29 February 2019. It is now a criminal offence to provide communications services without a requisite license, authorisation or exemption. The requirements can be seen at ncc.gov.ng/licensing-regulatory/legal/guidelines

FEBRUARY

Satellite operator Hellas Sat has confirmed that the Hellas Sat 4 satellite was successfully launched from French Guiana and will be positioned to provide coverage over Southern Africa, as well as Europe and the Middle East. Hellas Sat, a subsidiary of Arabsat, said the new Ku-band satellite, positioned at 39 degrees, "will extend Hellas Sat's capacity and geographical reach to meet the growing demand for applications that include video, maritime connectivity, cellular backhaul, corporate networks and government services". The Hellas Sat 4 satellite was successfully launched by an Ariane 5 launch vehicle from the Guiana Space Centre in Kourou. Christodoulos Protopapas, chief executive officer, Hellas Sat, described the satellite as "a powerful addition to our network and a major milestone to our business plan". He said: "It brings new capacity that will enable our existing and new customers to unlock new growth opportunities in applications including broadcasting, mobility and private data networks. Moreover, it will enable us to deliver high quality services at competitive prices as well as unmatched performance, resiliency and redundancy to our customers."

MARCH

Eutelsat Communications successfully mated the platform and payload of the Konnect Satellite, a step towards providing 75gb/s of capacity across a network of 65 spotbeams to cover Africa and western Europe. Konnect is a next generation all-electric High-throughput satellite (HTS). It uses Thales Alenia Spaces new Spacebus Neo platform. Eutelsat described it as "a major pillar" of its strategy to return to growth, enabling the company to bolster its presence in the fast-growing broadband market. According to Eutelsat, the operation was an important milestone in the construction of the satellite in preparation for its launch by the end of 2019. Yohan Leroy, deputy chief executive officer and chief technical officer at Eutelsat, said "This mating operation represents a key step in this significant satellite programme." Eutelsat Konnect had a successful launch in Guiana in January 2020, via an Ariane 5 rocket. It is expected to be fully operational by the end of 2020 providing coverage over Sub-Saharan Africa. According to Eutelsat it will address direct to user consumer and broadband for enterprises, as well community networks connecting to Wi-Fi hotspots, mobile phone backhauling and rural connectivity.

APRIL

Sudatel, through one of its companies Sudasat and Hajar Group, and in partnership with Canar Telecom, helped send Arabsat 6A satellite into orbit. The satellite will allow Sudatel-owned Sudasat to provide broadband services across Sudan to internet service providers, VSAT subscribers and mobile network operators. It also provides multi-purpose solutions for commercial and government sectors. The

procedures, used to qualify the performance for Earth stations leading to formal type approval by a satellite operator. Industry has seen advances in the technology regarding the design and manufacture of satellite ground terminal equipment, advances calling for the development of new test methods to characterise terminal performance to support the growing volume of satellite terminals.

SOMAP – Satellite operator's minimum antenna performance

Working within the overall framework of the GVF MRA-WG, a group of satellite operators – AsiaSat, Eutelsat, Inmarsat, Intelsat and SES – have collaborated to develop updated guidance to antenna manufacturers regarding operators' expectations for new antenna products, and on demonstrating compliance with the specification requirements of SOMAP, effective September 2019.

The SOMAP initiative was started, and related requirements codified, to improve Quality of Service (QoS) worldwide for the industry and to minimise interference. The availability of quality products demonstrating compliance with operator specifications provides manufacturers with a valuable sales tool to differentiate their products. The SOMAP satellite operator group has the final authority for resolving questions regarding product compliance.

The SOMAP framework consists of: Minimum Antenna Testing Requirements; Minimum Antenna Performance Requirements; and, Performance Data on Manufacturer Product Datasheets, and has the objective of offering consistency for customers and antenna manufacturers. It does not replace the formal type approval procedures for each of the operators but establishes minimum performance that each of the operators expect when deploying equipment which has not been formally type approved. SOMAP is an important tool for achieving the QoS which satellite users expect and for the prevention of satellite interference.

Andrey Kirillovich, director, integration services & projects, RSCC

When we speak about sub-Saharan Africa (SSA) everybody is excited by the magic of the numbers:

- 1B people, which comprises 13% of the World's population, to be doubled by 2050;
- 60% rural population (400M people);
- 215M households.

On the other hand, SSA:

- Provides only 2% of the world's GDP;
- By 2050 with current population expected to double, 90% of it will be extremely poor, living for less than $2/day;
- Electrification rate is only 43%;
- Fixed broadband penetration is only 8%;
- Mobile broadband is doing a bit better, but still the penetration rate is below 30%.

What are the key challenges to increased connectivity and affordability in Africa?

According to GSMA, mobile internet adoption is SSA is only 24%. Region accounts for 40% of the global population not covered by mobile broadband network. Such small adoption of mobile broadband is affected 46% by the usage gap - lack of affordability and by 30% by the coverage gap – accessibility.

Mobile data has become more affordable for African people. The cost of 1GB has reduced to 6.8% of average monthly income in 2018 from 8.6% in 2017 (GSMA). But it still remains above the 2% of monthly income threshold for many countries of the region.

The two largest barriers for mobile internet adoption in SSA are lack of digital skills or literacy and affordability.

As a result, the majority of mobile connections in SSA are still 2G/3G (voice and SMS), so it remains narrowband. 4G is just start emerging in most countries and mainly in the downtown of big cities. 5G is still somewhere beyond the horizon.

So the very important issue that local connectivity providers have been solving is how

launch was watched by Sudatel CEO Eng. Tarig Hamza Zain Elabdein, who is also chair of the board of directors at Sudasat.

MAY

Avanti Communications, the UK-based operator, has penned a five-year agreement with MGI Global services which enables the latter to provide high-speed satellite broadband services across Angola, South Sudan and Chad.

The new partnership will improve the penetration of reliable satellite broadband in these three countries, and significantly increase access to the internet.

Using Avanti's latest Ka-band satellite HYLAS 4, MGI will provide affordable high-speed satellite broadband to connect governments, enterprises, schools, clinics and communities in Angola, South Sudan and Chad, especially in rural and other locations where terrestrial networks are either limited or unreliable.

Avanti chief executive officer, Kyle Whitehill, said: "HYLAS 4, the latest addition to our satellite fleet, was launched to complete our coverage of sub-Saharan Africa."

MGI Global Services' managing partner, Llija Reymond, added that the company was committed to providing governments, NGOs, businesses and communities across sub-Saharan Africa with reliable and top tier telecommunications services. Reymond added, "Avanti's HYLAS 4 enables us to provide customers with affordable high speed and quality broadband flexible Ka band satellite technology.

JUNE

PCCW Global and Télécoms Sans Frontières (TSF) have received official recognition from the Mozambique National Institute for Disaster Management (INGC) for their combined and ongoing mission to provide critical communications services following the two tropical cyclones which recently hit the country. One VSAT communications system was installed in the Matarara coordination centre, from which relief operations to five surrounding communities were conducted. A second VSAT was also installed at the Médecins Sans Frontières (MSF) cholera treatment centre in Mafambisse. A further two VSATs provided by PCCW Global have been handed over to Mozambique's INGC, enabling the organisation to rapidly deploy critical communications for any similar emergency in the country. The cyclone also devastated the region's electricity and communications infrastructure, frustrating disaster response teams that require effective communications in order to coordinate emergency services and relief efforts. Beira city itself suffered extensive damage, with almost 80 per cent of the economic infrastructure destroyed. One month later, Mozambique was struck by yet another tropical cyclone, Kenneth, resulting in the deaths of more than 40 people, displacing a further 21,000, and again damaging infrastructure critical for rescue and relief efforts. "PCCW Global's prompt reaction and instrumental aid, since the beginning of our operations in the country, have been essential for the positive impact of our mission for the affected population," said Jean-François Cazenave, chairman, Télécoms Sans Frontières. "The situation on the ground has been very difficult since the beginning, with isolated areas hard to reach and a significant need for rapid telecommunication connections. The contribution of PCCW Global's team on the ground has thus been very important for the success of TSF's operations."

JULY

Eutelsat Communications announces that it had secured a contract with GLOBAL technologies for the provision of C-band capacity on its EUTELSAT 10A satellite for connectivity and communications for the

Satellite Capacity

55E HIGH QUALITY

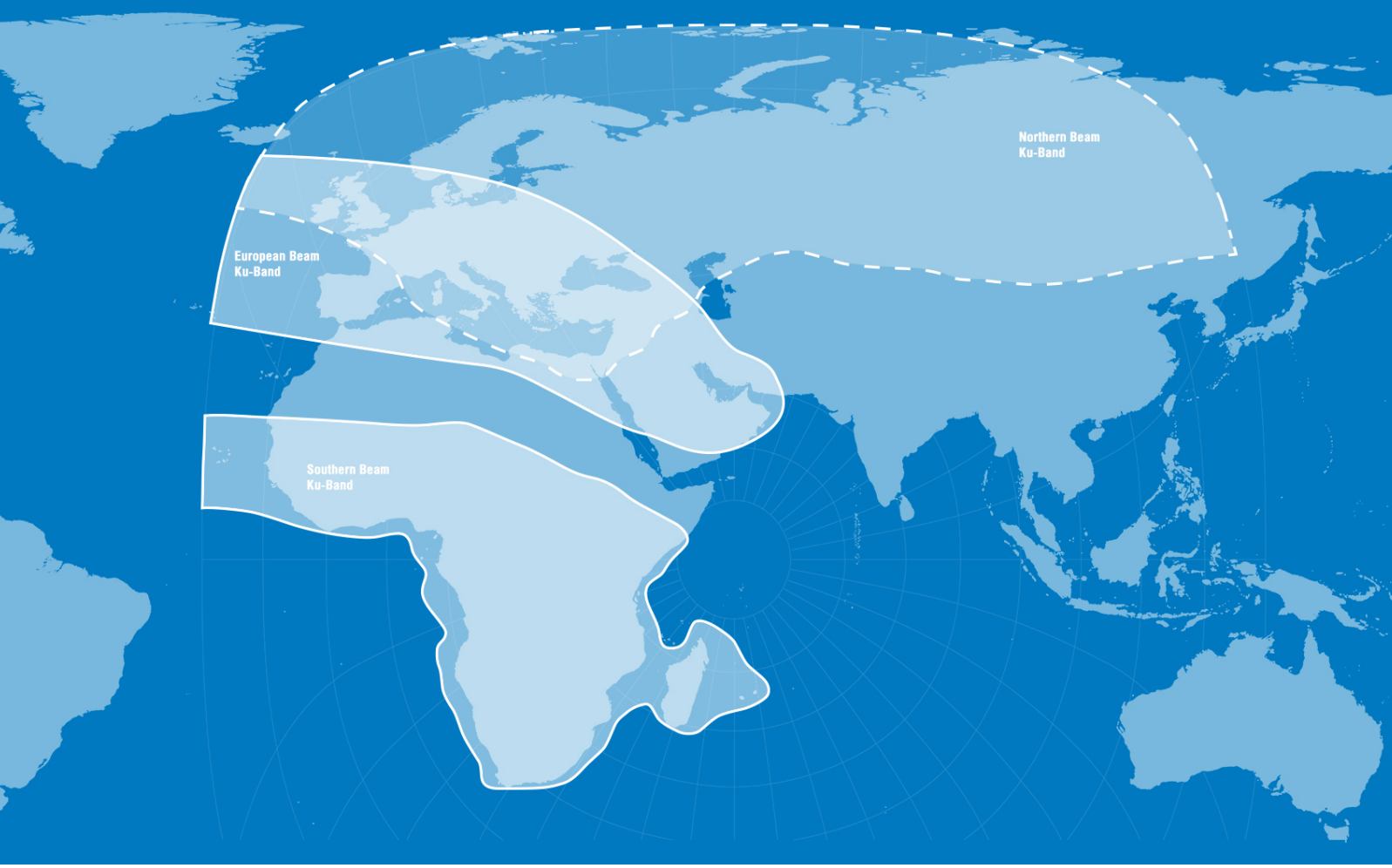
Yamal-402 TRUNKING

AFRICA High Performance EUROPE

BACKHAUL SNG MOBILITY IOT

Ku BAND MIDDLE EAST DATA TRANSMISSION

EIRP 53dbW up to 300 Mbps



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these users of 2G/3G service can migrate to 4G, or 40% of unconnected population can buy their 1-st 2G/3G mobile phone?

The challenge of the first scenario reveals the next layer of problems – lack of digital skills and literacy. So the new adopters shall understand the benefits of consumed data and ready to pay for its value.

Challenge for second scenario is connected with the second barrier for mobile internet adoption in SSA - affordability. But another challenge appears for provider when the number of 2G/3G users is increasing, as they generate narrowband data.

