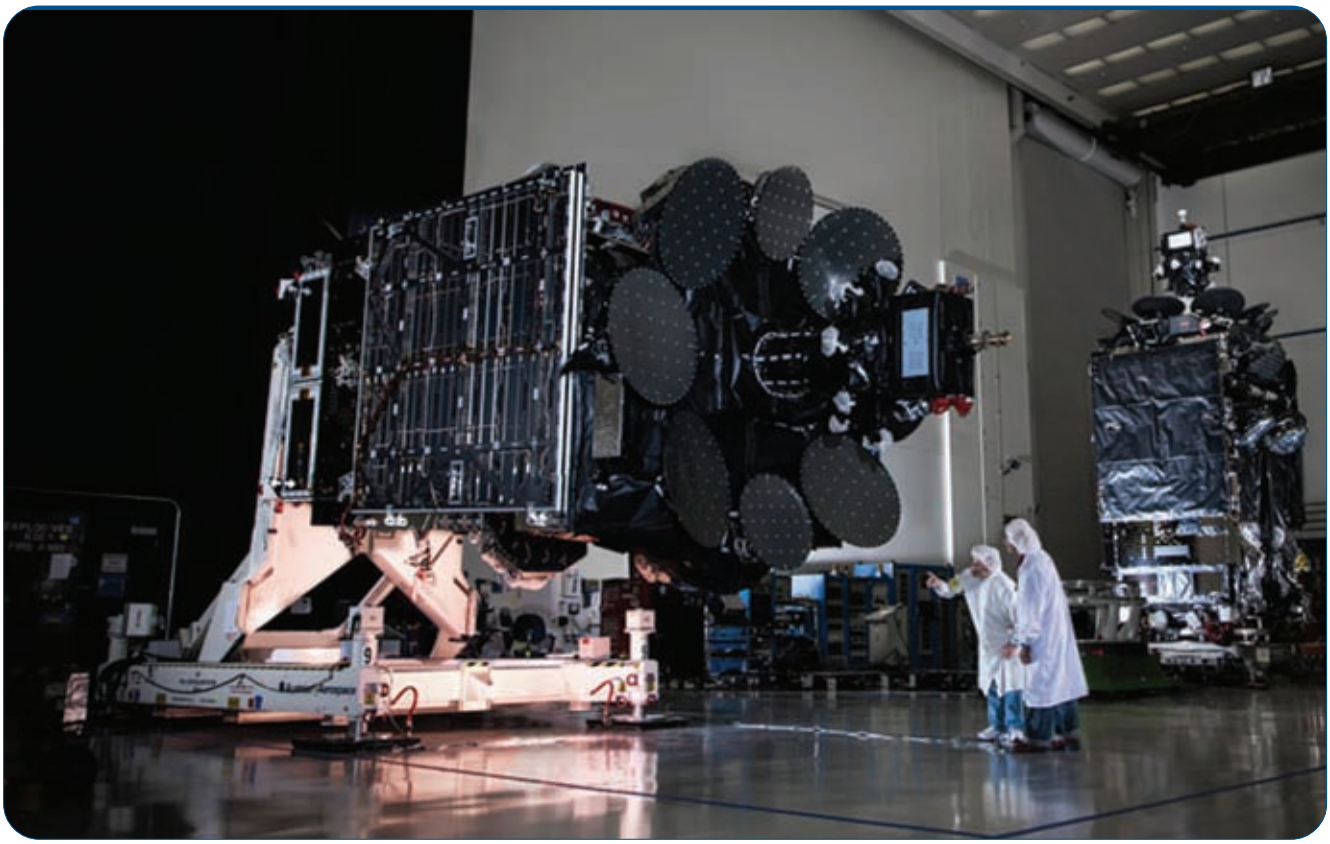

Inmarsat I-5 F1 and I-5-F2 in Boeing facility. Photo Inmarsat

# HTS goes global

High throughput satellites (HTS) have proven to be a massive game-changer in the satellite industry in recent years, providing huge amounts of capacity and opening the doors to new applications with lower cost per bit. As two-way data transfers become more cost-effective, communications on the move and remote VSAT systems in particular are expected to boom in popularity, providing a great opportunity for HTS operators.

