

NEW SATELLITE TECHNOLOGIES: DESIGN, MANUFACTURE, LAUNCH

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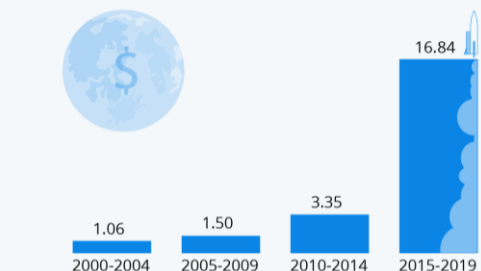
CURRENT TRENDS IN THE SATELLITE INDUSTRY

Revolution In The Satellite Industry!

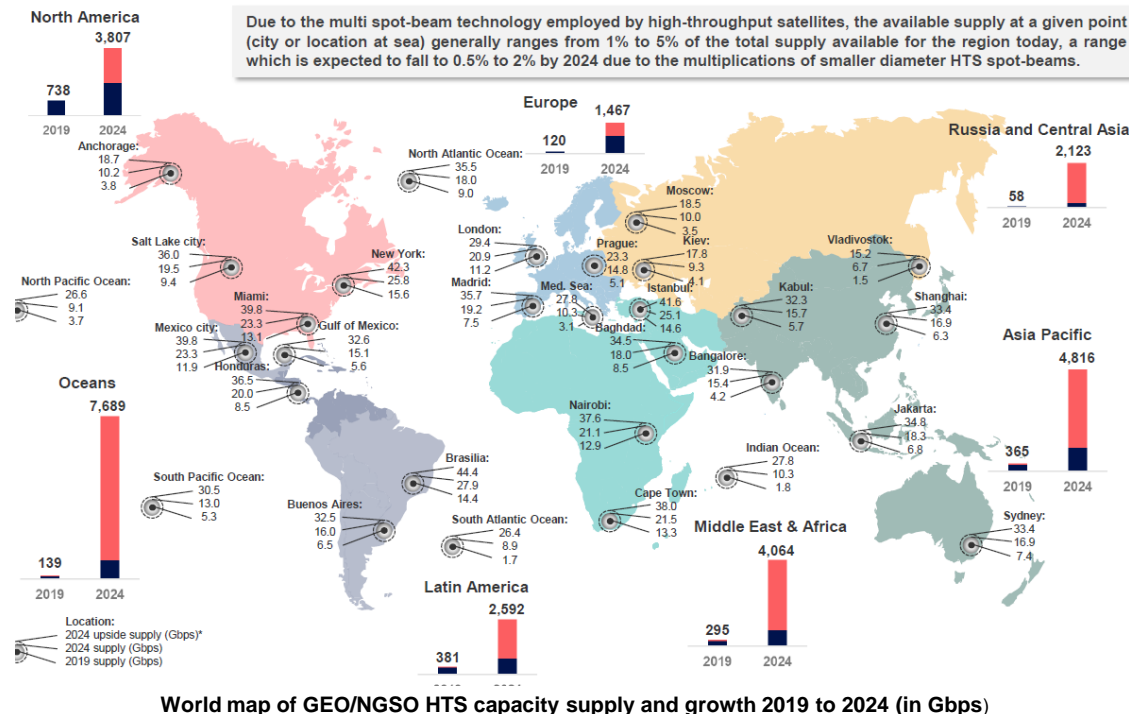
- New space investments will add exponential growth in bandwidth
- Russia & CIS supply to reach more than 2Tbps by 2024, mainly through NGSOs
- New HTS systems will dynamically supply connectivity wherever there is a demand.

Investment in Space Blasts Off

Total value of investments in space ventures over 5-year periods since 2000 (in billion USD)

