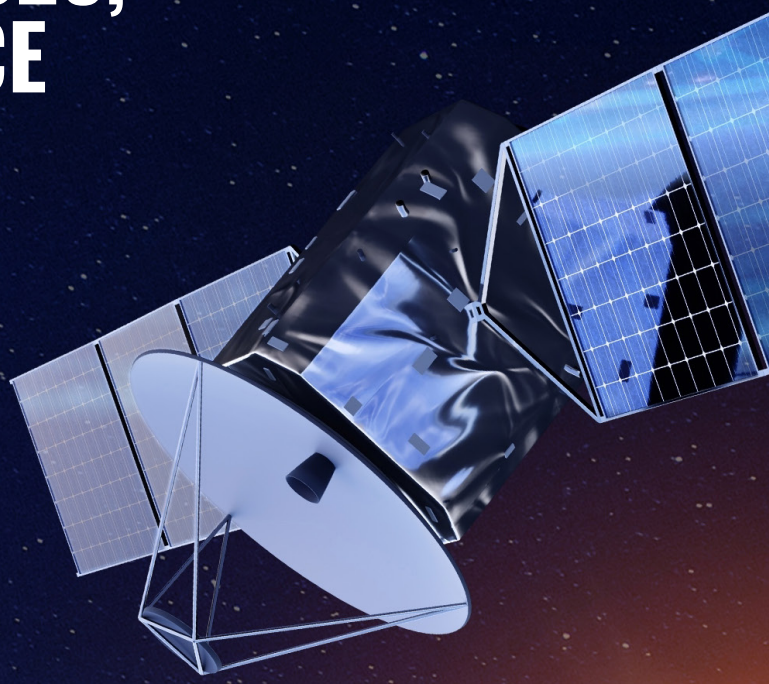
INSIDE THE ORBIT OF INNOVATION: INSIGHTS FROM MWC25, SATELLITE, AND GSTCE



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Introduction

Satellite communications, or Non-Terrestrial Network (NTN) communications, as it is now often referred to, continues to build momentum. The rate of acceleration has picked up since the 3rd Generation Partnership Project (3GPP) set out its roadmap for integrating NTN into the cellular technology fold. Proprietary mobile satellite services (MSS) have been around since the early 2000s, with the launch of Iridium's MSS. The MSS sector has evolved. Globalstar, A MSS provider, has survived the lean years and in September 2022, managed to secure investment and long-term contracts with Apple to provide the mobile device manufacturer with wholesale NTN connectivity. Recently the terrestrial communications service providers (CSPs) such as T-Mobile, Verizon, Vodafone, etc., have taken a deeper interest in the nascent NTN Direct to Cellular (D2C) market.

As demonstrated in our recent report, State of LEO Satellite Networks, the satellite market (total active satellites in operational orbit) is projected to increase from 7,473 Low Earth Orbit (LEO) satellites in orbit in 2023 to approximately 42,600 by 2032, at a Compound Annual Growth Rate (CAGR) of 21.3%.

In 2024, 93% of total active satellites in operational orbit were in LEO, and that is expected to only increase. Satellites in LEO, MEO and GEO orbit, are being used for various applications, including satellite communications (satcom), Earth Observation (EO), navigation, global positioning, and more.

