Changing the world with HTS

High throughput satellites (HTS) have proved a real game-changer for the communications industry. Delivering up to 20 times as much throughput as a traditional satellite enables significant cost savings per bit, making new applications cost effective and accessible. While launch delays set back plans during the latter half of 2016, 2017 has been rife with news and launches of the latest HTS – here, we take a look at the latest developments.

Ask anyone in the satellite industry what the biggest innovation in the last 10 years has been, and many will name the advent of high throughput satellites (HTS). Lauded for their ability to deliver many times more throughput than traditional satellites from the same amount of allocated orbital spectrum, HTS provide lower cost-per-bit capacity by achieving a high level of frequency re-use and spot beam technology.

Timing has been auspicious for HTS. Largely designed to deliver broadband and connectivity services on a global scale, if the technology had been launched 20 years ago, it probably wouldn't have achieved the same level of backing and popularity it has done today, in the age of the Internet. HTS technology has truly hit the ground running.

Storming the market

According to Euroconsult’s June 2017 report, ‘High Throughput Satellites: Vertical Market Analysis & Forecasts,’ the total committed investment from the 30 satellite operators in HTS systems has reached almost US$19 billion. There have been 36 GEO-HTS launches in the last decade, but around 100 more are expected in 2017-2025, with an average launch rate of 11 each year.

‘After relatively low net additions of HTS supply in 2015 and 2016, due in part to slippage of launch schedules, capacity supply is now set to more than double to nearly 2,000Gbps by 2018, reaching roughly 3,600Gbps by 2020,’ said Brent Prokosh, Senior Consultant at Euroconsult and contributor to the report. ‘Nevertheless, the growth in GEO-HTS is to be overshadowed by the emergence of non-geostationary (NGSO) constellation projects. NGSO-HTS constellation projects are building momentum, promising massive volumes of capacity supply, low latency and global (or near-global) coverage.

While it is highly unlikely that all will come to fruition, NGSO-HTS projects such as the continued expansion of SES’ O3b fleet of MEO satellites, OneWeb, SpaceX, Teesta and Leos at would combine to account for over US$20 billion of required investment capital and add upwards of 40Tbps of supply.’

According to the report, NGSO-HTS demand, today anchored by O3b, is expected to grow at an average rate of
40 percent annually, with at least one LEO-HTS constellation anticipated to be launched within the forecast period. Euroconsult states that HTS capacity lease revenues are anticipated to exceed US$6 billion by 2025, generating more than US$36 billion in aggregate revenues during 2017-2025, despite lower capacity prices and increasing commodification. Consumer broadband services in North America are expected to remain the single largest driver, consuming 1,200Gbps of capacity by 2025. Meanwhile, civil government and enterprise networks should grow at a CAGR of 33 percent to 555Gbps by 2025, while cellular backhaul and trunking is expected to reach more than 475Gbps by 2025, growing at an even faster rate due to low-cost 3G and 4G backhaul solutions. Finally, demand in the aeronautical and maritime mobility markets is anticipated to reach a combined leased capacity of 480Gbps by 2025.

Northern Sky Research (NSR) holds similar market expectations. Its ‘Global Satellite Capacity Supply & Demand, 14th Edition (GSCSD14)’ reports that, despite a decline of more than US$2 billion in annual FSS revenues driven by C-band and Ku-band declines, HTS revenues will increase by a factor of 10 between 2016 and 2026, producing a US$17 billion annual market by 2026. NSR expects HTS capacity to exceed 17Tbps by 2026, with around 60 percent of that capacity coming from one or more LEO-HTS constellations, and 7Tbps coming from GEO-HTS, primarily on Ka-band. Accordingly, the satellite industry will find itself in many positions where growth needs to be scalable, and operators must find an effective way to sell much more capacity than previously. “This will lead to operators forging closer ties to telcos, service providers, integrators, etc. - basically, companies who have the infrastructure to move a lot of capacity,” said Blaine Curcio, NSR Principal Analyst and report author. “I believe that SoftBank - one of the world’s largest telcos - investing US$1.4 billion into OneWeb, and the company’s subsequent interest in Intelsat, is not the last time we will see a telco looking at a satellite operator as a strategic asset in a world increasingly based on global connectivity. Though it certainly is a vote of confidence for the industry.”

