April 17, 2023

Stephanie Weiner
Acting Chief Counsel
National Telecommunications and Information Administration
U.S. Department of Commerce
Herbert C. Hoover Building, Room 62024
1401 Constitution Ave., NW
Washington, D.C. 20230

Re: Request for Comment on Development of a National Spectrum Strategy
NTIA Docket No. 202308-0068, Regulations.gov Docket No. 2023-0003

Dear Ms. Weiner:

Intelsat License LLC ("Intelsat") files these comments in response to the National Telecommunications and Information Administration's ("NTIA") Request for Comment ("RFC") on the Development of a National Spectrum Strategy.[1] Intelsat appreciates the opportunity to submit comments in this proceeding and emphasizes that the National Spectrum Strategy should be technology-neutral, forward-looking, and enabling of both existing and new satellite technologies and services.

Founded over 50 years ago and privatized in the United States over 20 years ago, Intelsat is uniquely and well-positioned to understand the spectrum policies needed to advance U.S. leadership in space and satellite services. Today, Intelsat is one of the largest satellite operators in the world, with a fleet of more than 50 geostationary satellite orbit ("GSO") satellites and a planned non-geostationary satellite orbit ("NGSO") system.[2] Intelsat provides diversified communications services to many of the world's leading media companies, telecommunications operators, and Internet service providers, as well as the U.S. Government and military. Intelsat uses its satellites as relay stations in space for the transmission of voice, video, and data communications, and is well-known as a pioneer in the satellite technology space. It made history in 2020 for being the first satellite operator to use mission extension vehicles on orbit.[3] Intelsat remains at the forefront of innovation today, having debuted plans to launch a series of software-

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[1] *See Development of a National Spectrum Strategy*, Request for Comment, 88 Fed. Reg. 16244 (Mar. 16, 2023) ("RFC").

[2] *See* Intelsat License LLC, Petition for Declaratory Ruling Granting Access to the U.S. Market for a Non-U.S.-Licensed Non-Geostationary Orbit Satellite System, IBFS File No. SAT-PPL-20211104-00146 (filed Nov. 4, 2021). The vast majority of Intelsat's satellite fleet and a large portion of its ground network are authorized by the United States.

[3] *See Mission Extension Vehicle 1 and Intelsat 901*, Intelsat, https://www.intelsat.com/global-network/satellite-network/launches/intelsat-901/.

defined satellites ("SDS"),[4] its Intelsat Epic series high-throughput satellites,[5] and a new medium-Earth orbit ("MEO") constellation that will complement its GSO network.[6]

Ubiquitous communication access is integral to every sector of the United States, from education to healthcare, agriculture to disaster relief. One of the greatest strengths of the satellite industry is its ability to connect the unconnected in areas of the world where terrestrial service is difficult or cost prohibitive. Indeed, satellite is the only technology today that can provide truly global coverage: Intelsat's satellites alone cover 99% of the earth's populated regions. This coverage allows the satellite industry to play a key role in today's most innovative and crucial services, including precision agriculture, emergency communications, and broadband connectivity. Moreover, satellite operators like Intelsat and others provide critical services to federal defense and security interests, and the importance of satellite to U.S. national security is only growing.

To support these and other innovative uses of spectrum, it is imperative that the National Spectrum Strategy consider—band by band—how spectrum can be put to its highest and best use, and such consideration must include satellite services. Each spectrum band is unique in its technical characteristics and thus its ability to support certain technologies and services. Each band is also unique in its utilization by incumbent operators. With access to "greenfield" spectrum waning, making spectrum available for burgeoning commercial services means either displacing incumbents or finding innovative ways to share spectrum. Displacement of incumbent operators may, in some cases, place undue pressure on already-stretched spectrum resources to the detriment of end users. Sound spectrum policy will therefore ensure that service allocations maximize use of each band.