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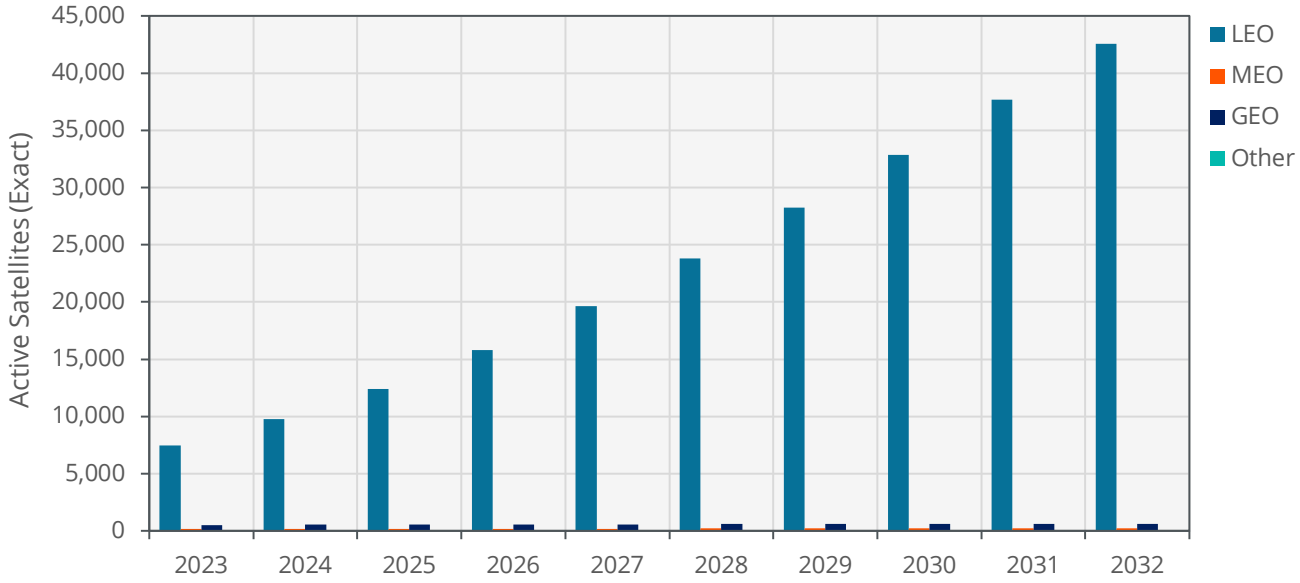
Figure 1. Total Active Satellites by Operational Orbit, World-wide (Source: ABI Research)



While satcom takes the largest slice of satellite pie, other applications are on the rise. Earth Observation/remote sensing is harnessing new technologies. Visible, Infra-Red and Ultra-Violet are now being complemented by Lidar and Synthetic Aperture Radar (SAR). Furthermore, AI and analytics are turbocharging insights as higher capabilities in real-time data processing and analysis, improved image and signal processing and enhanced pattern recognition are brought to bear on the EO data. There were 724 total active satellites in 2023, and deployments are expected to reach 2,329 satellites by 2032.

Other satellite applications are starting to appear on the horizon such as space-based solar power (SBSP) which is being prototyped by US, UK and China, among others. Beyond the horizon, there are even evaluation trials to mine for mineral and metal rich asteroids. We plan to delve into these topics over the next 6 months to year.

The commentaries below come from direct ABI Research analyst interactions and insights from face-to-face meetings and briefings that Andrew Cavalier, Senior Analyst, Rachel Kong, Research Analyst and me, Jake Saunders, Vice-President conducted at those events. The team attended Global Space Technology Convention & Exhibition (GSTCE) in Singapore, Mobile World Congress in Barcelona and Satellite 2025 in Washington DC.

We will be attending Satellite Asia 2025 in May 2025. We hope to meet you there.

MOBILE WORLD CONGRESS 2025: BARCELONA, SPAIN

Mobile World Congress (MWC) is probably the largest cellular conference and exhibition in the world. In 2025, the number of attendees increased to 109,000 from 101,000 during the previous year. What is fascinating about MWC is the intersections that cellular has built up with other sectors. With the rise of The 3rd Generation Partnership Project's (3GPP) Non-Terrestrial Network (NTN) initiatives, it is no surprise to see a number of satellite communication operators, System Integrators (SIs), and equipment vendors start to raise their profile at the show. What is fascinating is that this is not just about satellite-based messaging in times of crisis, but wider applications, even mobile satellite broadband NTN connections.