Taking into account all these challenges above, business growth potential for SSA connectivity providers can be achieved either by expanding coverage or by reducing cost of traffic and user terminals.

So what technologies are best suited to solve connectivity challenges in the rural areas in Africa? Based on the experience from other regions – fiber is the best technology for solving connectivity issues. New submarine cables have landed in the past few years in SSA countries, increasing connectivity with the rest of the world. But the terrestrial cabling within SSA remains a bottleneck.

Digging more cables is not an option, as 60% of the population in Africa is located in rural areas. So no one is ready to bring huge investments upfront and dig them into the ground with no money return guaranteed. It is different from other territories, like Russia for example, where a very distant and remote city of 50K+ inhabitants settles far North. Laying fiber there is very difficult, but once you do this – you get all 50K subscribers at once in your network as people live very compact due to harsh and severe environment.

Africa is different. The continent is also large, but very rural. You cannot lay fiber everywhere. MNOs are also struggling to get into rural communities. So satellite is ideal for Africa by assisting in development of various 2/3/4/5G connectivity and reaching as much rural communities as possible via providing backhaul. For less than US$3K you can get 2/3G service on a remote rural site in C/Ku/Ka band, depending on the SLA. If an enhancement to 4G/5G is required, one can simply upgrade the RF ($10K-$15K per site) or migrate to GEO HTS or invest US$100K-US$150K and get onto Non-GEO HTS. Sums are quite large, but still much less than laying fiber to every point.

Satellite connectivity market is very competitive now. African connectivity providers can shop for best option, as prices for satellite bandwidth in the region are the lowest in the world.

How can existing service providers evolve their business models and strategies to make rural connectivity a reality? By educating their customers (e.g. regional ISPs). Usually the customer in Africa is shopping for the lowest price on the market. And usually this is done at the expense of quality. Such approach has led to a very broad interpretation of the SLA in Africa, where the quality of service may vary from lower actual data rates to serious interruptions. In the end, as a result, the end user is paying more. Large potential in reducing the cost of connectivity for African users (and increasing the affordability) hides in more effective use of the existing hardware and satellite bandwidth.

So it is very important to educate the customer and assist him to find the roots and hidden paths to the cheapest solution without serious degradation in quality. How to achieve this? For satellite connectivity below is a summary of recommendations successfully implemented by many providers in the region sharing the risks with their customers.

Technical:

- Working in alternative, not widely used frequencies;
- Professional mitigation of terrestrial interference with by installing filters and identifying the source;
- Initiate other actions aimed at raising the quality of service may include some not evident actions like installing the lightning rod for the antenna.

Marketing and financial:

- Sharing capex and revenues;
- Providing modems FOC;
- Grace periods;
- Higher data rates in a demo mode or as an incentive.

Africa, with its long-underfunded healthcare systems, has also been heavily affected by a pandemic situation quickly spread all over the globe. In these circumstances the role of telemedicine, as well as distant access of the

West Africa Power Pool Project (WAPP).

Global was awarded the telecommunications part of the project to monitor major power distribution sites across the region.

Established by the Economic Community of West Africa States (ECOWAS) in 1999, the main aim of the project is to bring about the interconnection of the power grids of 14 West African countries. Philippe Olivia, Eutelsat's Chief Commercial Officer, said: "After a successful partnership in Mauritania three years ago, we are delighted to be working alongside Global technologies once again with assisting WAPP in achieving its ambitious shared energy project in the West African region over the coming months."

Global Technologies plans to contribute a fast, reliable and cost effective satellite coverage for the region, that will add to achieving a better and cheaper access to power for millions of people by delivery of a telecoms infrastructure to connect WAPP members.

AUGUST

Amos-17 was successfully launched on August 6, by a SpaceX Falcon 9 rocket. It is located at 17 degrees East where it reaches across the African continent, along with Middle East and Africa. Amos-17 is billed as the most advanced high-throughput satellite (HTS), providing communication services for Africa.

Its technical capabilities include C-band, Ka-band and Ku-band to meet Africa's demand for fast, reliable communications.

Built by Boeing, Amos-17's advanced digital payload will enable a combination of broad regional beams and high throughput spot beams to maximise throughput and spectral efficiency.

It will also offer connectivity spanning Africa, the Middle East, Europe, India, China and Brazil.

Prior to the launch, Spacecom signed a deal with Nigerian broadcaster IDS Africa to use Amos-17 to broadcast Channels TV across Nigeria and to the Nigerian diaspora in Europe.

SEPTEMBER

In September Algérie Télécom Satellite (ATS) selected Hughes' Jupiter System to provide satellite broadband services to small-to-medium enterprises (SME) and home users. ATS wants to develop and promote satellite telecommunications throughout Algeria. It will launch satellite internet services employing the Jupiter System, including a hub and thousands of user terminals. "To connect people throughout Algeria with satellite broadband service, we need a satellite platform that can deliver high performance and efficiency, with the right economics," said Yassine Sellahi, chief executive officer, ATS. "We chose the Hughes Jupiter System for these reasons, and also for its scalability as we look to grow our satellite Internet business and extend connectivity everywhere." Ramesh Ramaswamy, senior vice president and general manager, international division of Hughes said the firm's strategy globally is "to connect the unconnected by delivering services directly where we operate the business" and working with selected partners like ATS in places where it does not. "We appreciate the opportunity to help ATS launch service throughout

Algeria and to bring the benefits of high-speed Internet access to the many that are unserved or underserved by terrestrial providers," Ramaswamy added. The Jupiter System is the next generation very small aperture terminal

people to basic government, financial and other services is increasing. As we see from current examples e-commerce, digital healthcare, education and entertainment are expanding. Satellite is a very reliable and scalable solution to keep these people away from the epidemic, but do not exclude them from the business, social and cultural national or regional ecosystems.

In general telecom market will face sales challenges due to retail store closures and supply chain disruption and may also take an ARPU hit as states insist on bill waive programs to keep the financially weak sectors of society online.

But there has never been a more pressing need for digitization. In the long-term, the outlook for telecom sector remains positive, as reliable connectivity becomes a critical commodity. Coming out of Covid-19, millions of users worldwide including Africa will be more connected and more familiar with digital tools.

So this is a good chance for Africa to force digital inclusion and raise Internet adoption on the continent. Internet connectivity is no longer a luxury, but an inevitable requirement for post pandemic life of all African people. ■

Year in review

Although Africa's space industry is still in a development phase it is well aware of the potential revenue that the capability to build and launch domestic satellites can bring, coupled with the benefits of better communications and weather forecasting for the African continent that launched satellites will bring. Africa's space industry has started to grow and even has ambitious targets exemplified by countries such as Nigeria and its desire to put a person into space by 2030. With such wide expanses for many African nations, satellite is the only cost-effective way to provide telecommunications, data and internet. The ability to improve critical communications and for agricultural areas of Africa, weather forecasting is a positive of satellites. According to the African Space Industry Report for 2019, Africa has already reached revenues of US$7 billion for the year.

Ever increasing satellite coverage

2019 saw an increase in the number of African nations expressing an interest in launching their own satellites. Some African countries such as Uganda and Zimbabwe see exploring links with Russia to develop the capacity to launch satellites as a way forward, while countries such as Ethiopia are being helped by China.

Last year the continent of Africa launched 8 satellites, these included, Egypt's EgyptSat-A, CubeSat, NARSSCube-1, TIBA-1, Sudan's SRSS-1 and Ethiopia's ETRSS.

Rwanda benefited from the launch of its first satellite in February, named Icyerekezo. A low earth orbit satellite, it will provide a fast, reliable broadband signal for the internet, benefiting educational and emergency services amongst others. The satellite was launched by OneWeb in partnership with the Rwandan government.

On the topic of Low Earth Orbit (LEO), satellite launches, SpaceX progressed its Starlink project. SpaceX stated, "As demand escalates for fast, reliable internet around the world, especially for those where connectivity is non-existent, too expensive or unreliable, SpaceX is taking steps to responsibly scale Starlink's total network capacity and data density to meet the growth in users' anticipated needs."

SpaceX's 60 Starlink satellites offer the potential to help with Africa's ever-increasing demand and in cases need for reliable, secure and low latency broadband services. We will have to wait and see as to how many telecom companies serving Africa take up the capabilities of Starlink.

Back in August Spacecom launched its AMOS-17 satellite to boost connectivity in Africa, providing HTS beams from a geostationary orbit of 17 degrees east orbital position, with technical capabilities including C-band, Ka-band and Ku-band, to meet Africa's growing demand for fast, reliable communications. Amos-17's advanced digital payload was built by Boeing to enable a combination of broad regional beams and high through put spot beams (HTS) to maximise throughput and spectral efficiency. The satellite covers the growth area of Africa's sub-Saharan markets and will provide a large selection of services to a variety of broadcast, broadband and telecom clients.

Ethiopia's success in becoming the11th

(VSAT) platform from Hughes for broadband services over both high-throughput and conventional satellites. It supports applications such as community Wi Fi hotspots, cellular backhaul and in-flight connectivity services, as well as broadband internet access.

OCTOBER

Hughes Network Systems, announced that Algerian Telecom Satellite (ATS) company, a public satellite telecoms provider had selected the Hughes Jupiter system to enable satellite broadband provision to homes and small to medium size enterprises in Algeria.

Yassine Sellahi, chief executive officer at ATS said, "To connect people throughout Algeria with satellite broadband service, we need a satellite platform that can deliver high performance and efficiency, with the right economics." The Jupiter system is, according to Hughes, the next generation Very Small Aperture Terminal (VSAT), providing both high-throughput and conventional satellites. Employing the DVB-S2X standard for highly efficient use of satellite bandwidth.

NOVEMBER

Egypt's TIBA-1 military comms satellite was en route to Guiana Space Centre launch. The satellite was developed by Airbus Defence and Space and Thales Alenia Space (TAS) and due for launch on an Ariane 5. Airbus and Thales had joint responsibility for building TIBA-1 and delivering it into orbit. TAS supplied the Eurostar E3000 platform and assembled and tested the spacecraft. The communications payload consisted of a dual mission in Ka-band for secure and broadcast communications, it has the capability to provide internet and broadband services for Egypt, the Nile Basin and other parts of North Africa. TIBA-1 was designed to remain in service orbit for more than 15 years. Egyptian President Abdel Fattah el Sisi signed a US$600 million contract with the French President Francois Holland in April 2016 for TIBA-1 and its launch by Arianespace. Controversy was caused when the International Telecommunications Union allowed Egypt to keep an orbital and frequency slot that had expired because Egypt had failed to place a satellite in orbit within the required time frame.

Due to be launched on the 15 November it was eventually launched on 26 November.

DECEMBER

China and Ethiopia make a satellite pact, with China helping Ethiopia to build a continental satellite and data receiving station, according to the director general of the Ethiopian Institute for Space Science and Technology (ESSTI).

Speaking to China's Xinshua news agency, Solomon Belay said the partnership also includes training programmes for Ethiopian space engineers, while assistance to Ethiopia for the launch of space satellites is being negotiated.

The technological infrastructure expected to be completed in the next three years, is said to be ideally located in the capital Addis Ababa, which is also home to the headquarters of the African Union (AU).

The east Africa nation is in the process of opening to foreign investment and is determined to capitalize on Chinese knowledge to learn more and contribute more to the satellite communications space.

African country to accomplish a satellite in space was achieved in December. The cost of the satellite was mainly funded by China and provides a satellite that can collect data for use in agriculture, mining, climate and weather forecasting. It was launched from China.

CETel, Central European Telecom Services based in Germany, a provider of Satellite, fibre and wireless enabled communications started to deliver connectivity in remote areas of northern Africa via Intelsat's EPIC 37e satellite. It will deliver a Ku-band spotbeam to land locked areas of Chad and south of Libya, which require stable, reliable and efficient solutions for their data and voice transmissions.

VSAT

Mozambique disaster sees PCCW Global and TSF connect. Both organisations received official recognition from the Mozambique National Institute for Disaster Management, for their combined mission to provide critical communications services following the two tropical cyclones which hit the country.

One VSAT communications system was installed in the Matarara coordination centre from which relief operations to five surrounding communities were conducted. A second VSAT was also at the Médecins Sans Frontieres cholera treatment centre in Mafambisse. A further two VSATs provided by PCCW Global were handed over to Mozambique's INGC, enabling the organisations to rapidly deploy critical communications for any similar emergency in the country. ■

Brian Jakins, regional vice president, Intelsat

Brian Jakins, Intelsat's regional vice president, Africa says the market has been very receptive to a lot of the products the company has released. "We've got our Flex platform, which is really a managed service and we're in the process of releasing Flex on the Move, Comms on the Move and Comms on the Pause based on the flex platform.