**SKY Perfect JSAT invests in LEO-HTS**

NGSO-HTS is proving to be a real draw for some of the major satellite operators, with SES famously acquiring O3b Networks, a medium Earth orbit (MEO) constellation of 12 Ka-band HTS in August 2016. An additional eight MEO satellites are planned to augment the existing constellation and meet demand, with four due for launch in 2018, and four in 2019. Similarly, Intelsat was set to merge with OneWeb, which in July 2017 inaugurated the first assembly line in Toulouse, France, for its Ultra-high throughput LEO satellites, however, this deal was terminated in June 2017 after Intelsat’s
shareholders were unable to reach an agreement on the exchange offer.

Most recently, in May 2017, it was announced that SKY Perfect JSAT Corporation (SJ C) had entered into an agreement to invest in LeoSat, which plans to launch a constellation of up to 108 LEO-HTS to provide the fastest, most secure and widest coverage data network in the world. The unique HTS architecture includes inter-satellite laser links which create an optical backbone in space, negating the need to hop between Earth stations, and delivering gigabit per second data delivery.

The investment will enable SJ C to pursue new business opportunities in the data and mobility markets in telecommunications, enterprise, maritime and government sectors. The LeoSat constellation’s unique features are expected to prove useful for 4G and 5G backhauling, delivering secure networks to banking foreign offices, providing ‘enormous’ bandwidth for the energy and maritime sectors, ensuring critical back up for emergency communications, and enabling Internet access in remote communities.

“SJ C sees the strategic importance of aggressively participating in the LEO-HTS business and we see the LeoSat solution as a key opportunity to opening up new markets and delivering business growth,” said Koki Koyama, Senior Managing Executive Officer of SJ C. “With the current and future growth of data traffic and the unique nature of the LeoSat system and its focus on the business market, we believe there will be very strong demand for the LeoSat solution. This investment and development partnership with LeoSat will allow SJ C to expand and complement our existing GEO satellite services and beyond by enabling us to respond to customer needs which are not being met by today’s technology.”

LeoSat is currently working with Thales Alenia Space to finalise the manufacturing plan for the production of the entire constellation.

SES launches first HTS

While SES’s first HTS capacity came with the acquisition of O3b networks as detailed above, the company has since launched its own HTS, SES-15, on 18 May 2017 with Arianspace from French Guiana.

The hybrid SES-15 satellite combines wide Ku-band beams with Ku-band spot beams and connectivity gateways in Ka-band. From its 129 degrees West position, SES-15 provides coverage over North America, Mexico and Central America, stretching from Arctic Alaska to the South of Panama, and from Hawaii to the Caribbean, and will deliver services to the aeronautical sector, maritime, government and VSAT networks. Coverage was designed to allow airline passengers full, seamless HTS coverage from New York to Hawaii, or from Alaska to Mexico. The satellite carries a Wide Area Augmentation System (WAAS) hosted payload that will enable the Federal Aviation Administration (FAA) to augment the Global Positioning Systems (GPS) with the goal of improving accuracy, integrity and availability for the aviation industry.

The launch of SES-12, originally expected to be SES’s first GEO-HTS with a launch in the first half of 2017, has now been pushed back to the first quarter of 2018, reportedly. Like SES-15, SES-12 will deliver a combination of wide and spot beams in Ku-band, with coverage of key areas in the Asia-Pacific region. SES-14, another Airbus Defence and Space Eurostar E3000 model satellite like SES-12, will also feature a mixture of wide and spot beams in Ku-band, with coverage over the Americas and North Atlantic, and has a launch date in the first quarter of 2018.

Looking ahead, 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.

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 Internet services over the Asia-Pacific region, with speeds of 6Mbps down and 4Mbps up.

The company’s latest HTS project was announced in October 2016. Thaicom’s subsidiary, International Satellite Company Limited (ISC), entered into a satellite procurement contract with China GreatWall 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.”

Intelsat advances Epic™ fleet

For many in the industry, it’s impossible to think about HTS without the minding fitting to the Intelsat Epic™ 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 EpicNG 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 EpicNG 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. Meanwhile, February 2017 saw the launch of Intelsat 32e to 317 degrees East – the satellite will overlay certain beams of Intelsat 29e, increasing the throughput available in the high-traffic areas over the Caribbean and North Atlantic routes.

More recently, in July 2017, Intelsat 35e was launched to deliver coverage over the Americas, the Caribbean, Europe and Africa from its orbital position at 325.5 degrees East, replacing Intelsat 903, which will be redeployed to another position by the end of 2017.