Globalstar

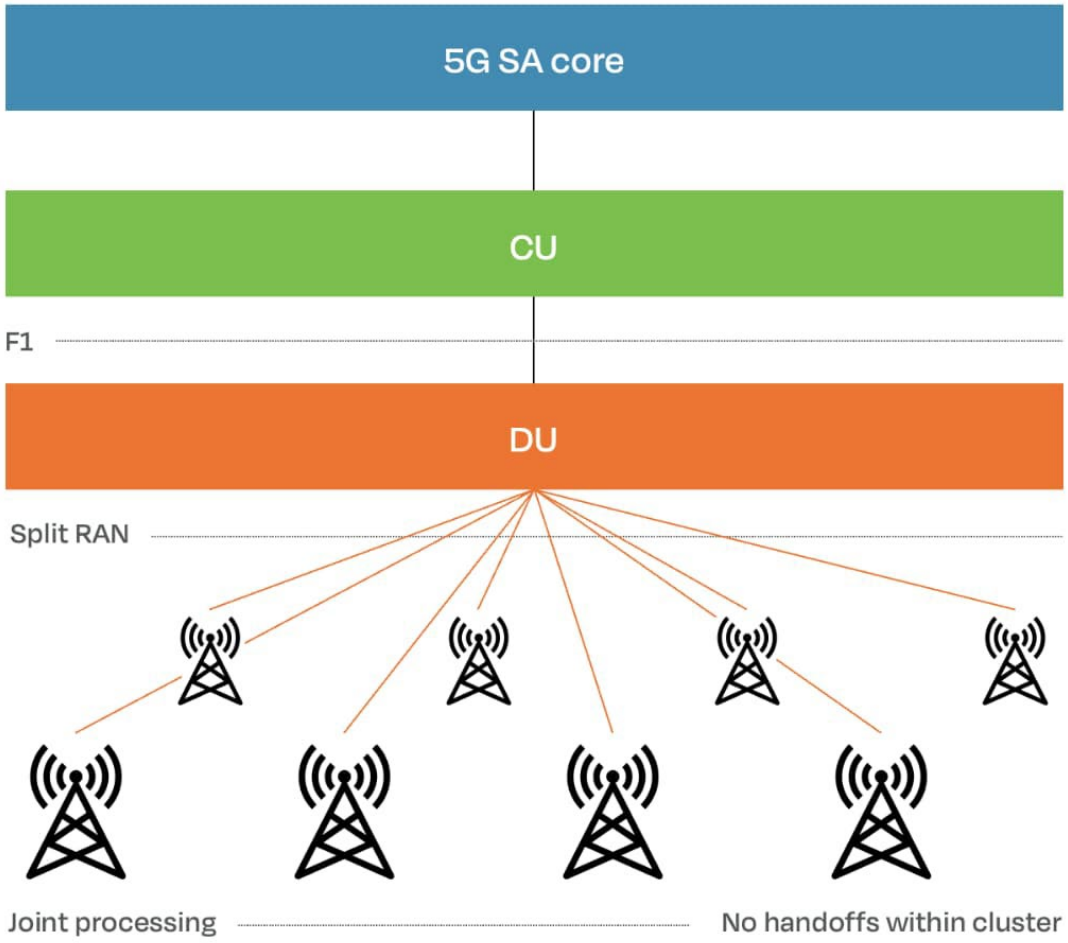
Longstanding Low Earth Orbit (LEO) operator Globalstar's booth highlighted the satellite communication capabilities of its constellation. Globalstar, founded in 1991, is an American satellite company that operates a LEO satellite constellation for mobile satellite voice and low-speed data communications services for commercial and recreational subscribers in more than 120 countries. In addition to individual retail consumers, the satellite operator has had a significant focus on the enterprise segment, such as oil & gas, government, mining, forestry, commercial fishing, utilities, etc.

Since September 2022, Globalstar has also provided satellite connectivity for Apple's Emergency SOS service, a new safety feature that Apple introduced on its latest iPhone 14 models. As part of the agreement, Apple would be funding 95% of the costs of a new generation of satellites that Globalstar ordered in February 2022 and Globalstar has also mentioned that it will allocate 85% of its network capacity to Apple.

A Key Investment: The above commentary was a mainstream narrative for Globalstar at the event, but Globalstar also demonstrated a solution that reflects an investment made in 2021 in XCOM. The investment has been touted as a strategic alliance that harnesses XCOM's high-capacity, high-throughput private cellular technology with Globalstar's frequency band 53 license. XCOM reported that its solution supports 100 Megabits per Second (Mbps) download and 60 Mbps upload speeds. These throughput scenarios allow for mission-critical applications such as robotics, autonomous forklifts, enhanced video, and Augmented Reality (AR) applications.

Band 53, Time Division Duplex (TDD) spectrum that utilizes the 2,483.5 – 2,495 MHz band, has been licensed for commercial use in the United States, as well as 12 additional markets. SIs, enterprises, governments, carriers, and cable companies can use the spectrum and XCOM solution for dedicated high-throughput, high-capacity applications.