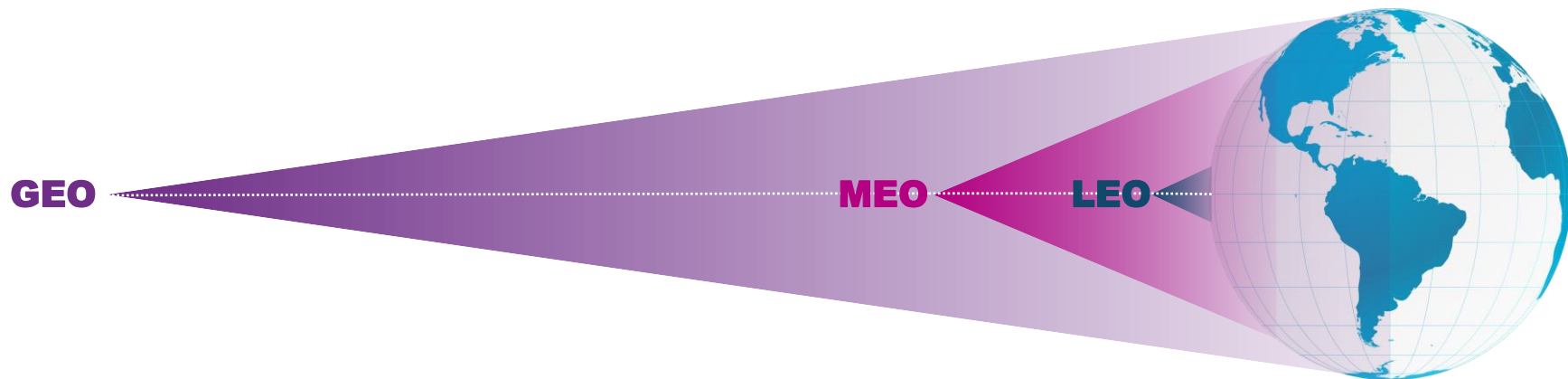


Source: Tauri Group - Start-Up Space 2020



World map of GEO/NGSO HTS capacity supply and growth 2019 to 2024 (in Gbps)

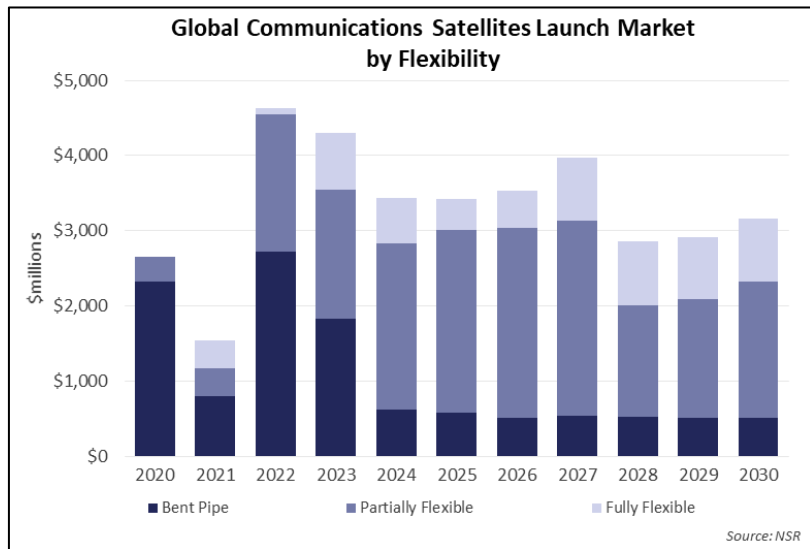
Orbital Comparison



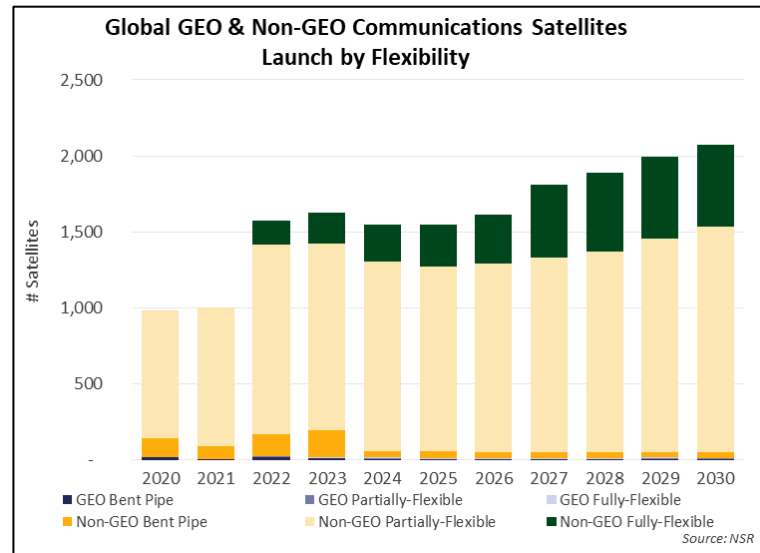
GEO – 36,000km	NGSO MEO ~ 8,000km	NGSO LEO ~ 1,000km
High latency (~700 msec)	Low latency (~150 msec)	Very low latency (~50 msec)*
Very large Earth view	Large Earth view	Small Earth view
Continental gateways	Regional gateways	Many local gateways
Stationary antennas (3 satellites for global coverage)	1-hour tracking (6 satellites for coverage)	10-minute tracking (100's-1,000's needed for coverage)