“The successful launch of Intelsat 35e is a major milestone in our business plan for 2017, furthering the footprint and resilience of our Intelsat EpicNG infrastructure,” said Stephen Spengler, Chief Executive Officer at Intelsat. “With each Intelsat EpicNG launch, we advance our vision of creating a global, high performance infrastructure capable of supporting new growth opportunities in applications including mobility, wireless infrastructure and private data networks. As we further our innovations with respect to ground infrastructure and managed service offerings, like IntelsatOne Flex, we are transforming the role of satellite in the telecommunications landscape.”

Finally, at the end of September 2017, Intelsat launched Intelsat 37e, the first all-digital satellite to offer full, high-resolution interconnectivity between C, Ku and Ka-bands for use in wireless backhaul, enterprise VSAT, government and mobility networks. According to reports, the C-band payload presents a comprehensive mix of high-power spot and wide beams, designed to deliver additional services and improved...
throughput. The Ku- and Ka-band steerable beams, which can be positioned as needed, have been added to increase network access and support high-demand areas for government and commercial mobility applications. They will complement the extensive Ku-band multi-spot beam coverage. In addition, Intelsat 37e improves the resiliency of the IntelsatOne Flex managed platform, bringing additional throughput to support enterprise, broadband, government and mobility applications in the Americas, Africa and Europe.

“Intelsat 37e is a powerful addition to our award-winning Intelsat EpicNG network. It brings new technology and resilience as we continue to deploy the first, all-digital, high-throughput satellite system,” said Spengler. “Intelsat 37e features enhanced power sharing technology and steerable beams, which bring additional flexibility to meeting regional and application requirements over the life of the satellite. Intelsat 37e reflects our multi-band, open architecture philosophy. Our overarching goal is to offer satellite services that unlock high-demand applications such as mobility and wireless infrastructure, supporting the growth of our customers.”

Intelsat will complete its global footprint in 2018 with Horizons 3e.

**Eutelsat launches 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 launched its most recent HTS, EUTELSAT 172B, on 2 June 2017. The satellite is the first high-power all-electric telecommunications satellite to be constructed in Europe, by Airbus Defence and Space. With C, Ku and high throughput Ka-band payloads, Eutelsat’s coverage will be enhanced over China and the Pacific Islands once fully operational. 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.

ViaSat has since augmented its HTS capacity with the launch of ViaSat-2 in June 2017, which will provide both high capacity bandwidth and wide coverage over Ka-band frequencies, 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. Areas of coverage include North America, Central America, the Caribbean and part of northern South America and the primary aeronautical and maritime routes across the Atlantic Ocean. Indeed, 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 achieves delayed Global Xpress satellite launch**

Inmarsat’s Global Xpress (GX), which, according to the company, was the first service that provided full, global coverage with capacity from a single satellite operator, providing a consistent network service, entered full global commercial service in December 2015. 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, but the launch was delayed due to the backlog in SpaceX’s launch programme following the launch
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pad explosion in September 2016. As such, the I-5 F4 satellite was successfully launched by SpaceX’s Falcon 9 on 15 May 2017; once fully operational, it will provide additional capacity for Global Xpress users on land, at sea, and in the air.

Spacecom invests in AMOS-17
Israel’s Spacecom, operator of the AMOS fleet of satellites and delivering services to Asia, Europe, the Middle East and Africa, is one of the latest companies to announce a new HTS project. The company famously lost its first HTS, the AMOS-6 satellite, in a SpaceX launchpad explosion which also destroyed the Falcon 9 rocket it was due to launch on.

In December 2016, SpaceX announced that it had entered into a US$161 million satellite procurement agreement with Boeing Satellite Systems International. AMOS-17 will deliver Ka, Ku and C-band services with a combination of broad regional beams and high throughput spot beams to maximise spectral efficiency. Operating from 17 degrees East, AMOS-17 will expand Spacecom’s coverage over Africa, the Middle East and Europe for an expected in-orbit lifetime of 15 years. The satellite is due for launch in 2019.

"AMOS-17 will be a multi-band high-throughput, state-of-the-art satellite that will provide reliable solutions and offer a significant competitive advantage for our customers," said David Pollack, President and CEO of Spacecom. "We are pleased to partner with Boeing in making this important addition to our fleet. The Boeing satellite will provide a great fit for Spacecom’s expansion strategy, offering an innovative design with capabilities that provide flexible service offerings to meet the growing demands of our customers. AMOS-17 will enhance our capabilities as a growing and highly capable satellite operator."

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 Yahsat’s coverage to Brazil and 19 new markets in Africa, doubling its reach upon its launch, which has been pushed back to the third quarter of 2017. Around 10Gbps, or 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 J CSAT-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.