Figure 1. XCOM's RAN Architecture
(Source: Globalstar)



An XCOM/Satellite Network Slice? Clearly the XCOM, mesh-based private 4G and 5G cellular solution is pretty impressive and punches well above its weight for the throughput it offers and for the amount of spectrum utilized, but where is the satellite or NTN angle? It may still be further out, closer to the 6G time frame of reality (2028 to 2030), and Globalstar has not explicitly stated as such, but ABI Research believes it is possible that Globalstar will be able to bring private cellular and NTN together, potentially on a "network slice," where an enterprise customer or government could have all their indoor assets (forklift trucks, tracked personnel, tablets, laptops, Automated Guided Vehicles (AGVs), high-value monitored tagged pallets, etc.) that would be monitored on the indoor XCOM private cellular network, and could also have connectivity and be monitored outdoors on the satellite layer. Would it not be cheaper to have those assets switch to terrestrial cellular outside of the private cellular network? In the short to medium term, most definitely "yes," but perhaps the enterprise customer does not want the asset to hop across unsecured, unverified terrestrial networks? Satellite network capacities, terminal equipment portfolios, and cost of service will all need to evolve, but we have seen what 3GPP innovation cycles can deliver for the cost of terrestrial cellular equipment and service, and those innovation cycles could be applied to NTN.

HFR Mobile (South Korea)

HFR Mobile, a South Korean firm, incorporated in January 2020 has been building momentum offering xHaul, broadband access, and private cellular access. The vendor claims Verizon, AT&T, NTT DOCOMO, SK Telecom, KT, and Samsung, among others, as its clients across the above-mentioned technology domains.

Hyper-Connected: At MWC25, HFR Mobile set out a bold vision for a merged private cellular/satellite communications solution, known as "Space to Enterprise Connect." The vendor did acknowledge the solution is not commercial at this stage, but plans to have a commercial solution in place in 2026. The vendor set out a vision that very explicitly offers an integrated indoor solution, using private cellular, and an outdoor solution, using satellite-based NTN, on a single network that would be dedicated to the enterprise customer. HFR Mobile considers that the enhancements that come with 3GPP's Release 19 will enable this vision. Release 19 supports "regenerative" payloads for the satellite, which means the satellite can more effectively route the satellite traffic, either from ground-to-satellite or satellite-to-satellite. Before this, satellites operated in a "transparent" or "bent pipe" configuration, which is not as flexible. Furthermore, some core network functions can be handed off to the satellite.

Bold Vision: HFR Mobile did report that both AT&T and AST SpaceMobile showed considerable interest in HFR Mobile's solution at the show. HFR Mobile still has a lot to prove. The firm has shown it can gain traction in the highly competitive cellular infrastructure equipment market and has set out a bold vision, but will need to demonstrate intermediary results to reassure customers and their investors. This vision predicts that the cost per bit per hertz for NTN will come down considerably. Many terrestrial cellular operators offer bucket plans of 30 Gigabytes (GB) to even 100 GB as standard tariffs. The operational cost of providing satellite connectivity means end users often can only send "kilobytes" and perhaps even just "bytes" of data. NTN constellations are being upgraded, and we are likely to see even hybrid LEO, Medium Earth Orbit (MEO), and Geostationary Earth Orbit (GEO) satellites work in tandem to deliver data to the end user. That should shift the cost-of-service curve downward.

AST Space Mobile

At MWC25, AST SpaceMobile and Vodafone announced the launch of "SatCo," a joint venture that will commit to the buildout of a cluster of European ground stations to link AST's satellites with mobile networks across the region.

AST SpaceMobile (United States) was established in 2017 with the goal of providing the first cellular broadband network that can be accessed directly by standard mobile phones. Its in-orbit, BlueWalker 3 protype satellite, which is equipped with numerous phased-array antennas, is one of the largest satellites in LEO and can connect directly with "unmodified" mobile devices. This means that the mobile user's handset can communicate with orbiting AST SpaceMobile LEO satellites using a cellular carrier channel that belongs to their existing terrestrial Communication Service Provider (CSP). The communications links are not dedicated satellite spectrum bands.