Intelsat also released a blended connectivity product in 2019 with Djero, which is called IronRoute. This really takes broadband connectivity, wireless or GSM connectivity and blends it with satellite connectivity," adds Jakins. "Often you might have a drop in cell coverage which automatically switches over to satellite connectivity, or go from a broadband connection to GSM. So, this is ideal, for a lot of our services and products are developed so that the new evolution is software-defined satellites and everything will be cloud-based."

He says the big challenges are not unique to Intelsat because they relate to the continent. They are lack of infrastructure, lack of investment coming in, with the fact much has to be localised.

"If you have a dollar-based product and your selling it into a South African rand-based economy, you need to make sure you meet the local demands and you can convert that into your cost base," Jakins continues. Infrastructure remains the big challenge across the region, so even though you're deploying infrastructure, if it depends on a stable electrical grid, that's a challenge."

Intelsat has been busy forming partnerships, too.

"We've partnered with a company called African Mobile Networks (AMN) for a unique solution in how we connect the last mile," says Jakins. "We do this in a very cost-effective manner and the intention is really to show it's a sustainable model using satellite connectivity and it can generate revenue. So, connecting these communities that live on less than $5 a month or less have connectivity now, it really changes the economics of those communities."

Jakins says since the two companies formed a partnership, they've connected close to 500 rural sites. "Some might say 500 sites doesn't sound like a lot, but if you look at rural Africa, just getting the equipment there is a huge success," he adds.

Intelsat has already partnered with MTN and Orange on these deployments and it's going very well, he says.

Ramesh Ramaswamy, SVP & general manager, international, Hughes Network Systems

Ramesh Ramaswamy, SVP & general manager international division at Hughes Network Systems, says 2019 was a "phenomenal year" in what continues to be a highly-competitive market." Our company's primary charter is to be the leader in satellite broadband and we do it two ways," he says. "We are obviously a service provider and as a broadband service provider we're vertically integrated,

Martin Jarrold, vice president, international programme development, GVF

The year ahead: A GVF Member, Danish start-up QuadSAT, is developing a new approach for conducting on-site antenna verification using Unmanned Aerial Systems (UAS). The technology offers new ways to characterise performance of ground terminals not available before, with accurate performance data being acquired for deployed VSAT terminals. This is a new capability which can be used to evaluate terminal performance on mobile platforms for maritime, ground based and airborne applications.

Hardware demonstrations have been conducted for major operators and they have acknowledged QuadSAT's innovation as a valuable alternative to traditional testing methods. Similarly, the European Space Agency has recognised the potential value of this technology, awarding QuadSAT a contract to continue development and validation with support from GVF. The SOMAP recommendations will be used to compare performance data acquired by UAS measurements with comparable test data acquired from a traditional far-field outdoor test range. In each case the same test antenna will be used for comparing the test results.

The QuadSAT Unmanned Aerial System

The equipment is transportable as a portable test range providing high-precision antenna pattern measurements. The UAS flies in a profile to simulate a satellite. Installed VSAT antenna systems are aligned to the geostationary orbital plane and the antenna elevated to a positive angle dependent on the latitude at which the station is located.

Unlike traditional antenna test ranges operating over fixed transmission distances, the QuadSAT solution enables the transmission path length to be adjusted to provide a true far-field test environment for different sized antenna apertures.

The UAS system can be flown freely around the antenna under test, at various far field distances and at various test angles. The test equipment provides a flexible, cost-efficient method to verify antenna performance globally. This system allows for testing and verification of already operational antennas, without interrupting their services. This technology is a "game changer" for the industry.

The mega-LEOs

The decades-long history of launching communications satellites to Earth's equatorial geostationary (GSO) orbit involved a lot of "big" things. Big budgets funded the design,


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meaning we own the end-to-end infrastructure in the satellites and ground segments.

In Africa, Hughes has a 20% stake in YahClick, a joint venture that was concluded in late 2018. That JV has two satellites that cover the Africa and Middle East and as a minority partner, Ramaswamy says Hughes plays an important role in supporting the company by providing technology operations.

What's particularly pleasing for Ramaswamy is that 2019 was a year in which from a service perspective "we consolidated our leadership, expanded in new markets and from a technology supply perspective our Jupiter platform has become the de facto standard for anybody who operates in the satellite broadband business".

However, Africa has its challenges and Ramaswamy points to three of them. "Firstly, it's extremely fragmented because there are so many countries and so there's no critical mass," he says. "Secondly, while the need is there the challenge is the ARPUs as the ability for people to pay is not the same as the market we usually operate it. The third challenge is fundamentally when you have underdeveloped infrastructure, the day-to-day logistics of delivering and operating a business is more challenging."

Having said all of that, Ramaswamy says Hughes is a big believer in the African market, which is why it made a strategic investment in the region. Previously it just supplied equipment to the operator.

"I think the focus in 2020 will be to build and help support YahClick and successfully deploy its gateways for the Eutelsat Konnect satellite, which launches in early 2020."

Alexander Mueller-Gastell, CEO, ND Satcom Communications

To fully understand what ND Satcom did in Africa in 2019, one needs to look back to 2018, says CEO Alexander Mueller-Gastell. In short, it turned "from technically-focused company to more of a commercially-focused" business.

What does that mean? "It means that we have a great suite of technical products, but what we had to do was include the voice of the customer in it and listen to the market and see what we needed to do in order to meet the demands of the customer," he says. "How did we do it? We started expanding our commercial footprint into the regions where we see opportunities for our business. ND Satcom now has a sales rep office in Johannesburg covering southern Africa."

ND Satcom flexed its muscle in 2019 when it acquired TECNA Suarl, a satellite transmission and radio telecommunications solutions provider based in Dakar, Senegal, which has given the German firm a footprint in west Africa.

"We've always been working from HQ in Germany on a global scale and we've always had projects in Africa, predominantly around air traffic control (ATC)," Mueller-Gastell adds. "Now we're looking to get into the government enterprise sector."

He says the highlight has really been the fact that the 2018 strategy we introduced is starting to materialise in 2019 projects.

"We have successfully closed projects in countries where over the last three or four years we haven't done much business in Africa," Mueller-Gastell continues.

The biggest challenge isn't just doing business in Africa, it's also about finding out where you can and where it makes sense to do business. What I mean by that is political stability drives economic prosperity, so when you're talking about certain countries you want to do business in, you want to pick out those countries where you know if you do win the project and get it implemented, that you get paid."

Many say Africa can be a trickier place to do business compared to other parts of the world, but Mueller-Gastell doesn't subscribe to that view.

"Timing-wise, it's not that different to other regions, especially when you're talking on a project basis," he adds. :You've just got to stick with it. We're convinced that in order to be successful in Africa and also the other regions, you need to be there on the ground. You can't just do the fly in, fly out. You've got to show commitment."

Sean McCormick, managing director, Globalstar Africa

The African continent is vast. Its rugged landscapes and limited infrastructure impact on its ability to drive economic growth and capitalise on the digital revolution, throwing up barriers to connectivity that are complex to manage and expensive to overcome. It's challenging but solutions are emerging onto the market that are allowing organisations

construction, launch, and in-orbit operations of commercial and government satellites which, over time, became multi-metric tonne structures the physical size of a double-decker bus and bespoke design related technical complexity.

NewSpace is the overall context within which an alternative industry developmental path, that of "smallsats", is being followed. Whilst the earlier model of commercial and government space activity is not being replaced or supplanted by NewSpace, the latter is a radical departure from the established model. It is radical because the business of getting to space, and associated applications, are increasingly endeavours within an entrepreneurially oriented domain of many small-scale technology start-ups and academic spin-offs.

Satellites are being built with shorter development cycles, by smaller teams of engineers, using off-the-shelf components and miniaturisation technologies, and mass-production assembly. Satellites exhibit increasingly standardised form-factors and are based on a low-cost per-unit of functional capability with easier and cheaper integration with new generation launch vehicles.

The actual adoption and deployment of the new technology that is the very fabric of the NewSpace environment is not only driven by development of said space (and ground) segment technologies. The NewSpace entrepreneurs financing revolutionary expansion in commercialisation of space are driven by new commercial opportunities created by cheap satellites – costed in the millions of dollars, not hundreds of millions – and designed to last for just a few years. NewSpace technologies have created a growth cycle that has narrowed the gap between innovation and implementation, and this is happening in a widening range of countries, including in many smaller developing nations.

Small satellites – communications mega-constellations or single Earth imaging spacecraft – operate in NGSO. This permits improvements in link budgets and reduced transmission latency, whilst also having the coverage of higher altitudes. Small Earth imaging/observation satellites operate in the Sun-synchronous orbit (SSO) LEO orbit variant which reduces revisit times/increases revisit frequencies (high-frequency change detection) for the same Earth surface territory.

Thus, satellite communications is at an inflexion point, undergoing changes that are revolutionising all facets and segments of the industry. In the space segment these changes are:

- Impacting the design and construction of launch vehicles and bringing innovation in launch procurement services;
- Impacting satellite design process drivers and manufacturing methods; and,
- Facilitating development of new applications and realisation of new vertical markets.

In the ground segment, the changes encompass:

- A radical re-direction in antenna/terminal design parameters; together with
- Changes in the nature and function of teleports..

to develop reliable and robust connectivity systems that meet their evolving needs.

One of the drivers of this change is satellite. Satellite solutions are shifting the dialogue around African communication and collaboration thanks to their ubiquity, reach, and price. This technology is capable of bridging the infrastructural gaps to bring much needed communication services to rural and remote parts of Africa.

Africa isn't equipped with the technology and ground infrastructure it requires to compete with the rest of the world in terms of communication and connectivity. Building terrestrial systems is expensive and severely limited in terms of support and maintenance. Satellite can bypass these complexities of building infrastructure or private networks.

Thanks to its low maintenance capabilities and relative simplicity, a satellite is less demanding of the skilled resources that are already in short supply on the continent. Satellite makes provision for rural areas, previously impossible to track and monitor, to become connected, and for organisations to minimise the need to roll out large terrestrial-based infrastructures to get services to relevant areas. This has become crucial over the past few years as the inexorable push of digital, the Internet of Things (IoT), and automation have become a rush of innovation and a race to the top.

IoT and industrial IoT (IIoT) are key trending technologies, especially as we move into 2020 organisations can't afford to be left behind. They can't afford to sit and watch as other markets catch the customers because they lack connectivity and the ability to tap into the potential of digital. The pressure to innovate, develop and stay ahead is relentless, especially as the Fourth Industrial Revolution (4IR) makes itself felt.

Traditional IoT requires a terrestrial infrastructure to operate, but satellite offers IoT solutions with a 100% coverage area that can be extended globally. It doesn't require roaming agreements or terrestrial infrastructure to deliver the connectivity required, and it has fewer points of failure which can improve maintenance and reduce downtime. That said, while many companies use satellite to compete with terrestrial solutions, it can actually complement them, providing a more holistic platform for the organisation.

With satellite, companies can track, monitor and report on services in ways that were not possible in the past whilst becoming increasingly cost-effective. Satellite was considered expensive when it first entered the market, but has emerged as a reliable answer to Africa's connectivity challenges and very kind to the bottom line.

One of the biggest misconceptions that still surround satellite is the cost. Companies believe that these services are expensive and difficult to implement and manage. However, this could not be further from the truth. Satellite communications have not only evolved to meet changing economic requirements, but they can be adapted to fit into various verticals and environments.

Satellite is fairly ubiquitous, capable of adapting to a myriad of use cases that makes it useful, as well as flexible and scalable. It can be used in the consumer market, providing outdoor adventure solutions that enhance the business to consumer (B2C) segment, and it can be used in the industrial market to resolve challenges in the global supply chain or improve business to business (B2B) implementations.

We have seen some interesting satellite implementations in the wildlife sector. There have been numerous safari vehicles and wildlife animals equipped with satellite services that allow for the tracking and monitoring of these assets in real-time. They use these services to not only map wildlife movement in their own regions but across borders and varied landscapes. None of these solutions have required any investment into ground infrastructure either.

Over the past few years, satellite has also seen an increased uptake in the logistics sector to support its cross-border requirements. It can be implemented across road, rail and water, and provides organisations with reliable and accurate asset tracking services. The mining sector has also been paying attention to the benefits of satellite, using it to track and monitor yellow goods. These are unavoidable and expensive investments for the sector, but they are at high risk of theft and cross-border fraud. Employees working in these remote areas are safeguarded with satellite communication messengers which allow communication beyond cellular service.

Satellite is a solid solution for organisations looking to expand their reach across Africa whilst ensuring connectivity and access to digital technologies. It is far more cost-effective than many realise and works within existing solutions to add an extra layer of connectivity to the business.