Spectrum is the foundation of the space economy, and the continued erosion of spectrum allocated to satellite services will significantly impede the ability of the U.S. to lead in this critical sector. It is often the most vulnerable populations that are most dependent on satellite services, and thus have the most to gain from their growth and the most to lose from barriers to that growth. In preparing the National Spectrum Strategy, it is therefore vital that NTIA provide for the protection of current satellite allocations and the creation of new allocations to accommodate the growing demand for these services.

Alongside spectrum allocations, the United States should reexamine existing footnotes in the Table of Frequency Allocations and operational rules that may limit unnecessarily an operator's use of allocated spectrum. Rigidity can result in artificially thin use of spectrum, while the removal

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[4] *Airbus signs multi-satellite contract with Intelsat for OneSat flexible satellites*, Intelsat (Jan. 8, 2021), https://www.intelsat.com/newsroom/airbus-signs-multi-satellite-contract-with-intelsat-for-onesat-flexible-satellites/; *see also* Marisa Torrieri, *How Software-Defined Satellites Will Shape Communications*, Via Satellite (Apr. 2021), *available at* https://interactive.satellitetoday.com/via/april-2021/how-software-defined-satellites-will-shape-communications/.

[5] Intelsat, *Realizing Resilient Tactical Networks with Maximum Government Control on High-throughput Satellites*, White Paper, *available at* https://www.intelsat.com/wp-content/uploads/2020/04/intelsatgeneral-high-throughput-satellites-whitepaper.pdf.

[6] *See* Intelsat License LLC, Petition for Declaratory Ruling Granting Access to the U.S. Market for a Non-U.S.-Licensed Non-Geostationary Orbit Satellite System, IBFS File No. SAT-PPL-20211104-00146 (filed Nov. 4, 2021).

of certain restrictions—like the prohibition on domestic GSO use found in Footnote NG52[7]—would unlock a significant amount of spectrum for expanded use immediately.

In support of NTIA's efforts "to identify at least 1,500 megahertz of spectrum for in-depth study to determine whether that spectrum can be repurposed to allow more intensive use,"[8] Intelsat provides further comment below on the three proposed pillars of the National Spectrum Strategy.

Pillar #1: A Spectrum Pipeline To Ensure U.S. Leadership in Spectrum-Based Technologies

1-1. What are projected future spectrum requirements of the services or missions of concern to you in the short (less than 3 years), medium (3-6 years) and long (7-10 years) term? What are the spectrum requirements for next-generation networks and emerging technologies and standards under development (e.g., 5G Advanced, 6G, Wi-Fi 8)? Are there additional or different requirements you can identify as needed to support future government capabilities? What are the use cases and anticipated high-level technical specifications (e.g., power, target data rates) that drive these requirements? How much, if at all, should our strategy by informed by work being performed within recognized standards-setting bodies (e.g., 3GPP, IEEE), international agencies (e.g., ITU), and non-U.S. regulators or policymakers (e.g., the European Union)? What relationship (if any) should our strategy have to the work of these entities? Are there spectrum bands supporting legacy technology (e.g., 3G, GSM, CDMA, etc.) that can be repurposed to support newer technologies for federal or non-federal use?

NTIA should endeavor, to the fullest extent possible, to maintain the integrity of existing satellite allocations and avoid placing further downward pressure on already congested satellite bands. Furthermore, current satellite usage statistics do not provide a complete view of the industry's future spectrum needs. Accordingly, Intelsat recommends that NTIA incorporate forward-looking data, such as economic forecasts, into the National Spectrum Strategy to ensure that the future needs of satellite operators are adequately addressed. For example, as of September 2022, 2.7 billion people worldwide lacked internet access,[9] and forecasts indicate that the number of satellite broadband users is set to double to at least 500 million people by 2030.

Communications services provided by satellites are expected to deliver numerous social and economic benefits:

- Broadband delivery to households is expected to deliver $52 billion in revenue in 2030 (up from $26 billion in 2022). Estimates suggest that up to 81 million students will use satcom tele-education and 74 million people will use satcom telemedicine by 2030.