**High Throughput satellites (HTS) have prompted** a new era in the satellite industry, providing unprecedented capabilities the world over. One advantage of HTS is the increase in throughput, which can be 100 times greater than that of a traditional satellite, for the same amount of allocated spectrum. The increased throughput is enabled by high level frequency reuse and spot beam technology, resulting in a significant reduction in cost per bit.

The uses of HTS capacity are many and varied, and the lower cost per bit opens up new applications by virtue of increased affordability. The delivery of high speed Internet to rural, underserved and unserved regions is one of the top applications, while cellular backhaul, Internet of Things (IoT) systems and communications on the move also make great use of HTS. Even the broadcast market, which has historically been well-served by traditional wide-beam satellites, is now seeing opportunities for specific broadcast applications to serve relatively small geographic areas with a single spot beam.

"Spot beam technology has provided a huge advantage to broadcasters to concentrate more on their target market, enjoying the strength of satellite capabilities to ensure the high degree of reliability and availability to their customers, particularly in harsh and tropical environments, where the degradation of satellite signals have been always a big barrier to DTH market penetration," Mahdi Mehrabi, Chief Technology Officer and Managing Director (Asia) of North Telecom, told *Satellite Evolution*.

Research and Markets' *'High Throughput Satellites: Vertical Market Analysis & Forecasts,'* report estimates that 123 new HTS systems are expected to be launched over the next decade, with global capacity expected to more than quadruple from 690Gbps in 2015 to almost 3Tbps by 2020. HTS capacity lease revenues are forecast to grow from US$1.1 million in 2015 to US$4.9 billion by 2024.

Of course, the relationship between new space technology and ground technology is having a significant impact on the proliferation of HTS. The development of next generation ground equipment such as Phasor and C-COM's phased array antennas, and Kymeta's metamaterials systems, are

expected to enable much higher throughputs while being more cost-effective. HTS capacity consumption is expected to grow significantly as the new antennas enable greater uptake, especially within the mobility spheres like connected cars. With the first of these new antennas due for commercial launch in the second quarter of 2017, the HTS market is expected to boom.

### Thaicom builds upon IPSTAR 1 legacy

Thaicom changed the world when it launched the first HTS, IPSTAR 1, in 2005. The SSL-built satellite has 45Gbps of capacity and was designed to provide broadband Internet services over the Asia-Pacific region, with speeds of 6Mbps down and 4Mbps up.

Its latest HTS project was announced in October 2016. Thaicom's subsidiary, International Satellite Company Limited (ISC), entered into a satellite procurement contract with China Great Wall Industry Corporation (CGWIC) for US$208 million. The satellite will have 53Gbps of throughput via 37GHz of Ka-band capacity, and will provide services over the Asia-Pacific region. The launch is expected by the end of 2019.

"There is a growing demand for broadband services in the future, which will lead to a lot of competition and interesting developments. But we believe that there continues to be a strong market for GEO satellite enabled broadband services. Thus, we continue to invest in our broadband programme," Patompob (Nile) Suwansiri, CCO of Thaicom, told *Satellite Evolution*. "IPSTAR was the first HTS in the world and since its launch in 2005, our name has become synonymous with satellite broadband services in Asia-Pacific. We want to continue to build upon this legacy."


*EchoStar XIX. Photo SSL*

### Intelsat advances Epic$^{NG}$ fleet

For many in the industry, it's impossible to think about HTS without the mind flitting to the Intelsat Epic$^{NG}$ platform. When completed, the platform will deliver global coverage with HTS technology based on open architecture, engineered for backwards compatibility, utilising C, Ku and Ka-bands with a mixture of wide beams, spot beams and frequency reuse technology.