* Gateway distance, ISL & ground network dependent

Flexibility Is On The Rise

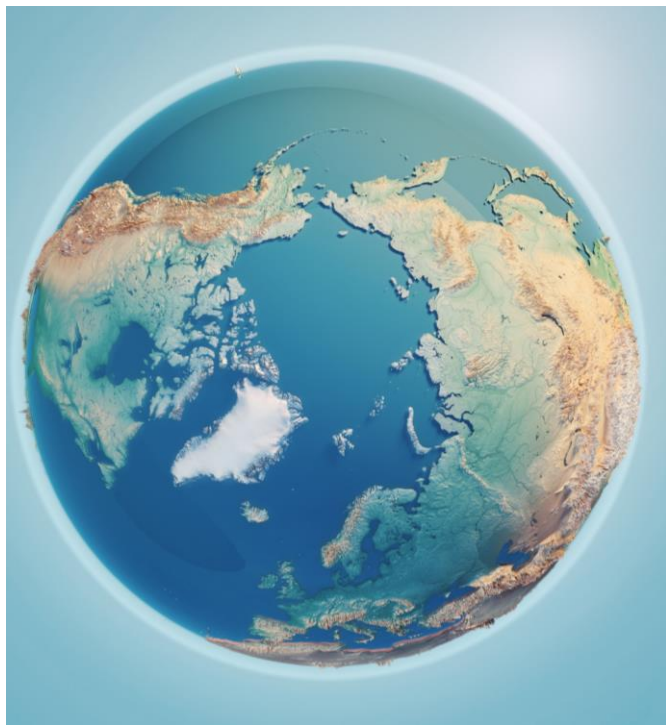


- More satellites ordered and launched will feature at least partial flexibility



- NGeo constellations will drive the growth in flexible satellites
 - GEOs are also slowly adopting more flexible systems

Key Innovations Inspired By Customer Requirements



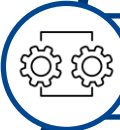
Increasingly open architectures



Digital processing & software-defined payloads



Phased array antennas (space & ground)



Adaptive software



Sustainable growth

SES, REDEFINING THE RULES OF SATELLITE TECHNOLOGY

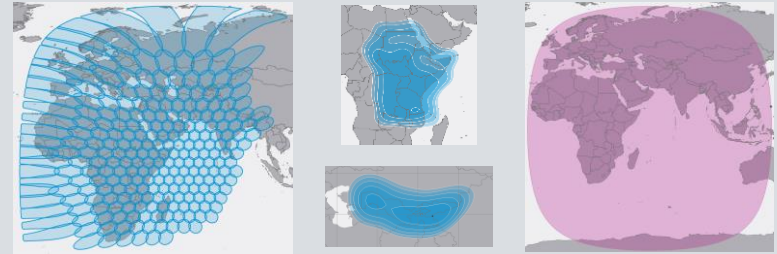
Next Generation Digital Satellite SES-26 at 57E

Fully Digital and Customizable on Orbit



- ▲ Fully digitally and customizable on orbit supporting traditional DTH widebeam, and 'VHTS' networks
- ▲ **Coverage** – On-orbit configuration forming wide shaped beams, regional beams, and multibeams for HTS
- ▲ **Connectivity** – Flexible and programmable channelization and frequency conversion adaptable to any orbital location and business segment
- ▲ **Power pooling** – satellite power can flexibly be directed over any portion of the beamformed coverage
- ▲ **Dynamic commanding** – The payload characteristic can be changed at any time to follow evolutions of demand (during the day, the year, the lifetime)

Fully digitally and Customizable on orbit in terms of Coverage, Connectivity and Power