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7 *See* 47 C.F.R. § 2.106 n.NG52.

8 RFC at 16244.

9 *See* United Nations, *Achieving universal and meaningful digital connectivity: Setting a baseline and targets for 2030*, Background Paper (2022), *available at* https://www.itu.int/itu-d/meetings/statistics/wp-content/uploads/sites/8/2022/04/UniversalMeaningfulDigitalConnectivityTargets2030_BackgroundPaper.pdf.

- Media broadcasting is expected to generate up to $86 billion by 2030.

- Broadband on the move is estimated to bring up to $118 billion to the economy in 2030 (up from $13 billion in 2022) as innovative new services are deployed.

- Cellular backhaul via satellites - a crucial technology to bring connectivity where terrestrial infrastructure cannot reach - will generate market revenues of almost $30 billion by 2030. The Internet of Things ("IoT") will rely on satellite communications to connect medical wearable devices and other sensors and monitors.

- New satellite applications, such as inter-satellite links, lunar links, and direct-to-cell phone connectivity, will create significant value in the coming years.

Satellite services are essential to providing communications coverage on a truly global scale and can therefore help to close the digital divide by bringing broadband to users in rural and underserved communities around the world, which often are otherwise difficult or cost-prohibitive to reach with terrestrial services. A predictable regulatory and spectrum environment is crucial to foster this type of meaningful digital connectivity.

These innovations and others will only be possible if there is sufficient spectrum and adequate protection from interference for satellite services. The National Spectrum Strategy must therefore be forward-looking in its approach to the spectrum requirements of next-generation satellite systems and the unserved and underserved populations they will benefit.

1-2. Describe why the amount of spectrum now available will be insufficient to deliver current or future services or capabilities of concern to stakeholders. We are particularly interested in any information on the utilization of existing spectrum resources (including in historically underserved or disconnected communities such as rural areas and Tribal lands) or technical specifications for minimum bandwidths for future services or capabilities. As discussed in greater detail in Pillar #3, are there options available for increasing spectrum access in addition to or instead of repurposing spectrum (i.e., improving the technological capabilities of deployed systems, increasing or improving infrastructure build outs)?

Next-generation satellites, whether GSO or NGSO, will use all available Ku-band resources, irrespective of their nominal allocations (*i.e.*, broadcasting-satellite service ("BSS"), planned fixed-satellite service ("FSS"), unplanned FSS), to maximize penetration and coverage most efficiently. The space industry is poised for exponential growth in coming years, and additional spectrum resources will be necessary to accommodate these operations. Intelsat identifies several satellite industry use cases below and offers recommendations for how to support these and other operations.

Earth Stations in Motion. There has been, and continues to be, increasing demand for widespread high-speed broadband connectivity on vessels, aircraft, and various other transportation mediums among consumers and industries worldwide. Earth stations in motion ("ESIM"), and the systems with which they communicate, form the backbone of these vital services today. Due to the growing strain on spectrum, the demand for these services may quickly outstrip the existing capacity to deliver on-the-move broadband connectivity absent action by policymakers.

The 12.75-13.25 GHz band is an ideal candidate for additional ESIM allocations. Opening up the band for use by aircraft and maritime earth stations will allow satellite network operators to provide additional capacity for the growing needs in this sector without placing additional strain on densely packed satellite bands.

Low-Latency Broadband by NGSOs. Larger NGSO systems deployed in MEO and Low Earth Orbit ("LEO") are able to deliver low-latency broadband data services anywhere on the planet. However, questions remain as to whether there is sufficient spectrum available to support multiple systems comprised of thousands of satellites each—and thus competition essential for market innovation. It is important to identify additional spectrum for these systems so as not to preclude future connectivity with multi-orbit, multi-domain, multi-service, and multi-band architectures and technologies.