Intelsat Epic$^{NG}$ services were first launched in March 2016 with Intelsat 29e at 310 degrees East, providing coverage over the Americas, the Caribbean, Eastern United States and the North Atlantic region. Consumers from every major end user market, including government, defence, aviation, maritime, enterprise and broadcast have already signed up to the service. Next, in January 2017, in-orbit testing was completed for the second Epic$^{NG}$ satellite, Intelsat 33e. Operating from 60 degrees East, Intelsat 33e provides coverage over Europe, the Middle East, Africa, Asia-Pacific, Mediterranean and Indian Ocean regions.

The most recent development in the Intelsat Epic$^{NG}$ timeline came in February 2017, when Intelsat 32e was launched to 317 degrees East by Arianespace. The latest Epic$^{NG}$ satellite will overlay certain beams of Intelsat 29e, increasing the throughput available in the high-traffic areas over the Caribbean and North Atlantic routes. Intelsat plans to launch another two Intelsat Epic$^{NG}$ satellites in 2017; Intelsat 35e and Intelsat 37e, and will complete its global footprint in 2018 with Horizons 3e, which will be orbited at 169 degrees East.

### Eutelsat nears launch of EUTELSAT 172B

As a well-established satellite operator, it was only natural that Eutelsat was one of the first to adopt HTS technology. In fact, the company launched Europe's first HTS, KA-SAT, in 2012. The 90Gbps satellite uses 82 Ka-band spot beams to deliver high speed Internet.

Eutelsat plans to launch its next HTS, EUTELSAT 172B, in the second quarter of 2017. Airbus Defence and Space finished manufacturing the satellite in January 2017, making it the first high-power all-electric telecommunications satellite to be constructed in Europe. With C, Ku and high throughput Ka-band payloads, Eutelsat's coverage will be enhanced over China and the Pacific Islands. EUTELSAT 172B will also provide coverage over the North Pacific Rim to serve aircraft travelling between the USA and Asia; Panasonic Avionics has already signed a long-term agreement for this capacity.

"We're building HTS with multi beam coverage for different regions. This is bringing down the cost of capacity to a point where we can provide services to end users at prices which are competitive with terrestrial telecommunications networks," Jean-François Fenech, CEO of Eutelsat Asia, told Satellite Evolution. "In Europe, service providers using our infrastructure are proposing connectivity for around Euro30/month, in line with the price of terrestrial alternatives. This has allowed us to capture a great deal of the unserved areas. We are now replicating this model in other regions of the world, notably in Russia, Sub-Saharan Africa and Latin America."

### ViaSat plans global HTS coverage

Global broadband services and technology company ViaSat augmented its capabilities with the launch of its first HTS, ViaSat-1, in 2012. This capacity has been used to provide Ka-band services over North America and Hawaii, delivering Exceed Internet in the US, and Xplornet in Canada.

The company is now preparing for the launch of ViaSat-2 in the first quarter of 2017. ViaSat-2 was designed to provide both high capacity bandwidth and wide coverage, as well as the flexibility to move bandwidth to where it's required. The satellite will provide double the bandwidth economics advantage of ViaSat-1, double the throughput, and provide seven times the coverage. ViaSat-2 is the company's first step toward spreading its high-capacity coverage worldwide for fixed broadband and mobility services for aviation and maritime.

Going forwards, ViaSat plans to develop its ViaSat-3 platform, a system of three satellites that will deliver a global broadband network with enough capacity to deliver an affordable, high-speed, high-quality Internet and video streaming service. ViaSat announced the Preliminary Design Review (PDR) for the first two of its ViaSat-3 satellites in November 2016. Each ViaSat-3 satellite is expected to deliver more than 1Tbps of capacity, and will have the flexibility to dynamically direct capacity to where customers are located. The first two ViaSat-3 satellites will provide Ka-band coverage over the Americas, Europe, the Middle East and Africa, while a third ViaSat-3 satellite is ultimately planned for the Asia-Pacific region, completing ViaSat's global service coverage. The first ViaSat-3 satellite is expected to launch in 2019.