> "With AMOS-17's beams efficiently serving rural regions, we are assisting businesses and governments to overcome the digital divide, in which earlier satellite-based connectivity was not viable"

Eran Shapiro, director business and technology ventures, Spacecom

Spacecom operates the AMOS satellite fleet: AMOS-3 and AMOS-7 co-located at 4°W, AMOS-17 at 17°E and AMOS-4 at 65°E. A multi-regional operator, the company provides high-quality data communication and broadcast services to Africa, Europe, the Middle East, and Asia via direct-to-home (DTH) operators, Internet service providers (ISPs), telecom and MNO operators, network integrators and government agencies. With three satellites providing expert communication solutions to Sub-Saharan Africa – AMOS-17, AMOS-7, and AMOS-4 we are expanding business offerings, technological solutions and partnerships throughout Africa.

"Spacecom has been a stalwart operator in Africa, conducting our satellite business since 2005. With partners, sales teams and an innovative Vertical Solutions team that develops and deploys turn-key communications solutions for telecom, broadband, data and broadcast clients, we are tremendously excited to be able to support Africa's connectivity needs," says Eran Shapiro, director business and technology ventures, Spaceom.

On August 6, 2019, Spacecom's AMOS-17 communication satellite soared upward towards the 17°E orbital position. From this slot above the middle of the African continent, Shapiro says it's the most advanced digital satellite over the continent with powerful steerable Ka-band HTS beams, regional Ku-band beams and C-band HTS beams offering a wide range of services to Africa. In addition, these beams can connect to Europe, the Middle East, India, China and other areas in Asia, and as far west as Brazil. "So, for the company, this year's biggest highlight was AMOS-17's successful launch and the beginning of its commercial operations," he adds..

AMOS-17's extensive tri-band capabilities enable the satellite to combine broad regional beams and high throughput spot beams to maximize throughput and spectral efficiency, meeting our clients' needs for innovative solutions, with the flexibility to easily and quickly change configuration to match their usage patterns. "We designed AMOS-17 specifically for the growing broadband, broadcast and communication markets served by Africa's and international operators, broadcasters, cellular companies as well as governments and other agencies," continues Shapiro.

With AMOS-17's beams efficiently serving rural regions, we are assisting businesses and governments to overcome the digital divide, in which earlier satellite-based connectivity was not viable. By enabling a wide range of services to be quickly and highly efficiently deployed to outlying populations, AMOS-17 helps create a new economic stimulus

for bettering services to these populations."

Shapiro says sub Saharan Africa's biggest challenge remains providing accessible communications with proper infrastructure to low density population areas. A consequence of this major issue is how to improve reliable coverage and service to the continuously growing number of subscribers who utilise smartphones not only as their communication device but also as their entertainment and business centres. "With Africa's growing young population, smartphones are allowing people to navigate the world with apps," he says.. "A new generation of high-throughput, digital satellites offers easy and economically viable connectivity infrastructure, expanding terrestrial based networks' reach. With HTS, as in AMOS-17's C-band HTS capacity, governments and service providers can quickly establish reliable and economical communication services in low density population regions."

Spacecom, Shapiro says, Spacecom recognises that there are truly abundant opportunities for its business in sub Saharan Africa. With one of the world's fastest growing populations – forecast to reach 1.5 billion and continue rising, Africa is a huge market.

Pieter-Paul Mooijman, vice president, Africa, ST Engineering iDirect

As an enabler of exciting opportunities for business growth, education and healthcare advancement that have a positive and lasting impact on communities, satellite continues to have a key role to play in Africa. Its speed and ease of installation, as well as its ability to be deployed anywhere, makes it the perfect solution to connect even the most remote communities, lifting barriers and bridging the digital divide. As we move into 2020, the African market is incredibly exciting due to its almost unrivalled potential for development. So, what can we expect to see from the region in the coming months?

With multiple African countries kick-starting digital divide programs in 2019, many of these government-driven social inclusion initiatives are using satellite to expand the reach of the Internet to rural areas and schools. This will ensure access to better services, bringing significant improvements in health, education and finance. Capacity and terminal prices are also becoming more affordable, and this is resulting in growing demand from small businesses and home offices. Traditional broadband connectivity for remote and underserved areas has always been a key component of our offering, but there is a growing shift towards enterprise applications within sectors such as the banking industry, where broadband connectivity is required for ATMs. With Internet connectivity now a basic need for any business, we see this as a key growth area with even small business in Africa now looking to get connected.

Consequently, 2020 will bring a massive increase in demand. In 2017, satellites only provided 5.9 Gbps of broadband access, in 2022 we expect this to increase to 162.99 Gbps. This is the same for enterprise broadband, which was only 10.76 Gbps in 2017, but we expect it to grow to 68.74 Gbps in 2022. Across the globe, this demand for connectivity is redefining how communication networks are designed and what they need to deliver. Today, networks must converge voice, data and video on one platform; support any application; reach any geography and provide unified global service plans.

Satellite can offer 100% comprehensive coverage which is entirely independent of terrestrial infrastructure. In a continent as vast as Africa, removing the inconvenience of constructing terrestrial infrastructure is a huge advantage. It also offers a high level of resiliency and supplies secure, reliable mission-critical and high-value services for mobility, disaster recovery and business continuity. The technology provides immediate, seamless access and constant connectivity, enabling IP applications at a moment's notice in any geography. For growing businesses and communities across Africa, this allows for potential expansion when needed and ease of mobility.

Mobility is also increasingly popular with consumers, with the majority of people in Africa accessing the Internet via a mobile phone or tablet, rather than desktop computers or laptops. There are now more than 200 million devices with the ability to connect to the Internet through Wi-Fi in Africa. This figure is expected to grow to 500 million next year. As a result, Cellular Backhaul will be another key area of growth in Africa, with Mobile Network Operators (MNOs) continuously looking to expand their subscriber base into new regions.

Many operators are choosing to use satellite for cellular backhaul when delivering 2G, 3G and 4G services. The expansion of 5G will further increase the role satellite has to play in cellular backhaul, creating the need for the convergence of all access technologies into a unified force. Furthermore, Africa is set to be the fastest growing region for 5G mobile broadband uptake in the next six years. According to Ericsson's Mobility Report, mobile broadband users in Sub-Saharan Africa are expected to reach 50% by the end of 2025. As a result of this growth, 5G will play a crucial role in supporting this massive increase in demand, which means having the correct infrastructure in place is more important than ever before.

Throughout Africa, the emergence of new High Throughput Satellite (HTS), Low-Earth Orbit and Medium-Earth Orbit (MEO) constellations hold huge promise for the region and will be crucial in making 5G a reality by bringing down cost-per-bit and lowering latency.

The increased availability of HTS technology is also bringing a shift towards multiservice solutions and platforms. This will enable operators to expand their service portfolios and move their offerings to wider, less-traditional markets.

We also expect to see an increase in the viability of community Wi-Fi solutions. The benefits this type of solution can provide aren't just in the education sector - they can also provide new business models, such as Internet provision on an access voucher basis or on an as-a-service basis sold by local shops. This not only benefits business owners who have a new revenue stream but also end-users, who can receive Internet access without the need for up-front investment in home VSAT equipment. While a satellite Wi-Fi hotspot solution is slightly more expensive to set-up, the large number of end-users it can reach means the Total Cost of Ownership (TCO) per user represents just a fraction of the cost when compared to a traditional-single user VSAT terminal.

Throughout all these trends, the importance of ground infrastructure technology that matches the innovations in the sky remains key. Our aim for Africa is to ensure people are connected, which is essential for the economic and educational development of the continent. Being connected to the Internet vastly improves the knowledge and skills base of users, providing advantages that previous generations may not have had. We want to be able to ensure that users in remote, rural areas have the same opportunities that are available in more developed regions and communities.

Nadine Fassbender, marketing manager, AXESS EMEA

AXESS Networks (AXESS) provides end-to-end connectivity solutions to various industries across Africa. In 2019 AXESS supported gold miners in Sub-Saharan Africa with encompassing managed multi-orbit solutions, therewith enabling operational endurance and continuity on highest available levels. Telecommunication operators, ISPs, Oil & Gas, Corporates and NGOs across the African continent benefit from AXESS connectivity and solutions. Depending on several variables, AXESS implements the best available technical and operational solutions. Factors, such as location, climate, applications, number of

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sites, throughput, availability, etc. determine communications solutions. The designed networks meet internal requirements in terms of security and layouts and claim to be future-proof and scalable to adapt to any changes in a timely manner. In 2020 AXESS boasts its African operations with a presence in Johannesburg and a dedicated sales team. In November, AXESS Networks exhibits at the AfricaCom 2020.

Ayes Amewudah, VP sales, Talia

During 2019, Talia delivered several projects for the provision of VSAT communications services across the African continent, particularly providing reliable low-cost internet solutions through Ka-band and Ku-band to schools, enterprises, banks, NGO's and government agencies.

"We have completed successful projects in many countries across the whole of Africa where our VSAT services, capabilities and communications systems have helped governments meeting their social development goal to bring high-speed internet access to African communities that are hard to reach," says Ayes Amewudah, VP sales of Talia. These projects are slowly contributing to overcome barriers to the Africa's digital divide.

He adds that in a continent where less than a third of the population has access to the internet, connecting the 100 million people who live out of reach of traditional cellular mobile networks require substantial infrastructure investments, but also the adoption of new disruptive and sustainable technologies. "Our mission is to close the gap between connected and unconnected areas and to resolve a significant cause of economic and social inequality," Amewudah says.

The plan in 2020 is for Talai to continue on our mission to connect the unconnected in line with the latest World Bank Group's "Connecting Africa Through Broadband" report which has acknowledged its Quika platform as example of a sustainable business model to accelerate the use of internet connection in Africa. The platform aims to empower individuals through the educational, economic and social benefits that online connectivity brings.

Amewudah believes new technologies and new orbits, such as LEO and MEO, are creating a buzz about space again. "Lower orbits have the potential to offer fibre-like connectivity and bandwidth at speed and costs that are comparable to fibre," he continues. "This renewed interest and increased investments in satellite communications show that people are starting to believe that satellite can compete with fibre and, in many cases, outperform it especially in those areas where fibre is not available."

Andrey Kirillovich, director, integration services & projects, RSCC

For RSCC, 2019 in Africa was quite stable, says Andrey Kirillovich director of integration services and projects. Existing customers continued slow but steady growth of their networks. "Some projects have slipped to 2020, but some other, delayed from 2018, have been finally implemented by our customers in 2019," he says. "Data networks were increasing throughputs per remote site. Especially cellular backhaul customers, as there was an ongoing migration to 3G and even 4G. Also, we had some new add-ons to our customer base, with new countries and connectivity providers in west, central and east Africa joined our geographic service portfolio."

When asked about the highs, he says that during recent years, sub-Saharan Africa as a region has made a tremendous boost in RSCC revenues. Being almost zero five years ago, Africa now generates approximately 10% of its international revenue.

"Our customers' mix is a good balance between African and European service providers developing domestic in-region networks and Europe – Africa cross continent connectivity," he says. "Some of them build their business on the continent only on our satellites, as we provide good variety of C and Ku band coverage with wide and spot beams from 14W, 40E and 53E orbital locations on our Express-AM series satellites." Besides solid customer base, RSCC also has a good split between C and Ku networks, between the regions - eastern, central and west Africa and a plural mix of verticals: IP backbone connectivity, cellular backhaul, enterprise VSAT, maritime and mobility, as well as content distribution and even IoT.

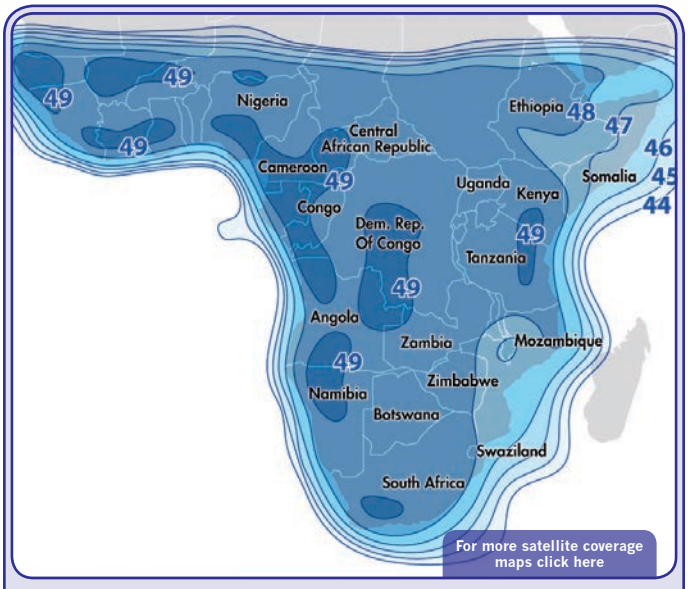
Besides payment collection, which is an ongoing and longtime issue in Africa, the other serious challenge RSCC faced is educating the customer on cost effective connectivity solutions. "Usually the customer in Africa is shopping for the lowest price on the market," Kirillovich adds. "And usually this is done at the expense of quality. Such approach has led to a very broad interpretation of the SLA in Africa, where the quality of service may vary from lower actual data rates to serious interruptions."

