SIA Spectrum Report

National Policy Must Prioritize More Spectrum for the U.S. Commercial Space Industry or the United States Will Lose the Space Race

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SIA The voice of the satellite industry | Satellite Industry Association

September 2023

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Spectrum and the Technological Transformation of the Satellite Industry

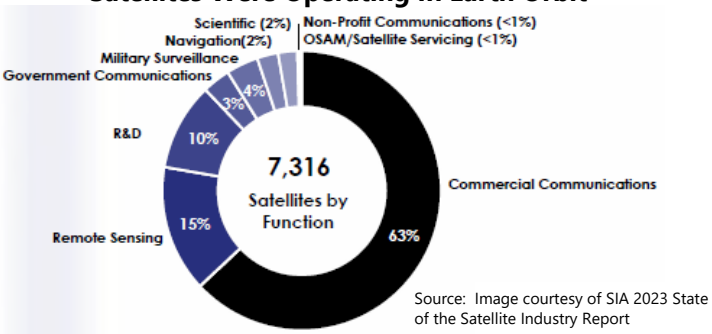
National Policy Must Prioritize More Spectrum for the U.S. Commercial Space Industry or the United States Will Lose the Space Race

The space industry's massive surge in technology is being led by U.S. innovation. Satellite and space services are touching the lives of every citizen directly and indirectly. Further, these services are becoming increasingly integrated in 5G and will be more so in 6G. In addition, the U.S. government, including the U.S. Department of Defense and NASA, is relying increasingly on commercial satellites and space services. As recognized in the National Space Policy, this means making more megahertz of spectrum available for commercial satellite and space services is critical. For the U.S. government to lead the world in the new space race and compete with global adversaries, it must have a coherent multi-agency policy that ensures that the spectrum needs of the commercial satellite and space community are met. To meet the significant increasing demands of users, whether government, consumer or enterprise, not only must the U.S. provide continued access to existing allocations, but additional spectrum is required in the low, mid and high bands.

The need for access to additional spectrum is further demonstrated by the significant growth of the U.S. commercial satellite and space industry. The U.S. commercial satellite and space industry have made and are continuing make hundreds of billions of dollars in investment.

For example, the number of operational satellites has grown from approximately 1000 in 2013 to 7316 as of the end of 2022 (right). Another 2100+ satellites have already been launched in 2023[2] and this pace of growth is expected to continue with approximately 10,000 satellites orbiting by the end of the year and applications for tens of thousands of satellites already having been approved.

Approximately 1000 Satellites Orbited the Earth in 2013 - At the End of 2022, More Than 7300 Satellites Were Operating In Earth Orbit

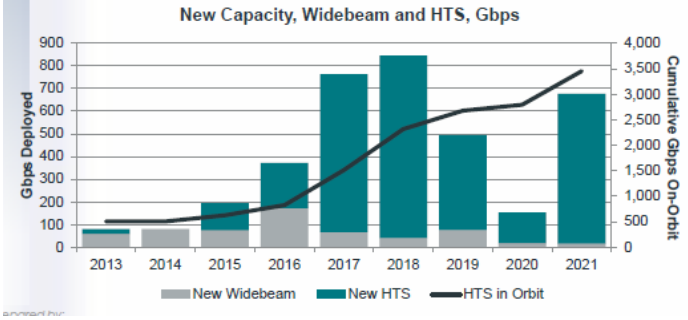


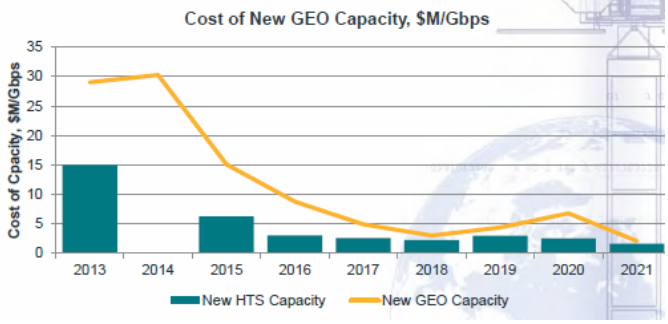
Source: Image courtesy of SIA 2023 State of the Satellite Industry Report

It is not just the number of satellites that is growing. The capacity of those satellites deployed also has increased significantly. As of mid-2022, operators have announced plans to deploy an additional 200 Tbps of capacity through 2026. In addition, in the past 10 years we have seen a 6x increase in the throughput per kilogram launched, leading to increased capability across the many services provided by satellites. One example of the impact this has had is there has been an 83% increase in satellite broadband subscribers since 2018. Similarly, commercial Earth Observation satellites collect and download more than 100 terabytes of satellite imagery data per day.[1]