- ▲ Coverage and capacity allocation are adjustable on orbit, minimizing stranded capacity
- ▲ Resources, power and bandwidth, can be concentrated where demand is located
- ▲ Ku Widebeam and Ku HTS can simultaneously be served
- ▲ Global C-band payload with 6 transponders

Current Generation O3b MEO

O3b **mPOWER**

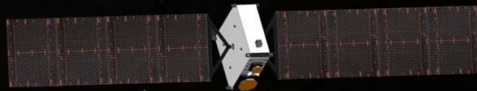
Existing O3b MEO Satellite constellation

- 8062km Equatorial orbit
- Steerable 700 Km diameter beams that can be re-pointed to regions with higher demand
- Maximum Throughput:
 - O3b Classic 2.4m/40W ~ 1Gbps FWD/RTN
 - O3b mPOWER 2.4m/40W ~ 1.8Gbps FWD/RTN

- O3b has deployed a constellation of twenty (20) high throughput satellites in a unique Medium Earth Orbit (MEO)
- 4 Additional satellites were launched recently bringing additional 15 beams to the region
- **Low Latency – Less than 150 millisecond round trip**
 - High Throughput - 432 MHz per beam/transponder enabling 1.6 Gbps of throughput

Next-Generation MEO

O3b mPOWER



Beam to Beam connectivity, using low latency (150ms RTT). Remote terminals will be able to operate in the following modes:

- ▲ Regional Gateway to remote terminal
- ▲ International Gateway to remote terminal
- ▲ Remote terminal Point to Point mesh in future release

In addition to flexible bandwidth and power control available through beamforming, channelization (carrier routing) provides significant routing flexibility including:

Terminal to Gateway: Trunk traffic designated for the Internet backbone utilizing least-cost routing and direct peering.

Terminal-to-Teleport: Traffic designated for customer facilities (VoIP, IoT, etc.)

Terminal to In-country Hub: Traffic designated to remain in-country.

All connections are reconfigurable as traffic timing needs change

Connectivity Solutions mPOWERED



Scalable Satellite Infrastructure

Dedicated customer beams on O3bmPOWER satellites in O3b MEO orbit. O3bmPOWER can scale as customer grows.



Powerful Customer Beams

250km spot beams with up-to 10Gbps throughput on O3b mPOWER compared to 700km beams with 1.6Gbps max. throughput on current.



Carrier-grade

High-performance, low-latency, efficient use of infrastructure & higher return throughput capability



ARC

Dynamic, adaptive control through software encompassing MEO/GEO



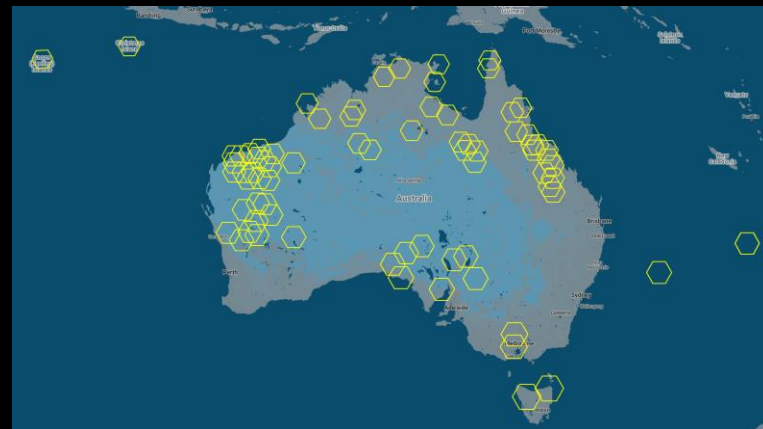
Cloud Optimised Satellite Ecosystem

Integrated seamless space/ground infrastructure



In-Country Gateway & Security

Customers are able to opt for in-country gateway in compliance with local regulations.



Connectivity Solutions mPOWERED



Features	O3bC	O3bmP
Number of beams	10 beams per satellite	>4500 beams per satellite
Beam Diameter	750km	250km
Beam Landing	Steerable, shared beam	Steerable, 1 beam per site
User Terminal Opt.	2.4m	2.4m, 1.2m Terminals
Max Throughput	Upto 1.6Gbps	1.2m – Up to 650 Mbps 2.4m – >1.2 Gbps
UT Power	AC Only	DC Variants available
IDU	Outdoor rack required	Modem can be housed in the customer Base Station rack.
Space	12m x 7m typical	8m x 3m typical (1.2m)
Link Portability	No	Yes
Link Agility	No	Yes
Gateway	SES Regional Gateway	SES Regional Gateway or Customer Gateway

Intra-beam pool and Inter-beam portability



Intra-Beam pooling: The pooling service region can be served by a single beam. Within a beam, throughput can be shared dynamically between sites (through the Gilat or STE platform).