### Inmarsat anticipates delayed Global Xpress satellite launch

Inmarsat's Global Xpress (GX) entered full global commercial service in December 2015. According to Inmarsat, GX was the first service that provided full, global coverage with capacity from a single satellite operator, providing a consistent network service. The GX constellation consists of three Ka-band I-5 class HTS which between them provide full global coverage. The I-5 satellites use a combination of fixed narrow spot beams that deliver high speeds through compact terminals, and six steerable beams so that additional capacity can be directed in real-time to where it's needed.

Inmarsat ordered a fourth I-5 satellite from Boeing for the GX constellation to augment existing capabilities. The I-5 F4 satellite was initially expected to launch at the end of December 2016, however the launch was delayed due to the backlog in SpaceX's launch programme following the launch pad explosion in September 2016. I-5 F4 is now expected to be launched by SpaceX in the first half of 2017.

### SES prepares for first HTS launches

SES's first HTS capacity came with the acquisition of O3b Networks in August 2016. The medium Earth orbit (MEO) HTS constellation provides low latency Ka-band capacity via 70 spot beams and 12 satellites. An additional eight MEO satellites are planned to augment the existing constellation and meet demand, with four due for launch in 2018, and four


*O3b satellite, manufactured by Thales Alenia Space. Photo O3b Networks*

# Solutions for specific needs

Spacecom, the Israeli operator of the AMOS satellites, is one of the latest companies to explore HTS technology. In December 2016, Spacecom ordered a new multi-band HTS from Boeing Satellite Systems International in a US$161 million deal. AMOS-17, will offer Ka, Ku and C-band services with a combination of broad regional beams and high throughput spot beams. Coverage will include Africa, the Middle East, and Europe, from its 17 degrees' East orbital slot. Amy Saunders spoke with Eran Shapiro, Director Business & Technology Ventures at Spacecom, to find out more about the company's expectations of the HTS market.

**Question: What is Spacecom's outlook and expectation for the potential of HTS?**
**Eran Shapiro:** At Spacecom, we feel very excited in this change of regime: We are now seeing the tipping point in which HTS can be the most sensible way to deliver some satellite-based services in current market segments and to open new segments. We are now at a point where HTS capacity and matching ground equipment can unlock new segments for some satellite services. We also believe that the combination of new pricing points and added capacity, both from the satellite point of view and ground segment equipment, can create new opportunities of which we are not yet aware.

**Question: What advantages will HTS provide Spacecom compared with traditional satellites?**
**Eran Shapiro:** The first obvious advantage of HTS is the ability to offer applicable applications more capacity at lower cost per Mbps. This is true across the industry, rather than specific to us at AMOS. Spacecom has current manufactured satellites and future planned ones that will be able to offer a mix of HTS capacity in multiple bands across different geographies. This will provide a competitive advantage to Spacecom, because at one point we expect that a majority of our future fleet will have this new and exciting tech. As we reach out and speak with some of our customers, they have very specific requirements for HTS capacity for different types of services. Our orbital rights at multiple orbital slots and how we build our future satellites will enable us to match their future thinking and needs.

**Question: What challenges does Spacecom expect as HTS become more commonplace throughout the industry?**
**Eran Shapiro:** Spacecom sees challenges in some countries and regions where there is still a perception that Ku-band or C-band are the only legitimate bands for delivering satellite services. Some still hold this opinion despite the advantages of a very low cost per Mbps and the low cost of ground equipment that Ka-band HTS provides. Therefore, in some areas there is still a certain reticence to remain with other bands for specific services instead of moving to Ka-band.

Another challenge in this market surrounds capacity. If a satellite operator takes the next step and builds a satellite with very HTS (VHTS) capacity of 500Gbps or 1Tbps it will be faced with a huge distribution challenge, selling that large amount of capacity. There is a limit to what one can sell to customers, resellers and others. Not everyone is capable of handling this larger ecosystem, and satellite operators will need to evolve to be able to effectively compete.

A further challenge is the ability to correctly forecast the future in relation to market and competition. When creating the blueprints to build a new satellite, taking into account figures for future consumer broadband and government services is not easy, especially when one needs to also consider competition. We all need to note that one size does not fit all!