Super-Sized Satellite Antenna: AST SpaceMobile's business model is to partner with regional CSPs and use their terrestrial spectrum to offer NTN mobile services. The company has been successful in this regard. In addition to Verizon, SpaceMobile has established strategic partnerships with more than 25 CSPs, including Vodafone, Rakuten Mobile, AT&T, Bell Canada, MTN Group, Orange, Zain KSA, STC, and Telefónica that collectively service approximately 2

billion cellular customers. The satellite operator has developed five new satellites, the first of which went up in September 2024. Crucially, the BlueBird satellite design offers a ten-fold increase in processing bandwidth and has an antenna that is a remarkable 64.4 Square Meters (m2) in size. That large satellite antenna allows data connections to end-user smartphones in the megabit range (10 to 20 Mbps have been demonstrated) as opposed to the kilobit or even in the "bits" range.

Will Need to Scale up Satellites: AST SpaceMobile is turning heads and drawing attention in a market that is being saturated with Starlink commentaries. The satellite operator does have some notable backing from terrestrial mobile operators, including AT&T and Vodafone. The antenna size and throughput are very commendable, but the scaling up of the satellite constellation will be challenging. The operator is committed to deploying another 40 or so satellites, but Starlink and Kuiper Belt are committed to getting several thousand LEO satellites in orbit.

SATELLITE 2025 CONFERENCE & EXHIBITION

SATELLITE 2025: WASHINGTON DC, UNITED STATES

The space industry is facing intense pressure from both SpaceX and the new U.S. administration. Many companies are struggling to keep up with Elon Musk's "fail fast, learn fast" approach due to rigid corporate strategies, regulatory constraints, and slow-moving supply chains. This has triggered widespread concern, leading to a surge in partnerships and consolidations. Notable examples include Rocket Lab's acquisition of Mynaric, a potential merger between Airbus and Thales Alenia Space, Viasat's Memorandum of Understanding (MOU) with Space42, and Lynk Mobile's deal with SES.

Now more than ever, the space industry is looking to the telco world and the evolution to 6G unified networks as the next phase of the industry. This was reflected by many space industry players moving their presence to MWC Barcelona this year, and ABI Research anticipates that this trend will only continue. Some people I spoke with believe that most of the industry may eventually view MWC Barcelona as a more essential event than SATELLITE 2025.

An insiders look at Satellite 2025.