New Satellite Data Capacity Deployment and Cost Trends

- Significant new HTS capacity deployed in 2021
- Growth in HTS capacity results in lower overall manufacturing cost per Gbps
- Continued deployment of less expensive satcom capacity leads to more affordable satellite broadband connectivity, improved affordability, greater data volumes and speed offered to multiple markets
- As of mid-2022, operators plan to deploy nearly 200 Tbps through 2026
  - Over 6 Tbps total capacity on planned GEO satellites under contract and in development
  - Potential capacity exceeding 180 Tbps planned by NGSO constellations in development





Satellite capacity cost estimated based on satellite manufacturing prices. Future capacity estimates reflect publicly announced plans and manufacturing contracts; some systems may not deploy. Source: 2023 SIA State of the Satellite Industry Report

1 https://www.datacenterfrontier.com/internet-of-things/article/11429032/terabytes-from-space-satellite-imaging-is-filling-data-centers

2. Source: Gunter's Space Page—www.space.rocket.de

The time is Now for U.S Policy Makers to Prioritize the Growing Spectrum Needs of the Space Industry

U.S. spectrum policy makers have in recent years elevated the spectrum needs of commercial wireless over those of the satellite and space industry. Because of this approach, there has been a lack of recognition in making spectrum decisions about spectrum policy concerning the incredible growth and importance to the U.S. economy of the U.S. space industry. The time is now for U.S policy makers to prioritize the growing spectrum needs of the space industry to ensure we can meet the needs for the United States, as well ensure U.S. space leadership globally.

If the United States is to lead in space globally, as well as address digital divide issues, it is critical that the United States government lead domestically and internationally in ensuring that there is adequate spectrum to support the rapid growth of the new space industry and the applications their customers rely upon. The objective must be to make new spectrum available no later than 2027 to ensure the United States' competitive edge in the rapidly evolving space industry including for 5G and 6G. This requires at least 15 GHz of spectrum of low, mid and high band spectrum to accommodate the growing number of applications in the 390 MHz to the 60 GHz band nationally and globally.

U.S. Innovation of New and Novel Services is Leading to Exponential Increase in Demand for Satellite and Space Radiocommunications Services

An important part of this innovation includes the development of non-terrestrial network standards (NTN) in 3GPP and the increasing integration of terrestrial and satellite communications services. The inclusion of non-terrestrial technologies in 5G and soon to be 6G standards, including 3GPP, means that satellite communications is becoming and will continue to become more pervasive including for direct to device, cellular backhaul, IoT and other widespread uses.

The integration of sensing and communication is a key enabler for a wide range of use cases, such as cellular backhaul and satellite direct connectivity to devices. Moreover, sensing the physical surroundings together with AI will further enhance situational awareness. Sensing supports various innovative applications such as high precision positioning and localization of devices and objects, high resolution and real-time 3D-mapping for automated and safe driving/transport, digital twins, and industrial automation.

Because of this increasing innovation, the satellite and space industry are supporting:

- **Inclusivity and Ubiquitous Connectivity:** Commercial satellite broadband and narrowband services are able to address the digital divide so that all users have access to critical communications services. Today, there are over 2 million[3] satellite broadband subscribers across the United States, satellite is providing critical backhaul services for 5G cellular networks, and there are deployed satellite-enabled direct to device services, such as the Apple I-Phone, the Bullitt device and others. With the dramatic increases we are seeing (for instance, an 83% increase in satellite broadband subscribers and remote sensing data revenues increasing by approximately 50% over the past five years), additional spectrum for these uses must be available now.
- **Communications on the Move:** The increasing reliance of users on communications services on the move including in land, air and water require significant additional capacity to meet demand. These services include everything from supporting smart roads, autonomous transportation, the needs of crew, and safety-of-life to entertainment.
- **Enhanced security, privacy and resilience:** By monitoring, encrypting, and managing data, as well as providing secure storage, satellite technology helps to ensure citizens' data is safe and secure. Satellite data, combined with geospatial datasets and machine learning will enhance security, resiliency and efficiency in smart grid implementation and management. Satellites will also provide increasing situational and security data for pipelines, offshore rigs and storage facilities. As satellites provide a comprehensive view of the world from above, satellites will increasingly be used to detect and prevent threats to a nation's security including monitoring borders, detecting suspicious activity, and providing intelligence on potential threats.