**Question: Does Spacecom have plans for more HTS beyond AMOS-17?**
**Eran Shapiro:** Spacecom is currently considering the right mixture for our growth strategy. We have existing orbital slots in use we can further develop, such as 4 degrees West, 17 degrees East and 65 degrees East, as well as finding the right method to use our other orbital slot assets in expanding both to the East and to the West. Spacecom believes that one of the keys for growth is finding the right partners for developing new orbital slots and building new satellites, whether in joint ventures or via hosted payloads. We are currently talking with these types of partners to explore such and other new possibilities. ■

in 2019. SES is currently gearing up for the launch of its first in-house HTS, SES-12, in the second half of 2017. The satellite has both traditional wide beam and high throughput Ku-band spot beams to provide capacity for growth in key areas over the Asia-Pacific region. SES-14 and SES-15, two further HTS with Ku-band wide beam and spot beam payloads, are also due for launch during the year. These will provide coverage over the Americas and the Atlantic Ocean region.

Most recently, in September 2016, SES ordered SES-17 from Thales Alenia Space. Due for launch in 2020, the all-electric HTS will complement the company's existing coverage with almost 200 Ka-band spot beams over the Americas and the Atlantic Ocean region.

### Hughes begins system level testing of 'world's highest capacity broadband satellite'

Hughes was another reasonably early adopter of HTS technology, having launched its first HTS, EchoStar XVII, in 2012. It has since built up a large ecosystem, including the HughesNet Gen4 satellite Internet service, around its new capabilities.

In January 2017, Hughes Network Systems began system level testing of its new EchoStar XIX satellite, 'the world's highest capacity broadband satellite,' which more than doubles the company's existing capacity. Designed with Hughes JUPITER System high throughput technology, EchoStar XIX is a multi-spot beam, Ka-band satellite that will power HughesNet Gen5, its next-generation high-speed satellite Internet service. EchoStar XIX's 138 beams will provide coverage over the continental US, Alaska, Mexico and parts of Canada and Central America.

### Yahsat looks to Brazil with Al Yah 3

YahSat is one of the few medium-sized operators to have taken advantage of the new capabilities that HTS bring to the table. Following on from the success of Ka-band HTS Yahsat 1B, Yahsat is currently preparing for the launch of Al Yah 3, an all Ka-band HTS with 60 spot beams based on Orbital ATK's GEOStar-3 platform. Al Yah 3 will expand

*Photo an artists rendering of the AlYah3*

Yahsat's coverage to Brazil and 19 new markets in Africa, doubling its reach, upon its launch in the first half of 2017. Around 10Gbps, 18 spot beams, of Al Yah 3's capacity will be used for Connect Africa, Eutelsat's strategy to deliver commercial broadband service to Sub-Saharan African nations by 2019. Up to 16 spot beams on Yahsat 1B will also be used for the project.

### Kacific Broadband Satellites orders first HTS

Kacific is one of the latest companies to join the HTS revolution. It plans to address the endemic lack of high-speed and affordable broadband in the Pacific and Southeast Asia. The company closed a US$147 million financing round in late 2016 to cover the satellite, launch service, ground systems and other project costs.

Kacific ordered its first HTS, Kacific-1, from Boeing in February 2017. The condominium satellite will be shared with JCSAT-18, ordered by SKY Perfect JSAT Corporation. Kacific-1 will deliver broadband throughput via 57 Ka-band narrow beams, each with up to 1.25Gbps of capacity. The beams were designed to cover 20 Pacific and Southeast Asian nations. So far, capacity has been sold on 51 of the 57 beams, with sold capacity exceeding 70 percent on most beams already. Based on the early sales success in the Asia-Pacific region, Kacific is now preparing plans for follow-on HTS.

"With the launch of Kacific-1 in 2019, people in areas currently lacking affordable high speed Internet will be able to access online education, healthcare and public services, and grow their local economies. Delivering Internet speeds over 100Mbps on low cost, small form factor terminals, will help connect the dots of South East Asia and the Pacific to the digital world," said Christian Patouraux, Kacific's CEO. ■

*AMOS-17, will offer Ka, Ku and C-band services*