In the end, as a result, the end user is paying more, he adds, plus large potential in reducing the cost of connectivity for African users hides in more effective use of the existing hardware and satellite bandwidth. "So it is very important to educate the customer and assist him to find the roots and hidden paths to the cheapest solution without degradation in quality," he says. "How to achieve this? Working in alternative, not widely used frequencies. Professional mitigation of terrestrial interference with by installing filters and identifying the source. Initiate other actions aimed at raising the quality of service may include some not evident actions like installing the lightning rod for the antenna. These are the examples of our cooperation with the customers in Africa."

Throughout 2020, the company expects to see the customers expanding their networks. "RSCC in turn will try to maintain customers' expectations and help them to continue building a successful satellite connectivity business around our Express-AM satellite fleet," he says. "Our main goal for 2020 is to help our customers – African service providers to propose the best service in the area, so that they can gain new end users, including the ones migrating from their competitors." ■

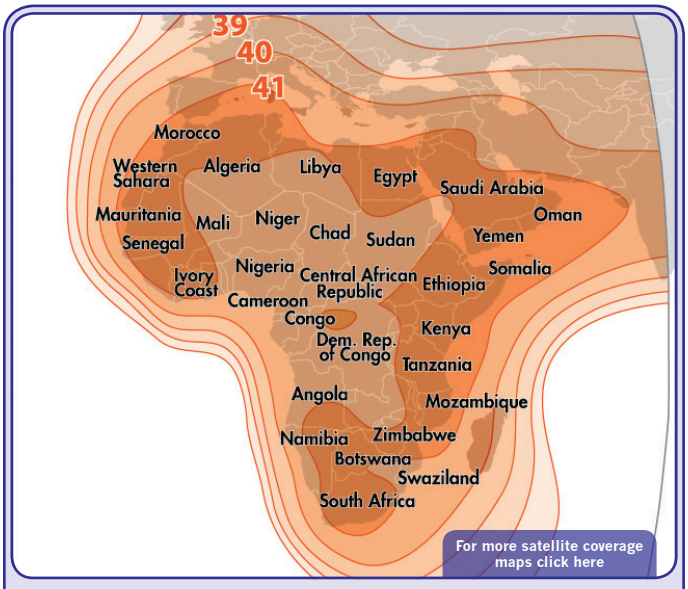
"Our mission is to close the gap between connected and unconnected areas and to resolve a significant cause of economic and social inequality"

"Usually the customer in Africa is shopping for the lowest price on the market, and usually this is done at the expense of quality. Such approach has led to a very broad interpretation of the SLA in Africa, where the quality of service may vary from lower actual data rates to serious interruptions"



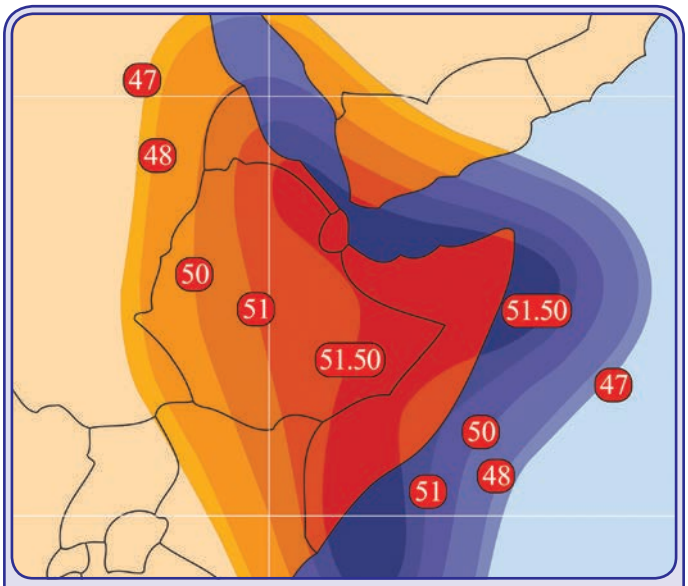
ABS-3A: 3°W – SAF Ku-band beam

Launch date:	August 2015
Launch vehicle:	SpaceX Falcon 9
Operational life:	15 years
Manufacturer:	Boeing 702SP
Coverage:	Americas, Europe, Africa, Middle East
Total transponders:	24 Ku-band 72MHz 24 C-band 72MHz



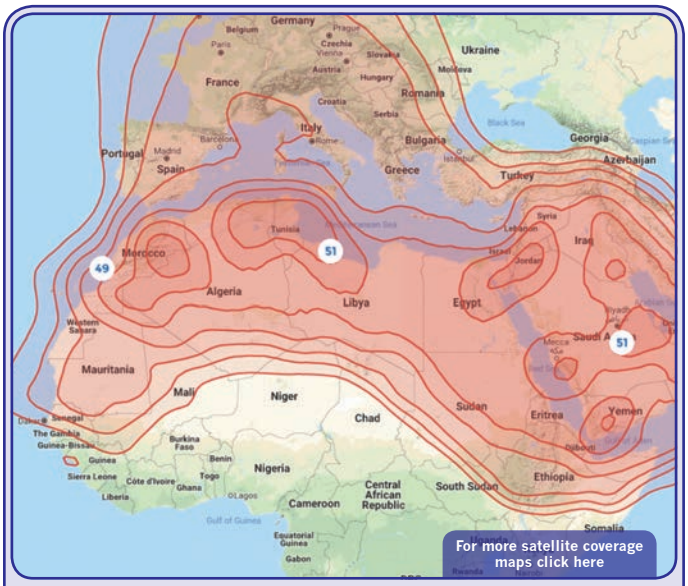
ABS-3A: 3°W – East Hemi C-band beam

Launch date:	August 2015
Launch vehicle:	SpaceX Falcon 9
Operational life:	15 years
Manufacturer:	Boeing 702SP
Coverage:	Americas, Europe, Africa, Middle East
Total transponders:	24 Ku-band 72MHz 24 C-band 72MHz



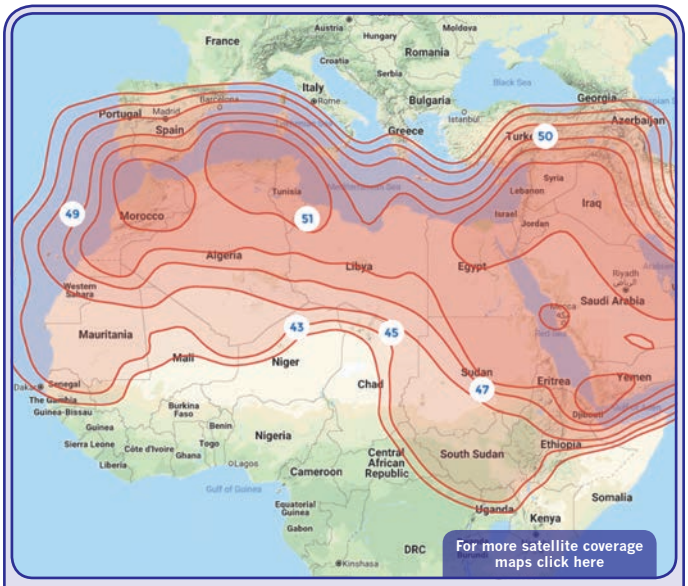
AMOS-4: 65°E

Launch date:	August 2013
Transponders:	4 x 216MHz Ka-band (steerable beam)
Band-1 uplink frequency range:	27.5 to 31.0GHz
Band-1 downlink centre frequencies:	19.875 or 20.125 or 20.375 or 20.625GHz
Band-2 uplink frequency range:	29.625 & 29.875GHz
Band-2 downlink centre frequencies:	18.325 & 18.575GHz
Uplink/downlink polarisation:	RHCP/LHCP
EIRP at beam peak (dBW):	51.4
G/T at beam peak (dB/K):	8.9 (Ka1); 9.9 (Ka2)
Saturated flux density (dBW/m2):	-72 (min) -92 (max) (Ka1); -75 (min) -96 (max) (Ka2)



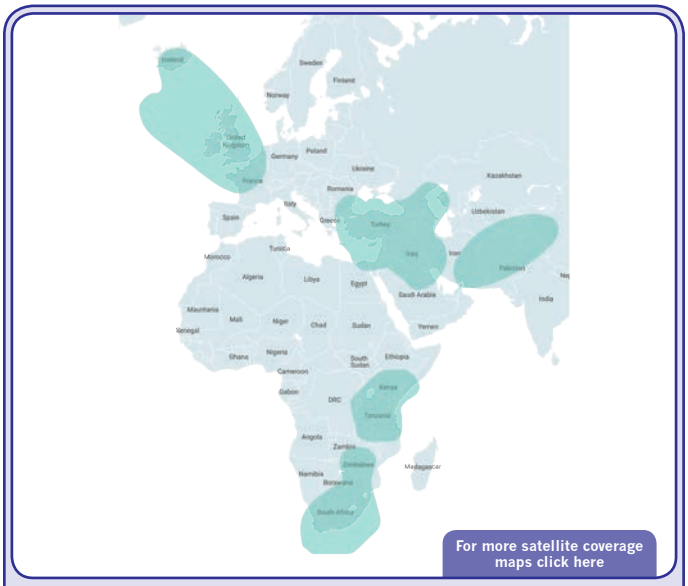
Arabsat BADR-4: 26°E

Launch date:	November 2006
Transponders:	Ku-band/FSS – 16 LTWTAs for 12 active channels Ku-band/BSS – 20 TWTAs for 20 (BOL) or 16 (EOL)
Bandwidth:	Ku-band/FSS: 36MHz Ku-band/BSS: 34MHz
Frequencies:	Ku/FSS: 13.75 to 14.00GHz (uplink); 12.50 to 12.75GHz (downlink) Ku/BSS: 17.30 to 18.10GHz (uplink); 11.70 to 12.50GHz (downlink)
Polarisation:	Linear horizontal/vertical
Typical G/T:	Ku-band/FSS 6.2dBK; Ku-band/BSS 3.2dB/K
Typical EIRP:	Ku-band/FSS 51.8dBW Ku-band/BSS 51.8dBW



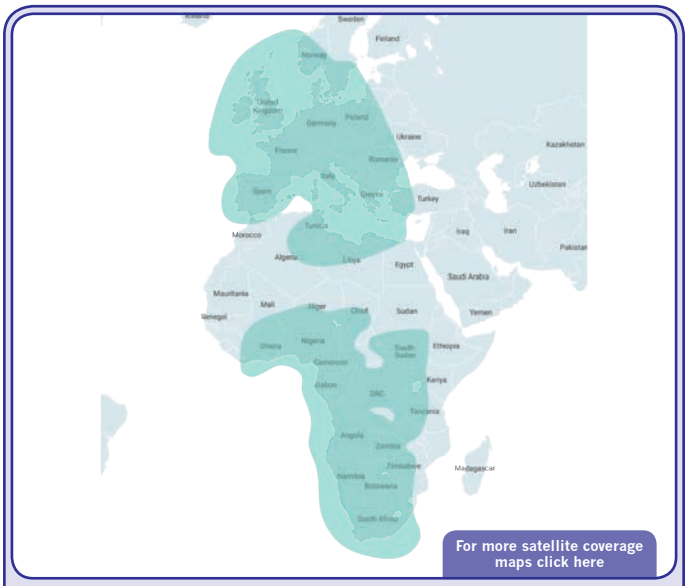
Arabsat BADR-5: 26°E

Launch date: June 2010
Frequencies: Ku-band/FSS MENA Uplink:13.75-14.00GHz
Downlink: 12.50 to 12.75GHz
Ku-band/FSS Apx-30B MENA Uplink: 13.00 to 13.25GHz
Downlink: 10.70 to 10.95GHz
Polarisation: Linear horizontal/vertical
Transponders: Ku-band/FSS switchable to Ku-band FSS Apx-30B MENA 12x36MHz
Typical G/T: Ku-band/FSS switchable to Ku-band/FSS Apx-30B MENA 2.2dB/K
Typical EIRP: Ku-band/FSS switchable to Ku-band/FSS Apx-30B MENA 52.6dBW