Mandatory sharing of operation information for coordination by and between NGSO systems can also meaningfully enhance spectrum sharing—particularly because advances in phased array antenna technologies can be used to create dynamic spot beams. The projected future spectrum requirements for NGSO services are potentially unlimited, so long as they are not restricted unnecessarily by the interference environment.

Non-Terrestrial Networks. There has been heightened interest around the world in the Non-Terrestrial Network ("NTN") services sector (*e.g.*, direct-to-handset, IoT services). As more of these devices and services come online, however, it is possible that capacity constraints will hinder satellite operators' ability to meet consumer demand for data services unless policy makers take preventative measures. Intelsat believes that Ku-band spectrum can help to alleviate anticipated congestion on satellite networks. The band offers substantial capacity relief and the technical characteristics to support high throughput for NTN-type applications.

In addition to the above use cases, increased spectrum availability will be needed for space-based next-generation networks supporting 6G, enabling use cases like augmented reality, autonomous transportation, Industry 4.0, and eHealth.

1-3. What spectrum bands should be studied for potential repurposing for the services or missions of interest or concern to you over the short, medium, and long term? Why should opening or expanding access to those bands be a national priority. For each band identified, what are some anticipated concerns? Are there spectrum access models (e.g., low-power unlicensed, dynamic sharing) that would either expedite the timeline or streamline the process for repurposing the band?

The proliferation of larger NGSO satellite constellations that rely on the same Ku-band frequencies as existing GSO satellites places a heavy load on the available Ku-band spectrum. Thousands of NGSO satellites rely on a single 500-megahertz of uplink spectrum, and a lack of spectrum availability may constrain operations and deployment in the future.[10] It is imperative, therefore,

[10] Indeed, the FCC noted in its recent Draft Order and Further Notice of Proposed Rulemaking on revising NGSO spectrum sharing rules that "[t]he number of applications filed in recent years for NGSO FSS system authorizations, and the number of satellites launched, are unprecedented." *See Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems*, Draft Report and Order and Further Notice of Proposed Rulemaking, IB Docket No. 21-456, ¶ 2 (rel. Mar. 30, 2023).

that the United States preserve all existing Ku-band spectrum for satellite use, as well as identify allocation and operational rule changes to enable greater satellite use of the Ku-band and alleviate capacity constraints.

12.2-12.7 GHz Band. The recent proposal by the Federal Communications Commission ("FCC") to introduce terrestrial mobile services into the 12.2-12.7 GHz band, if adopted, will adversely affect FSS satellite operators. Such mobile services are inherently incompatible with millions of consumer satellite dishes that rely on this band for their TV reception; there is no evidence to suggest that coexistence between terrestrial mobile and incumbent direct broadcast satellite ("DBS") operations could be successfully achieved. Additionally, the rapid growth of NGSO constellations that operate in this band further intensifies the use of this band by satellite applications. It would also create adjacent band interference to FSS operations in the 11.7-12.2 GHz band.[11]

12.75-13.25 GHz Band. The 12.75-13.25 GHz band should similarly remain with satellite and space-based communications and should not be re-allocated to terrestrial mobile.[12] The band is and will continue to be crucial for satellite services, therefore, permitting terrestrial mobile operations will further reduce the uplink spectrum available to satellite operators.[13] The shortage in uplink spectrum available to FSS operators is further exacerbated by the prohibition on domestic GSO operations in the band pursuant to footnote NG52 of the U.S. Table of Frequency Allocations.[14] To ensure that there are adequate amounts uplink spectrum available for future space operations, the U.S. Government should not add new users to the band and should encourage more efficient and intensive FSS utilization of the band by removing footnote NG52.