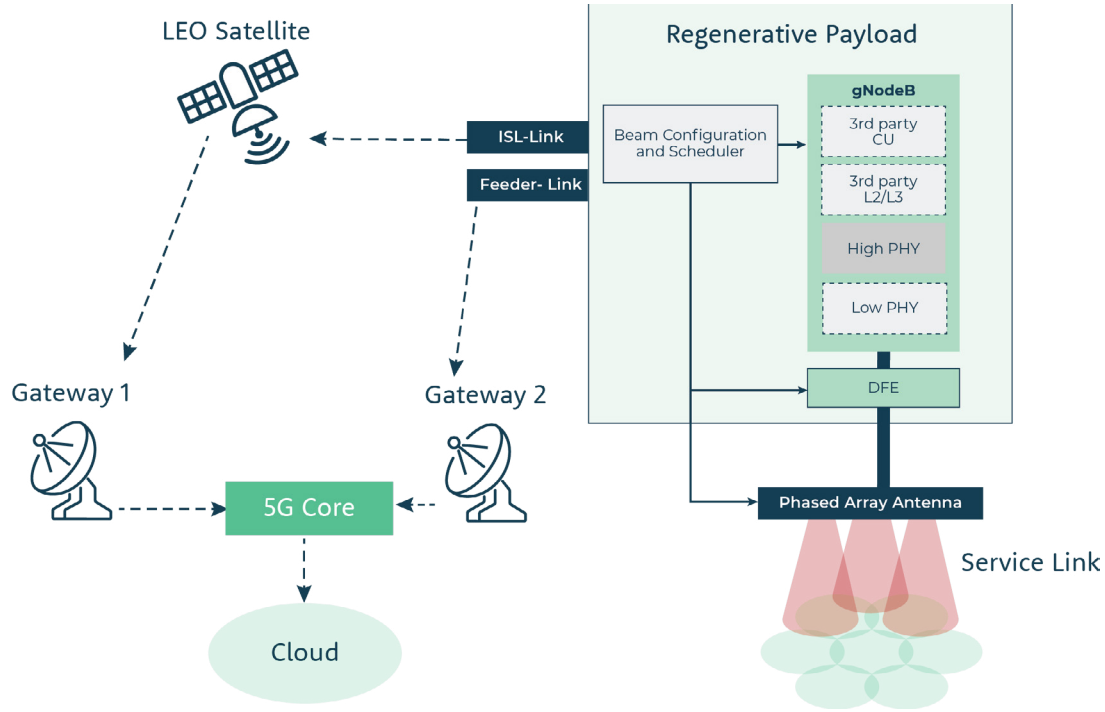
Key Trends at the Show

Vertical Integration and Adapting Supply Chains: The industry is moving toward vertically integrated space companies becoming the "new space industry," with full-stack space capabilities from production, design, launch, and operations. Rocket Lab's announcement to acquire optical terminal manufacturer Mynaric reflects the industry's push into a more tightly integrated value chain, from manufacturing to operations. While the industry is still following behind the "extreme vertical integration" model achieved by SpaceX or Amazon, a crucial focus for the industry now is aligning space manufacturers more closely with operators. Currently, this means prioritizing key supplier criteria, including high-quality, competitive pricing, and scalability, but inevitably, it will include merging or forming joint ventures to break down barriers and unlock innovation, and minimize supply-chain bottlenecks impacting the industry. For companies like Rocket Lab that are spearheading the vertical integration approach in the industry, this tight integration enables them to provide key space activities such as launch services, space and satellite component design and manufacturing, platform integration, and even on-orbit management. While SpaceX and Amazon may be leading the vertical integration charge, companies such as Rocket Lab, Spire, Terran Orbital, and Dhruva Space are narrowing the gap.

Sovereign Space: Elon Musk and the current U.S. administration have created uncertainty in the industry over Ukraine and created a resurgence in demand for sovereign space systems. This may be the blessing that legacy space players need to survive the impending mega-constellation storm from SpaceX, Amazon, and China. SES, for example, announced alongside the partnership to integrate Lynk's Device-to-Device (D2D) services, that it would plan to move Lynk's satellite manufacturing to Europe, in addition to the current facility based in Virginia. There is growing discussion about Eutelsat OneWeb potentially replacing Starlink in key regions across Europe and beyond. However, the company still faces challenges in scaling ground terminal production and delivering connectivity services at a cost comparable to SpaceX. While the industry has taken a more "united we stand" approach, gaps in technology, business models, and market knowledge remain between legacy and "new space" disruptors. In this way, Viasat is demonstrating its commitment to bridging gaps and exploring innovative solutions to deliver critical services to underserved regions throughout the world. This is evident through its collaboration with Space42 to co-develop a multi-tenant and multi-orbit Direct-to-Cellular (D2C) infrastructure, as well as its new partnership with the European Space Agency (ESA) to build a constellation for European Internet of Things (IoT) and D2C.

D2C and 5G NTN: Industry leaders widely view D2C and 6G unified networks as key to making satellite connectivity mainstream for smartphones, cars, drones, and beyond. Announcements such as SES' partnership with Lynk and Viasat's MOU with Space42 highlight a strong industry push toward enabling D2C connectivity. However, despite these advancements, the adoption of standardization (3GPP NTN) remains inconsistent. Companies appear more focused on rapidly bringing solutions and services to market, rather than taking a structured, standards-based approach to deployment. Companies driving 5G NTN capabilities, such as AccelerComm, Radisys, RFDSP, and TTP, are already providing the essential components needed for 5G NTN deployment. As standardization evolves toward 6G, which will integrate satellites into a unified architecture from the outset, these companies will become even more critical to the space and telco ecosystems. Visiting the AccelerComm booth, the company demonstrated how the challenges facing NTN architectures can be overcome today. The impact of this technology is evident: it accelerates the adoption of a standards-based approach for commercializing space-based communications, ensuring compliance with the New Radio (NR)-NTN standard, and delivering the required performance, at scale on space-qualified silicon. Critically, it also enables space SI companies and vertically-integrated operators to navigate a key challenge with NTN—balancing the rapid deployment of D2C services to capture market share with the long-term goal of building a unified network architecture, where Radio Access Network (RAN) capabilities are seamlessly distributed between terrestrial and space nodes.