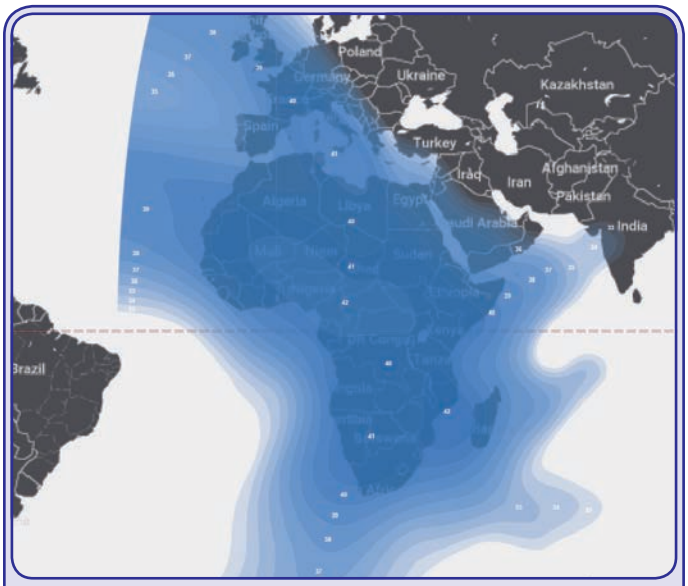
Avanti Communications HYLAS 2: 31°E

Launch date: August 2012
Ka-band uplink: 27.5GHz (forward); 29.5GHz to 30GHz (return)
Active Ka-band forward transponders: 24
Forward channel bandwidth: 230MHz per beam
Ka-band downlink: 19.7GHz to 20.2GHz (forward);
17.7GHz to 19.7GHz (return)
Active Ka-band return transponders: 6
Return channel bandwidth: 220MHz per beam
Typical 'dry beam' EIRP (at edge of coverage): up to 58dBW
G/T (at edge of coverage): up to 11.5dB/K-1
Typical 'wet beam' EIRP (at edge of coverage): up to 61.5dBW
G/T (at edge of coverage): up to 14.0dB/K-1



Avanti Communications HYLAS 4: 33.5°W

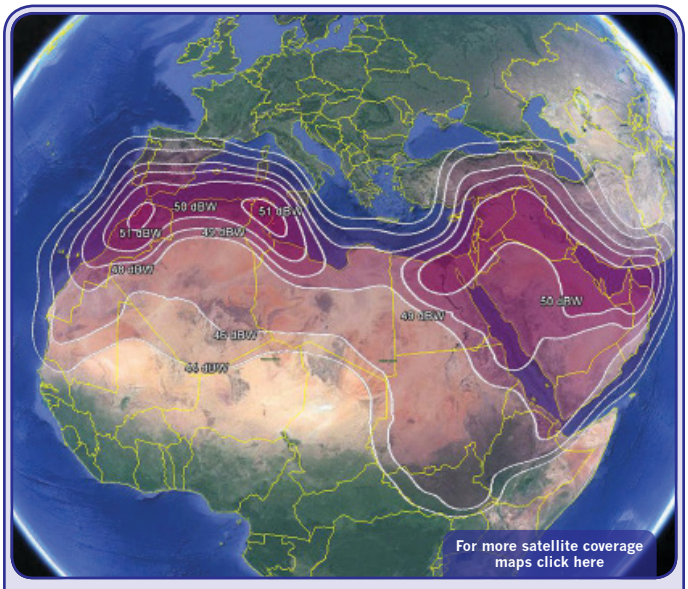
Launch date: April 2018
Ka-band uplink: 27.5GHz to 29.5GHz (forward); 29.5GHz to 30GHz (return)
Active Ka-band forward transponders: 32
Forward channel bandwidth: 220MHz per beam, 64 beams
Ka-band downlink: 19.7GHz to 20.2GHz (forward); 17.7GHz to 19.7GHz (return)
Active Ka-band return transponders: 8
Return channel bandwidth: 220MHz per beam
Typical Ka-band fixed beam performance: EIRP (at edge of coverage): up to 61.5dbW
G/T (at edge of coverage): up to 14dB/K
Bandwidth per steerable beam: Fwd: 2 x 230MHz; Rtn: 2 x 230MHz; 920MHz
Steerable beam frequencies:
Civilian bands – 29.5 to 30GHz (uplink); 19.7 to 20.2GHz (downlink)
Government bands – 30.0 -31.0 HGz (uplink); 20.2- 21.2 GHz (downlink)
Broadcast only – 21.4 to 21.9GHz (downlink)



Azerspace-1/Africasat-1a: 46°E – C-band Africa & Europe

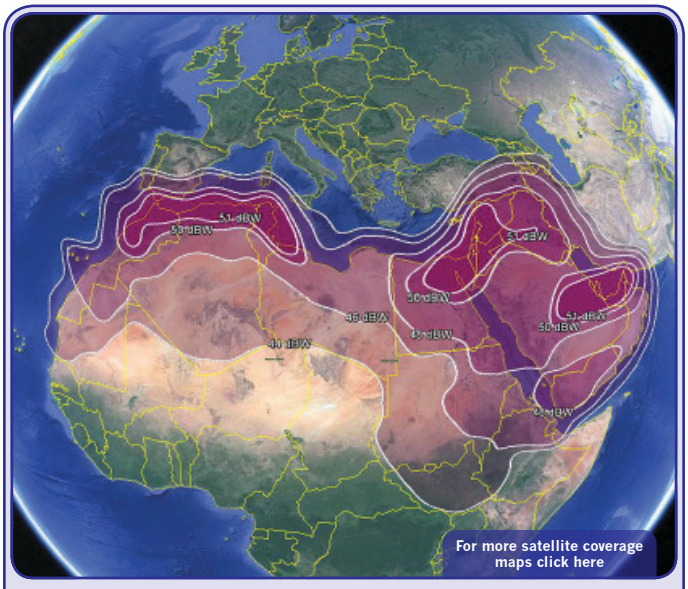
Launch date: February 2013
Active transponders: 24 (36MHz each)
Uplink: 5925 to 6425MHz
Downlink: 3700 to 4200MHz
Beams: Central Asia & Europe beam,
Africa & Europe beam
Polariaation: RHCP/LHCP and V/H relatively
TWTA power: 65W

All uplink and downlink channels are 4-block channel cross strap switchable between Central Asia & Europe and Africa & Europe beam.



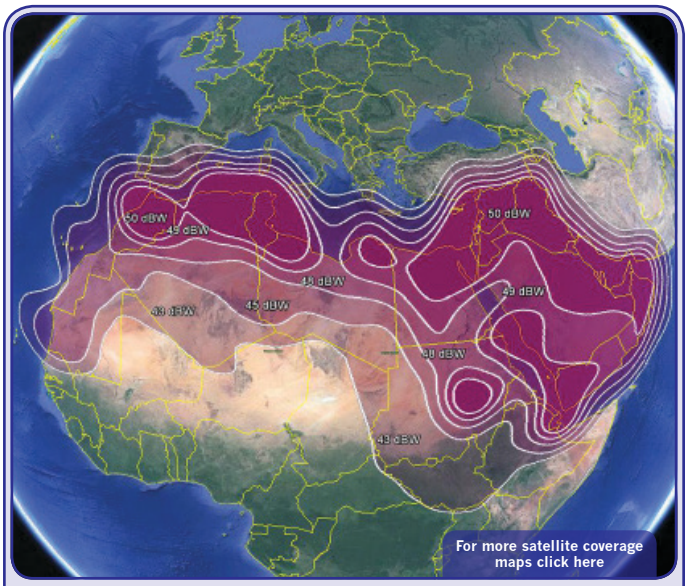
Es'hail-1 25.5°E Ku-band MENA

Launch date: August 2013
Operational life: 20+ years
Uplink coverage: MENA
Downlink coverage: MENA
Number of transponder: 16
Transponder bandwidth: 33 to 50MHz
Transponder Mode: FGM or ALC
Polarization: Linear
Downlink Frequencies: 10.95 to 11.20GHz and 11.45 to 11.7GHz
EIRP (Peak) (dBW): 52



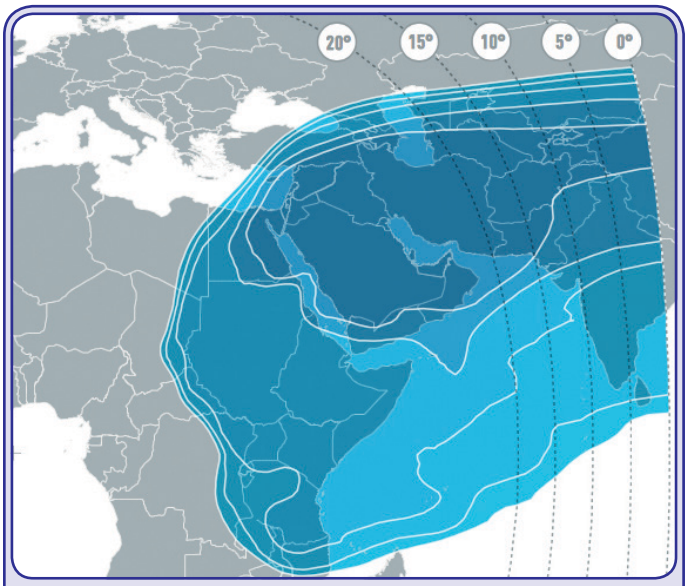
Es'hail-1 25.5°E Ka-band MENA

Launch date: August 2013
Operational life: 20+ years
Uplink coverage: MENA
Downlink coverage: MENA
Number of transponder: 7
Transponder bandwidth: 33 to 50MHz
Transponder Mode: FGM or ALC
Polarization: Linear
Downlink Frequencies: 21.4 to 21.7GHz
EIRP (Peak) (dBW): 53



Es'hail-2 26°E Ku-band MENA

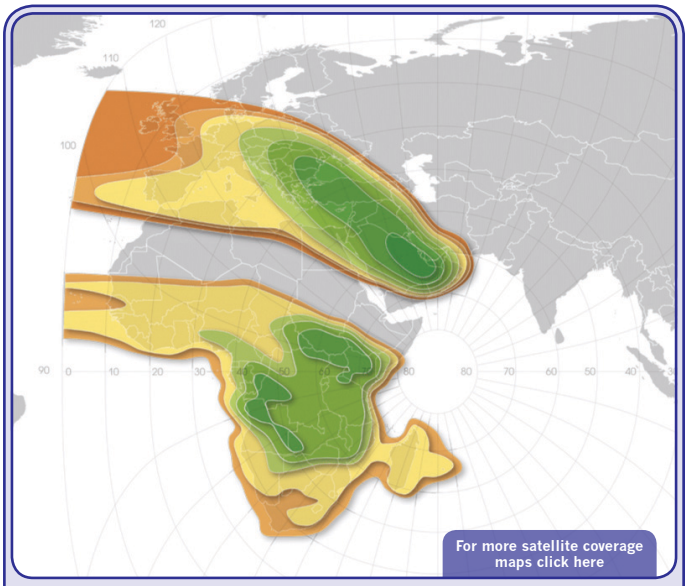
Launch date: November 2018
Operational life: 16+ years
Uplink coverage: MENA
Downlink coverage: MENA
Number of transponder: 20
Transponder bandwidth: 36MHz
Transponder Mode: FGM or ALC
Polarization: Linear
Downlink Frequencies: 10.70 to 10.95GHz and 11.2 to 11.45GHz
EIRP (Peak) (dBW): 53



EUTELSAT 3B: 3°E Ku-band

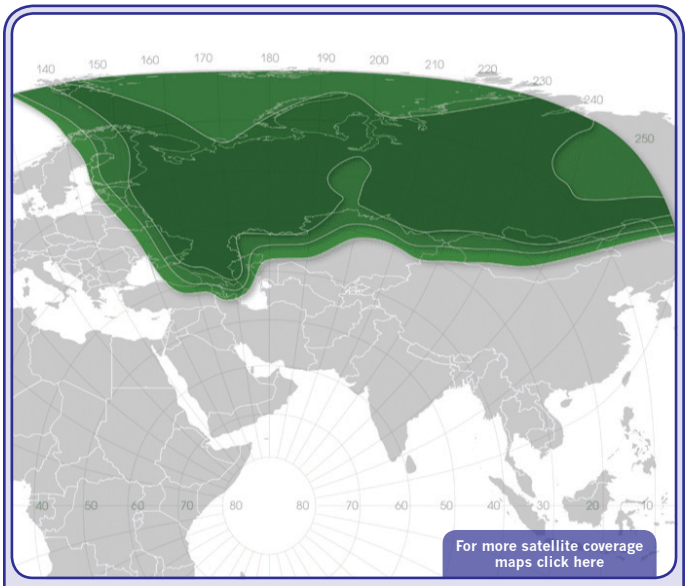
A tri-band satellite for Europe, Africa, the Middle East, Central Asia and South America, EUTELSAT 3B offers resources in Ku-, C- and Ka-band connected to fixed and steerable antennas for flexibility. It enables users to select the most relevant frequency band. Eutelsat says the Ku- and C-band capacity is optimised for broadcast and data markets, while the high throughput Ka-band beams are ideal for bandwidth-demanding markets.