13.75-14.0 GHz Band. The 13.75-14.0 GHz band is allocated to FSS on a primary basis, but commercial FSS operations are heavily constrained by the Department of Defense's use of the band. As part of its effort to identify federal bands that are ripe for repurposing, NTIA should examine whether the Department of Defense's current restrictions should be relaxed to permit greater use of the band by commercial FSS operators. The system characteristics and their

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11 *Expanding Flexible Use of the 12.2-12.7 GHz Band, et al.*, Notice of Proposed Rulemaking, 36 FCC Rcd 606 (2021). *See generally* Reply Comments of Intelsat License LLC, GN Docket No. 17-183 (filed July 7, 2021).

12 *See Expanding Use of the 12.7-13.25 GHz Band for Mobile Broadband or Other Use*, Notice of Inquiry and Order, GN Docket No. 22-352, FCC 22-80 (rel. Oct. 28, 2022) (considering whether to reallocate part or all of the band to terrestrial mobile services and relocate incumbent FSS, BAS, and other users).

13 *See, e.g.*, Comments of Intelsat License LLC and SES Americom, Inc., GN Docket No. 22-352, at 11 (filed Dec. 12, 2022) (describing how Intelsat's in-flight connectivity services rely on the 12.7 GHz band) ("Intelsat and SES Comments on 12.7 GHz Band"); Comments of Hispasat, S.A., GN Docket No. 22-352, at 2-3 (filed Dec. 12, 2022) (discussing how Hispasat uses the band for disaster relief communications, military and non-military aeronautical operations, telehealth and tele-education services, and a variety of media and broadband services); *Satellite Monitor Annual Research Shows SES Increase Reach to 366 Million TV Homes Worldwide*, Business Wire (Apr. 5, 2022), https://bit.ly/3iELFuP (describing how SES uses the band to provide direct-to-home video services to 59 million homes in the United States).

14 *See* 47 C.F.R. § 2.106 n.NG52.

associated usage and application requirements in this band have changed over the last few decades, along with the operational characteristics of the other services allocated to the band. Therefore, to accommodate the evolving needs of FSS operators, identification of possible alternative sharing conditions for this band are required.

1-4. What factors should be considered in identifying spectrum for the pipeline? Should the Strategy promote diverse spectrum access opportunities including widespread, intensive, and low-cost access to spectrum-based services for consumers? Should the Strategy promote next-generation products and services in historically underserved or disconnected communities such as rural areas and Tribal lands? Should the Strategy prioritize for repurposing spectrum bands that are internationally harmonized and that can lead to economies of scale in network equipment and devices? How should the Strategy balance these goals with factors such as potential transition costs for a given band or the availability of alternative spectrum resources for incumbent users? How should the Strategy balance these goals against critical government missions? How should the Strategy assess efficient spectrum use and the potential for sharing? What is an ideal timeline framework suitable for identifying and repurposing spectrum in order to be responsive to rapid changes in technology, from introduction of a pipeline to actual deployment of systems?

The National Spectrum Strategy should consider international harmonization, technological neutrality, and how the spectrum can be put to its highest and best use.

International harmonization of spectrum bands plays a pivotal role in fostering seamless communication across borders and promoting cost-effective development of network equipment and devices. By prioritizing the creation of internationally harmonized spectrum bands, the National Spectrum Strategy can facilitate economies of scale, which in turn encourages investment in infrastructure and the development of innovative products and services. Moreover, globally harmonized spectrum enhances interoperability—supporting both commercial and governmental operations that rely on cross-border communication, such as disaster response, aviation, and international trade.

In addition to international harmonization, adopting a technology-neutral approach in releasing spectrum for the pipeline is essential for promoting innovation and ensuring the efficient use of this finite resource. A technology-neutral approach allows for the accommodation of a diverse range of technologies and services, fostering competition and encouraging the development of advanced, cost-effective solutions by expanding the range of providers competing to utilize spectrum. Importantly, the National Spectrum Strategy should not presume that only terrestrial wireless users require spectrum access. In fact, spectrum is in high demand from various users, including those that rely on satellite services, which play a critical role in global communications infrastructure.