Intra-beam pool(s) provide the flexibility to allocate throughput to relatively low CIR sites and provide options to contend services.

Each Beam is an independent Pool of Capacity.

Site change requests through the customer portal

Multiple terminals required per 250km beam.

Entry point per beam ≥ 60 Mbps, serving multiple terminals

Minimum CIR per terminal 1Mbps, EIR limited to total beam capacity



Inter-Beam portability: The service region (Africa) will be served through multiple beams.

The customer can port capacity among existing and known sites, requested through the customer portal.

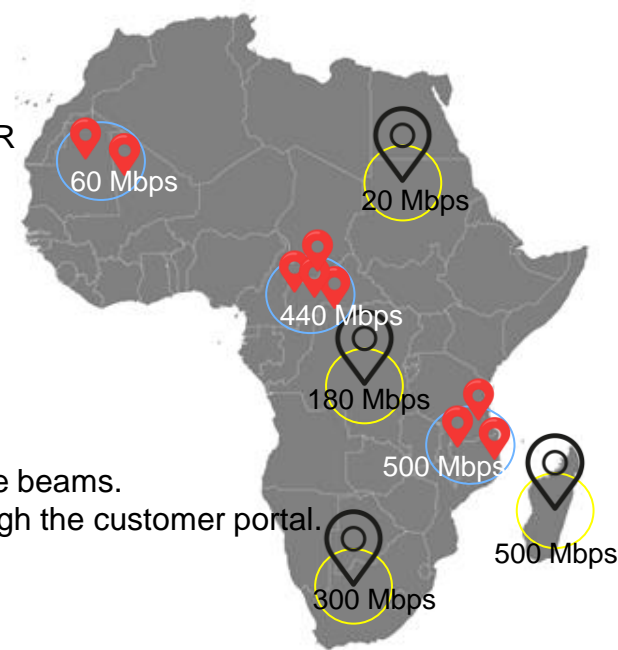
Surge option available

Single site per beam

Minimum CIR per terminal is 20 Mbps, but CIR per terminal must be ≥ 60 Mbps

Option to (re-)allocate CIR per terminal from 20-250Mbps guaranteed.

Higher CIR request require approval



*subject to exclusion zones (slide 5/6)

O3b mPOWER – GROUND



Gateways and Terminals Enabled by Partners

- ▲ Open Architecture
- ▲ Customer managed gateways
 - Bring your own hardware, waveform, and encryption
- ▲ Wider array of terminal form factors
 - Phased array flat panel antennas
 - Ultra small Ka-band antennas for mobility
- ▲ Intelligent networking software
 - Adaptive Resource Control (ARC)
 - Open Network Automation Platform (ONAP)
 - Terrestrial network intelligence (SD-WAN)
- ▲ MEF CE 2.0 certified



In space

- ▲ Electric orbit raising
 - Reduced reliance on chemical fuel
 - Increased satellite lifespan
- ▲ Reducing launches & space debris
 - O3b mPOWER – 11 satellites in four launches for global coverage
 - HTS & VHTS reduce number of GEO launches to address markets

On the ground

- ▲ Satellite connectivity improves:
 - Smart farming increases yield, decreases spraying
 - Environmental data reporting from energy segment
 - Smart mining reduces accidents
 - Remote industry digital workflows reduce waste
 - Machine learning optimises sustainable energy production and storage

O3b mPOWER

Deployment schedule



LAUNCH SpaceX Falcon 9

O3b mPOWER 1-3 Q3 '22

O3b mPOWER 4-6 Q1 '23

O3b mPOWER 7-9 Q2 '23

O3b mPOWER 10-11 H2 '24

START of SERVICE

Six (6) Satellites - Start of Service Q4 2022

Nine (9) Satellites - Start of Service Q2 2023

Eleven (11) Satellites - Start of Service Q2 2025





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