Figure 2. 5G NTN gNodeB Solution (AccelerComm, Radisys, RFDSP, and TTP) (Source: AccelerComm)



GLOBAL SPACE TECHNOLOGY CONVENTION & EXHIBITION (GSTCE) 2025: SINGAPORE

The Global Space Technology Convention & Exhibition event has also seen growth. In 2025, attendees increased from 500 to 1,500 and the event moved to the premier location of Marina Bay Sands. Singapore has an expanding hub of space tech firms that cover different facets of the space tech industry. Earth Observation (EO) had a significant footprint at the event. Many startups and established companies in the EO space attended GSTCE 2025, including BlackSky, Capella Space, Eartheye Space, TerraWatch Space, and others.

BlackSky

BlackSky has been a key player in the EO industry, providing space-based intelligence, satellite imagery, analytics, and high-frequency monitoring. Some of the innovative technologies by BlackSky include:

- **Gen-3 Satellites with Enhanced Resolution**: BlackSky has developed Gen-3 satellites that provide very high-resolution imagery at insertion altitude in February this year. Image quality is expected to improve further as the satellites complete calibration and reach their operational altitude. The company is on track to launch its next satellite in 2Q 2025 and plans to maintain a regular launch schedule throughout the year. This growing constellation will enhance capacity and flexibility through the continuous addition of Gen-3 satellites.
- **AI-Powered Imagery Services:** BlackSky has secured a multimillion-dollar defense contract with Singapore's Defense Innovation Unit (DIU) to revolutionize Artificial Intelligence (AI)-powered space intelligence. In addition, BlackSky also obtained a contract with EMDYN that will enable the delivery of real-time insights, reduce latency across the tasking-to-dissemination process, and derive accurate intelligence faster.

Eartheye Space

Another prominent player in the ecosystem is Eartheye Space. The company's founder, Shankar Sivaprakasam, was part of the GSTCE 2025 panel and spoke on the topic of "Utilizing Space-Based Technologies for Climate Monitoring." Some of the growing and diverse use cases and applications for EO satellite data include:

- **Climate Change Monitoring and Environmental Protection:** EO data can be used to track carbon emissions, deforestation and land degradation, and sea-level rise. Different sensor modalities such as Synthetic Aperture Radar (SAR), Light Detection and Ranging (LiDAR), radar, and optical sensors can be used to track land use changes and monitor these areas over time to provide valuable data for long-term projections of emissions or risks.
- **Disaster Management and Response:** EO data play a crucial role in emergency responses, especially in areas where deploying vehicles or drones is challenging due to weather conditions. Using satellite imagery, EO data can be used for tracking wildfires, floods, and earthquakes.
- **Finance Sector:** There have been increased use cases in using EO data for the finance industry, particularly by hedge funds and other financial institutions to gain unique insights that can aid in decision-making, risk assessment, and asset management. The data can provide real-time intelligence on various macroeconomic and microeconomic factors that can be leveraged for better predictive modeling, market analysis, and risk management.

Growing Demand and Supply of EO Data: ABI Research highlights the growing demand for EO geospatial data, with the industry expanding into a broader range of sectors and verticals. This growth is further reflected in the increasing number of companies entering space, signaling an increase in both supply and competition. As a result, the market is positioned for substantial growth, driven by advancements in satellite technology, data analytics, and the increasing importance of geospatial intelligence across industries such as agriculture, energy, defense, and urban planning.