3. Source: S&P Global Market Intelligence—The History of U.S. Broadband 2023

- **Ubiquitous computing:** Satellites are critical to support the ubiquitous use of data computing resources. Emerging trends in this regard include expansion of data processing in the network infrastructure to the network cloud and devices that are closer to the origin of the data and support for proliferation of ubiquitous intelligence globally. One facet of ubiquitous computing is that equipping smart objects with appropriate transmitters and receivers enables precise localization. Satellite supported localization technology is an absolute necessity.[4]

- **Smart industrial applications:** Through the leveraging of real-time intelligence and its ability to facilitate interactions between machines and citizens, satellite technology can scale to meet the performance of smart industrial applications. As these needs continue to grow, satellite capacity will have to scale up to meet these demands.

- **Lunar:** Human exploration missions to the Moon are set to occur as early as 2025. Lunar equipment includes spacesuits, handhelds, habitation, other lunar assets and other communication stations, landers, rovers, and extravehicular activity. All lunar equipment will require connectivity on the moon as well as ultimately, back to earth. It is critical that the U.S. government make available spectrum to support these expected needs.

- **Digital health and well-being:** Through the leveraging of AI, edge computing, ubiquitous connectivity, multi-sensory communication, positioning and sensing related capabilities, satellite technology is facilitating digital health services including interactive and remote monitoring, telediagnosis, remote tele-medical assistance (including tele-connected ambulances), tele-rehabilitation, digital clinical trials and telemedicine. As the medical community and patients become increasingly reliant on digital health, including in rural and remote areas, having sufficient satellite capacity will be key to its success.

- **Environmental Applications:** Satellite services enable critical environmental monitoring that terrestrial networks cannot do. This includes climate change surveillance, energy management, animal tracking, and support for polar expeditions. Leveraging satellite technology facilitates a broader understanding of our planet, supports sustainable practices, and aids in the conservation of biodiversity. As these applications increase in importance to the health of our planet, there needs to be sufficient spectrum to support this demand.

- **Emergency and Disaster Preparedness Communications:** Satellite services provide reliable, uninterrupted communication during crisis situations, enabling efficient emergency responses, predictive capabilities, and support during recovery phases. Earth observation satellites likewise can enable monitoring and early warning of natural disasters such as wildfires and also aid in recovery efforts. To ensure that the United States has the available capacity to meet the anticipated growth in need for these communications, additional spectrum must be made available.

- **Sustainability:** Satellite technology is addressing the need for increased environmental, agricultural, social, and economic sustainability, and also supports the goals of the Paris Agreement of the United Nations Framework Convention on Climate Change. Leveraging circular economy principles helps retain and recover value from resources and extend lifetime through such important considerations as reusing, repairing, repurposing or recycling. To meet the growing need of sustainability applications, there must be adequate spectrum for satellite services to meet this demand.

- **Space-to-Space Communications:** Intersatellite links (ISLs) provide a real-time connectivity solution by allowing satellites to communicate with each other or with third-party satellites to relay data when outside the range of an Earth station. Recognizing the value of next-generation ISLs for a variety of satellite missions that require two-way, higher capacity capabilities, it is critical that additional spectrum is allocated for this use.

4. Source: Proceedings of the International Conference on Trends & Advances in Computation & Engineering (TRACE).

Additional Capacity is Required for the United States to Win the Space Race

The importance of the U.S. satellite and space industry cannot be overstated. Satellite and space radiocommunications services are crucial for a myriad of applications that affect economics, health, education and U.S. national security, and more. By addressing these pressing needs through leveraging space, we can continue to drive our nation's progress, innovate, and lead in the space sector. It's time for our national policy to recognize this urgency and act now to secure our future in the space race. Failure to do so now and into the future will allow our adversaries to take the lead and jeopardize the United States' ability to win the space race.

To meet the myriad use cases addressed here, and the increasing use cases as we head to a 6G world, it is critical that space-based communications have access to the spectrum requirements it needs (both existing and new allocations). Because of the varied needs, the satellite and space industry must have made available (in addition to the existing allocations) by 2027 at least 15 GHz more of spectrum available globally within a wide variety of frequency bands from 390 MHz to 60 GHz.

**Image credits: U.S. Coast Guard photo by Petty Officer 3rd Class Eric D. Woodall and J Lamar/Cubic

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