Launch date: May 2014
Manufacturer: Airbus Defence and Space
Operational life: Over 15 years
Launch craft: Sea Launch AG's Odyssey
Operational transponders: Up to 51
Downlink polarisation: Ku-, Ka- and C-bands



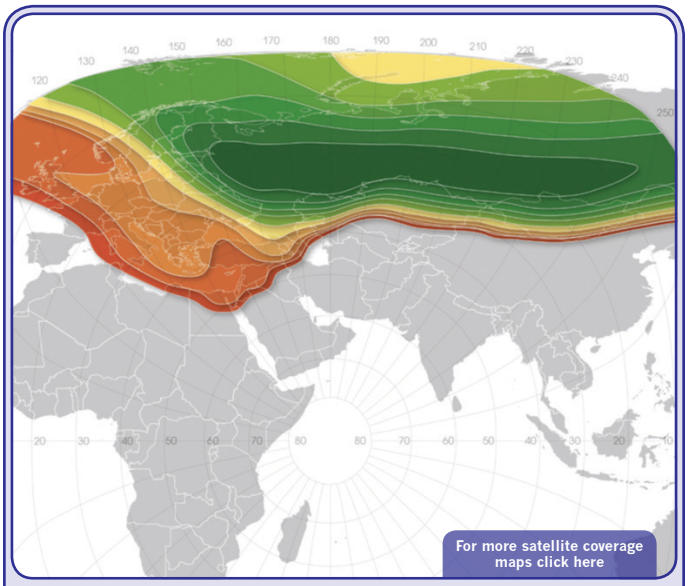
Yamal-402: 55°E Ku-band Eroupe and Southern Beams

Launch date:	December 2012
Frequency:	Ku
Operational life:	15 years
Transponders:	12 x 72MHz; 18 x 36MHz; 16 x 54MHz
Transmitter output power:	120 to 150W
Beams:	Four fixed: Russian, Northern, European, Southern, and one steerable. Eight 54MHz transponders are operating in a wide South beam that covers sub-Sahara Africa.
Payload power:	10,800W



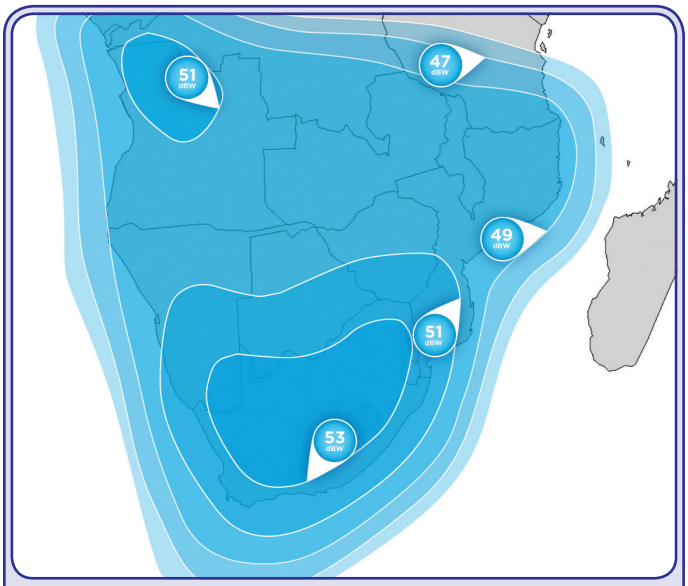
Yamal-402: 55°E Ku-band Russian Beam

Launch date:	December 2012
Frequency:	Ku
Operational life:	15 years
Transponders:	12 x 72MHz; 18 x 36MHz; 16 x 54MHz
Transmitter output power:	120 to 150W
Beams:	Four fixed: Russian, Northern, European, Southern, and one steerable. Eight 54MHz transponders are operating in a wide South beam that covers sub-Sahara Africa.
Payload power:	10,800W



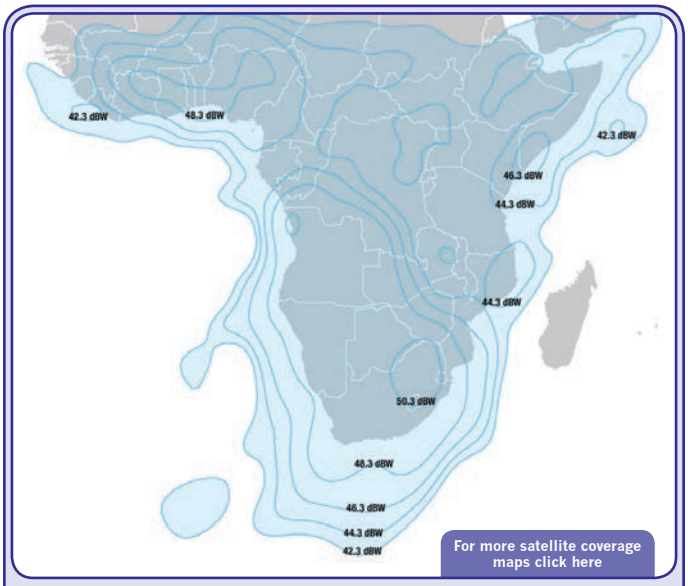
Yamal-402: 55°E Ku-band Northern Beam

Launch date:	December 2012
Frequency:	Ku
Operational life:	15 years
Transponders:	12 x 72MHz; 18 x 36MHz; 16 x 54MHz
Transmitter output power:	120 to 150W
Beams:	Four fixed: Russian, Northern, European, Southern, and one steerable. Eight 54MHz transponders are operating in a wide South beam that covers sub-Sahara Africa.
Payload power:	10,800W



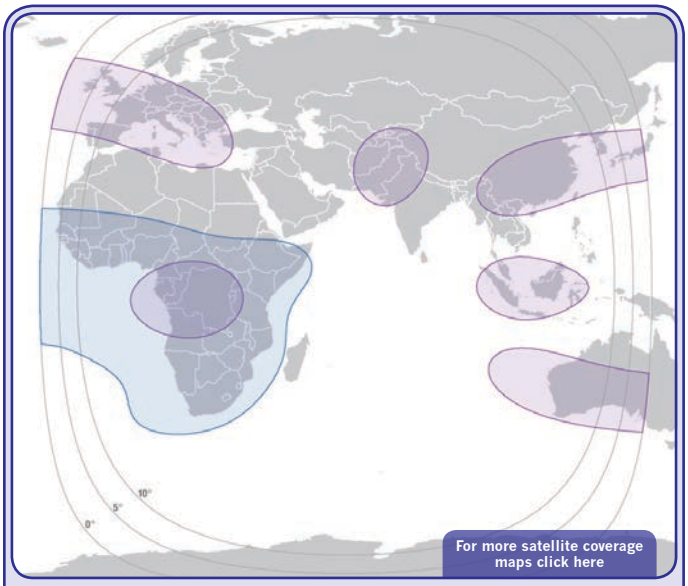
Hellas Sat 3: 39°E

Launch date:	June 2017
Coverage:	Europe, M.East and Southern Africa
Southern Africa beam	
Transponders:	12 x 36 MHz Ku-Band, 3 x 72 MHz Ku-band
Frequency:	Std & Ext. Ku-band
EIRP(S. Africa):	53 dBW
G/T (S. Africa):	+6 dB/K
Cross Strapping:	Europe to S. African beam



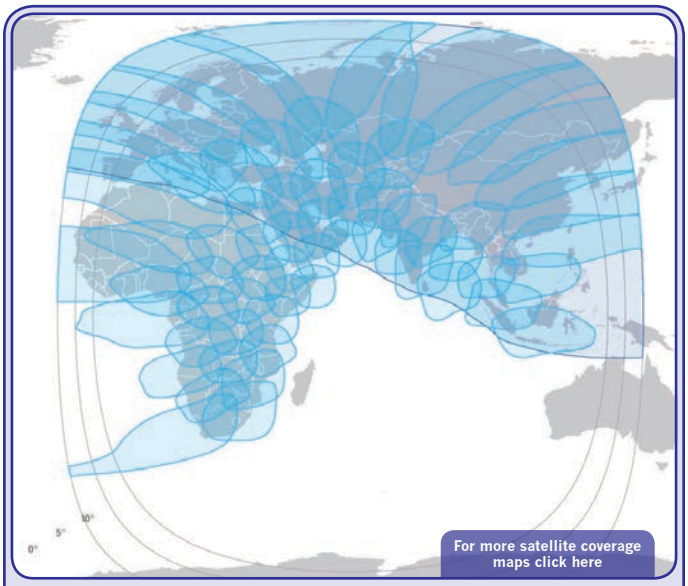
Intelsat 28: 33°E Ku-band

Configurable Capacity: 24 (in equivalent 36 MHz units)
Polarization: Linear - Horizontal or Vertical
Downlink Frequency: 10.95 to 11.70GHz
Typical edge of coverage EIRP: > 42.8 dBW
Uplink Frequency: 14.00 to 14.50GHz
Beam Peak G/T: Up to 5.6 dB/K



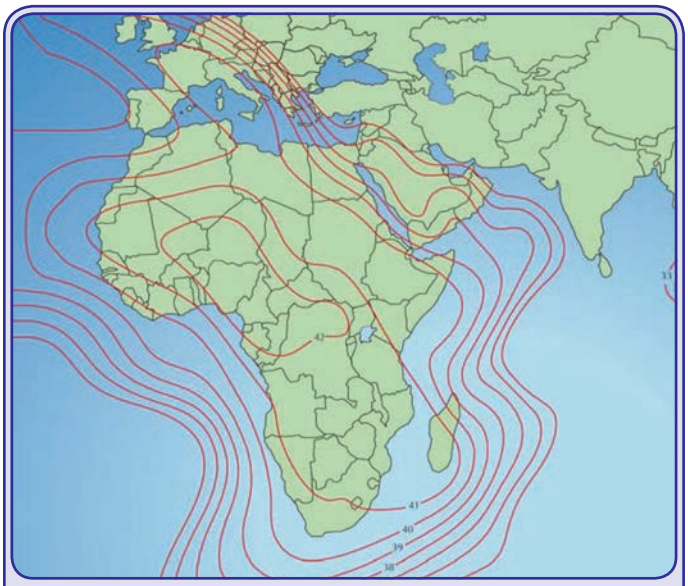
Intelsat 33e: 60°E C-band

Configurable Capacity: 79 (in equivalent 36 MHz units)
Polarization: Linear - Horizontal or Vertical
Circular - Right Hand or Left Hand
Typical edge of coverage EIRP: 46.7 up to 53.2 dBW
Typical G/T Range: 4.3 to 13.6 dB/K



Intelsat 33e: 60°E Ku-band

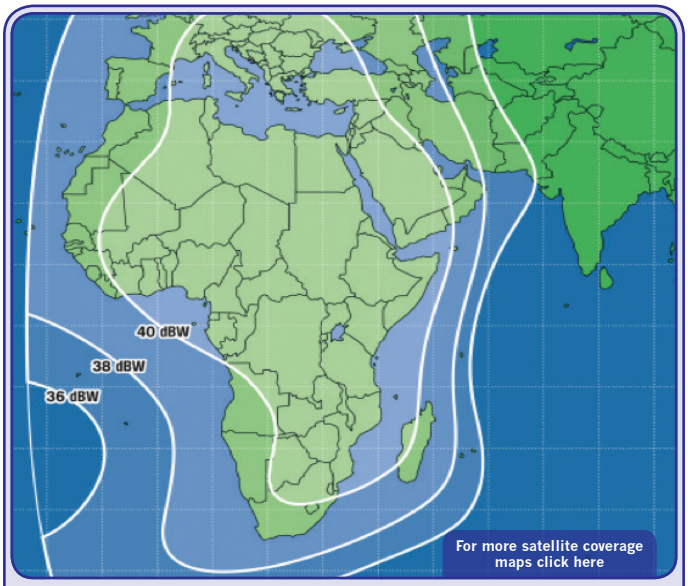
Configurable Capacity: 79 (in equivalent 36 MHz units)
Polarization: Linear - Horizontal or Vertical
Circular - Right Hand or Left Hand
Typical edge of coverage EIRP: 41.2 up to 43.4 dBW
Typical G/T Range: -0.6 to 1.8 dB/K



MEASAT AFRICASAT-1A/AZERSPACE-1: 46°E

AFRICASAT-1a / Azerspace-1 is the result of a collaboration between Malaysia-based MEASAT Satellite Systems and the Azercosmos Joint Stock Company set up by the government of Azerbaijan. It provides high-powered services across Africa, central Asia and Europe. As well as C-band capacity across Africa with connectivity to Europe, the Middle East & South East Asia, Ku-band services are also offered across South East Asia.