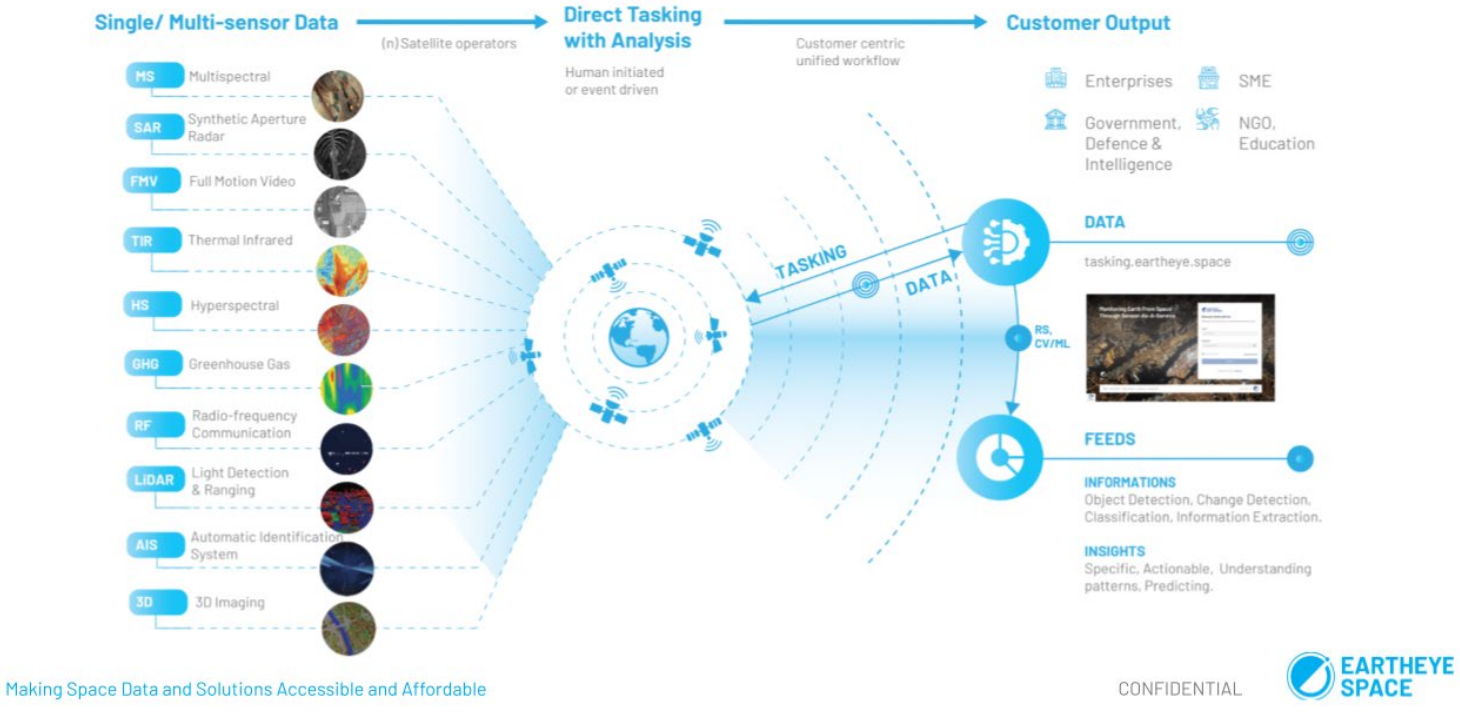
Market Expansion and Increased Applications: The market's expansion is also fueled by the increasing reliance on real-time, actionable data for decision-making, which is becoming critical in sectors such as climate monitoring, disaster response, and infrastructure development. As organizations seek more granular, timely insights to inform strategy and operations, EO data are becoming indispensable resources for business intelligence. With new players entering the field and existing companies expanding their capabilities, the EO market is expected to see further innovations, improved accessibility to data, and a more competitive landscape.

In Southeast Asia, EO technologies are playing an increasingly important role in monitoring infectious diseases. Many diseases emerge because of changes in land use, such as deforestation or shifts in vegetation, which can create new pathways for disease transmission. EO technologies help track these environmental changes, providing valuable insights for early detection and surveillance efforts.

Additionally, Southeast Asia's strategic location near the equator provides a unique advantage for space activities. This geographic positioning enhances the efficiency of space launches, as rockets benefit from the Earth's rotational speed. This presents numerous opportunities within the space sector, including the potential development of new launch sites and the expansion of infrastructure to support the space industry's development, including in areas like EO and remote sensing applications.

How to Stay Ahead: In this evolving ecosystem, businesses will need to leverage cutting-edge EO technologies, such as AI-driven analytics and Machine Learning (ML), to stay ahead of the curve and differentiate themselves. Additionally, partnerships and collaborations will be key to unlocking new opportunities and ensuring the continued growth of the industry. As the demand for geospatial data continues to increase, the opportunities for businesses and investors in the EO space are significant and growing.

Figure 3. Multi-Sensor, Multi-Orbit Solution
(Source: Eartheye Space)



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