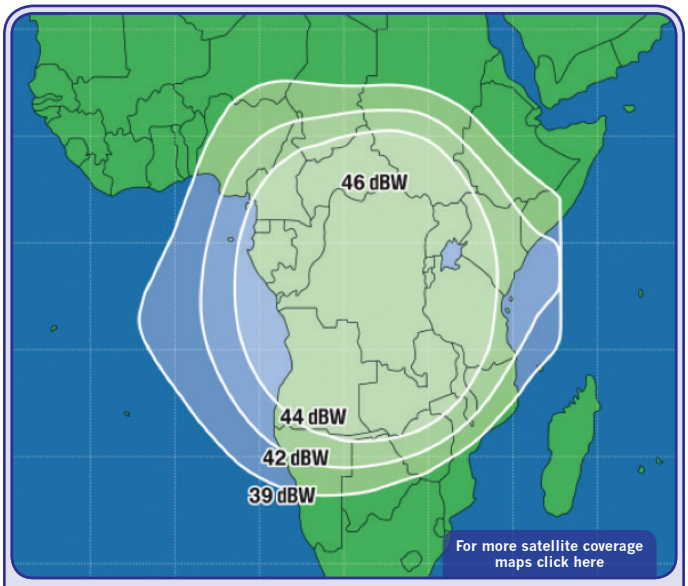
Launch date: February 2013
C-band transponders (36MHz equivalent): up to 24
Typical EIRP beam coverage: 42dBW (max)
G/T (dB/oK): -1 (max)
TWTA power: 65W **Polarisation:** linear



RSCC Express-AM6: 53°E – C-band, fixed beam, EMEA

Express-AM6 satellite is designed for TV broadcasting, enterprise networks, disaster recovery and business continuity, IP trunking, cellular backhaul, oil & gas and mobility applications.

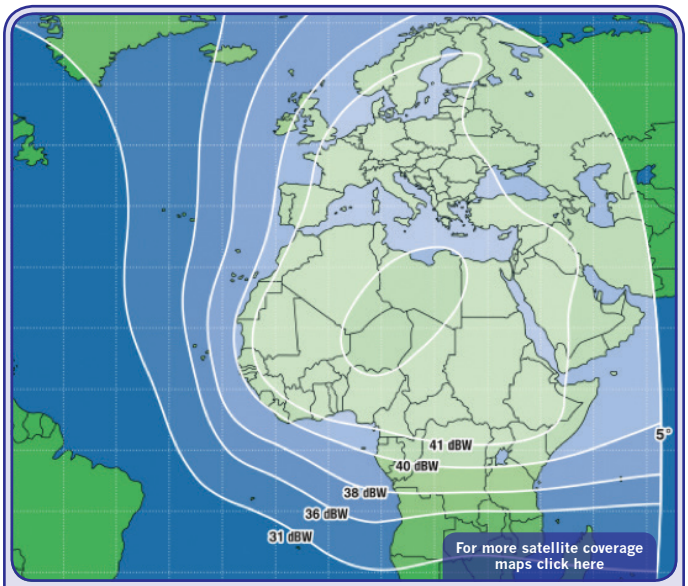
Launch date: October 2014
Coverage: Russia, EMEA, sub-Saharan Africa
Operational life: 15 years
Operational transponders: C, Ku, Ku-/Ka-, Ka, L



RSCC Express-AM7: 40°E – C-band, steerable spot beam, optional pointing: West Africa

Express-AM6 satellite is designed for TV broadcasting, enterprise networks, disaster recovery and business continuity, IP trunking, cellular backhaul, oil & gas and mobility applications.

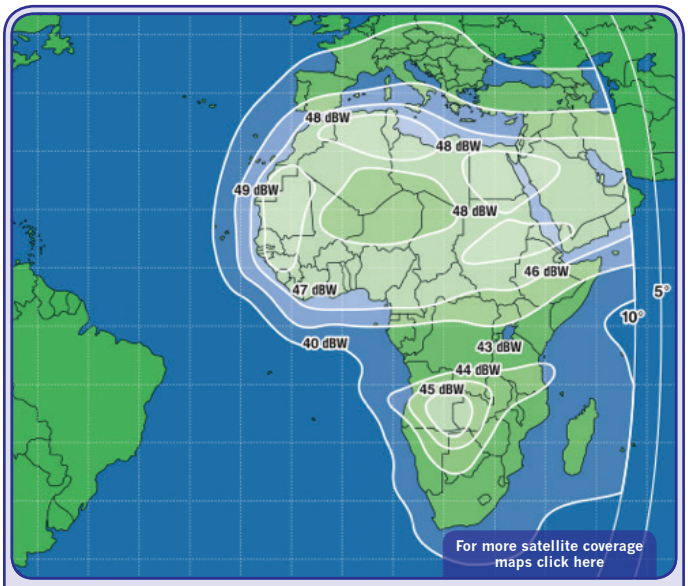
Launch date: March 2015
Coverage: Europe, Middle East, sub-Saharan Africa, Russia, South-East Asia
Operational life: 15 years
Operational transponders: C, Ku, L



RSCC Express-AM8: 14°W – C-Band, fixed beam, EMEA

Express-AM8 is designed for TV broadcasting, enterprise networks, broadband Internet access, USO, telemedicine and distance learning applications.

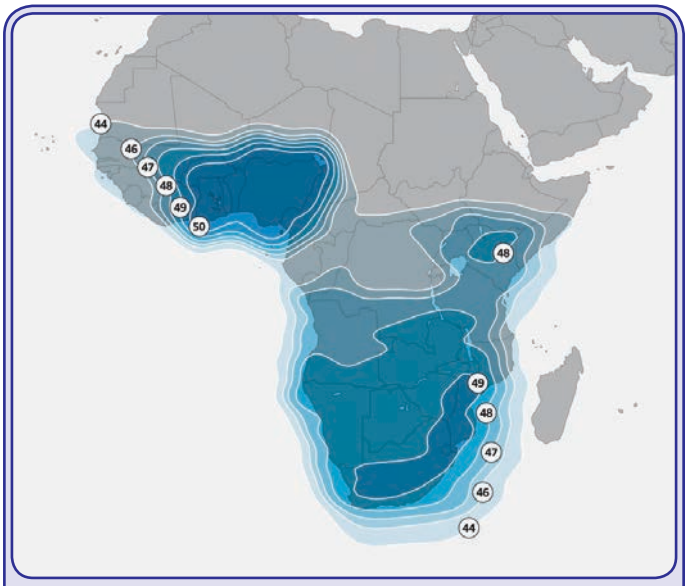
Launch date: September, 2015
Coverage: Europe, MENA, sub-Saharan Africa, Latin America
Operational life: 15 years
Operational transponders: C, Ku, L



RSCC Express-AM8: 14°W – Ku-band, fixed beam, MENA & East

Express-AM8 is designed for TV broadcasting, enterprise networks, broadband Internet access, USO, telemedicine and distance learning applications.

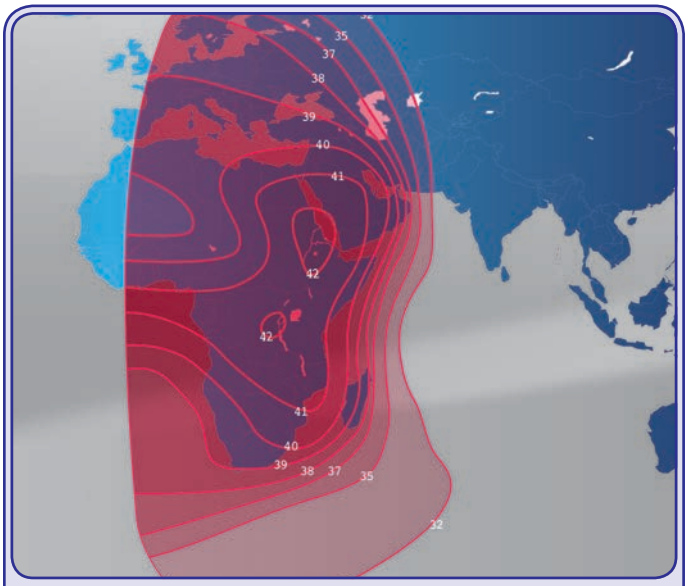
Launch date: September, 2015
Coverage: Europe, MENA, sub-Saharan Africa, Latin America
Operational life: 15 years
Operational transponders: C, Ku, L



SES ASTRA 4A: 5°E

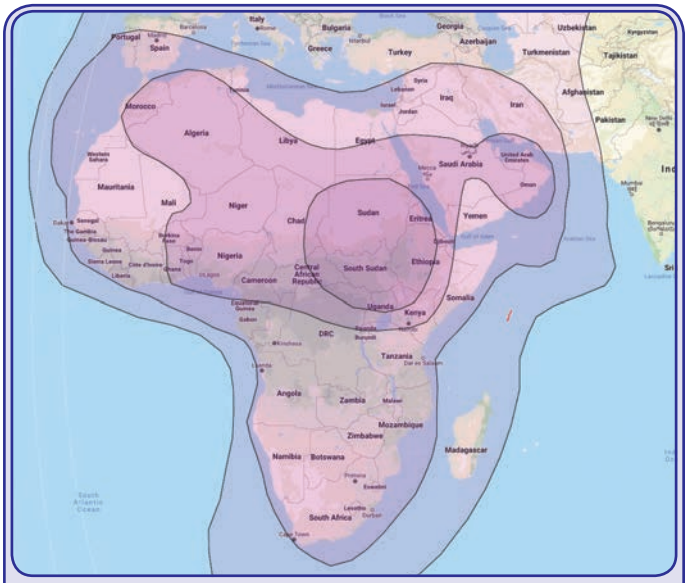
ASTRA 4A is a multi-mission Ku / Ka-band satellite that supports services for DTH broadcasting, cable TV feeds, occasional transmissions and broadband solutions to Europe and Africa.

Launch date:	November 2007
Launch vehicle:	Proton Breeze M
Operational life:	15 years
Manufacturer:	Lockheed Martin
Total transponders:	Ku-band: 54
	Ka-band: 3



Singtel ST-3: 75°E – Africa C-band

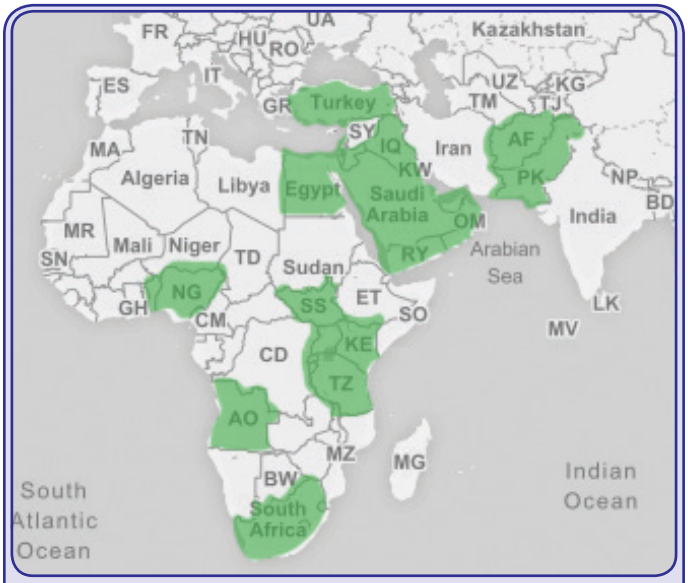
Launch date:	February 2014
C-band Payload:	13
Frequencies:	Uplink: 5.950 to 6.385GHz
	Downlink: 3.680 to 4.200GHz
Transponder bandwidth (MHz):	36 & 72
Polarisation:	Dual linear
Cross-polarisation separation (dB):	Better than 27
EIRP (peak value) (dBW):	45
TWTA size:	62W
TWTA redundancy:	34 for 26 primary TWTA
G/T (peak value) (dBK):	+6



Yahsat Al Yah 1 (Y1A): 52.5°E – C-band

Launched in April 2011, Al Yah 1 was the first satellite launched by Arianespace for the United Arab Emirates. It offers Ka-band for government solutions and Yahlive services, beaming high-quality free-to-air TV channels to a culturally diverse audience.

Launch date:	April 2011
Number of transponders:	C-band 8 x 36MHz plus 6 x 54MHz
	Ku-band BSS 25 x 33MHz
	Ka-band secure Military 21 x 54MHz
Payload power:	11.6KW



Yahsat Al Yah 2 (Y1B): 47.5°E

Al Yah 2, launched in 2012, offers YahClick services – providing high-performance satellite broadband for homes and businesses in the Middle East, Africa, Central and South West Asia. Its broadband coverage extends throughout rural and remote areas.

Launch date:	April 2012
Launcher:	ILS Proton
System Supply Contractor:	Airbus & Thales Alenia Space
Operational life:	15 years
Capacity:	Ka-band
Payload power:	9.7KW