When allocating spectrum resources, it is vital to recognize that not all spectrum bands are created equal, and some bands are better suited for specific telecommunications technologies than others. The National Spectrum Strategy should consider the unique characteristics of different spectrum bands to determine their suitability for various applications, including satellite communications. Factors like signal propagation, atmospheric absorption, the availability of existing satellite infrastructure, and the type of operations in adjacent bands all serve to make

some spectrum more suited for satellite users than others. In examining whether to relocate incumbent operations, the National Spectrum Strategy should also consider whether alternative spectrum is available and, if so, whether the amount of spectrum remaining is sufficient to support existing and anticipated demand. The National Spectrum Strategy should be thoughtful in its approach—rejecting calls to repurpose tens or hundreds of megahertz of spectrum without weighing opportunity costs against the expected benefits to new entrants.

1-5. Spectrum access underpins cutting-edge technology that serves important national purposes and government missions. Are there changes the government should make to its current spectrum management processes to better promote important national goals in the short, medium, and long term without jeopardizing current government missions?

The U.S. Government should conduct a comprehensive review of all spectrum reserved exclusively for use by federal agencies or spectrum that is constrained by federal users to determine whether the intensity of usage warrants the current allocations or if instead sharing with commercial users or repurposing for commercial use would make more efficient use of spectrum while still satisfying the U.S. Government's spectrum needs. To optimize the use and sharing of spectrum in a technology-neutral manner, any spectrum review should include empirical and evidence-based assessments to identify which services will make the most efficient use of a given band. Not all spectrum sharing frameworks should mirror policies employed for sharing of the 3.45-3.55 GHz (3.45 GHz) or 3.55-3.7 GHz (3.5 GHz) bands. Spectrum sharing can also take the form of relaxing regulatory constraints, like the prohibition on domestic GSO use found in Footnote NG52 of the U.S. Table of Frequency allocations, or eliminating the complete prohibition of commercial use in federal bands where inter-federal and non-federal system sharing is feasible, like the federal X-band and the federal military Ka-band. This is important to ensure that all technologies—including satellite—have access to spectrum to drive innovation and satisfy consumer demand.

Another area in which NTIA can improve existing spectrum management processes is by improving its interagency coordination processes. As an initial matter, NTIA and the FCC could work to improve the interoperability of their systems for sharing information so as to minimize the administrative burden on the agencies and resulting delay in coordination review. Setting up uniform data format requirements and templates, for example, could speed up coordination in an administratively efficient manner. Additionally, the FCC should request NTIA review earlier in the FCC application process when coordination is required and should establish a more definitive timeline for reviewing coordination requests. Reviewing coordination requests earlier with set deadlines in place will ensure that NTIA has adequate time to thoroughly review requests and will simultaneously increase regulatory certainty and reduce delays for operators.

1-6. For purposes of the Strategy, we propose to define "spectrum sharing" as optimized utilization of a band of spectrum by two or more users that includes shared use in frequency, time, and/or location domains, which can be static or dynamic. To implement the most effective sharing arrangement, in some situations incumbent users may need to vacate, compress or repack some portion of their systems or current use to enable optimum utilization while ensuring no harmful interference is caused among the spectrum users. Is this how spectrum sharing would be defined? If not, please provide a definition or principles that define spectrum sharing. What technologies, innovations or processes are currently available to facilitate spectrum

sharing as it should be defined? What additional research and development may be required to advance potential new spectrum sharing models or regimes, who should conduct such research and development, and how should it be funded?

Spectrum sharing means that two or more users can access the same spectrum without causing harmful interference to one another's operations. The concept of spectrum sharing does not, and, indeed, should not require incumbents to vacate, compress, or re-pack some portions of their systems. Methods that require incumbent users to move out of a band in whole or in part fall under the umbrella of "spectrum clearing" rather than "spectrum sharing."

Pairing together compatible services maximizes sharing. The satellite industry routinely shares spectrum intra-system (*i.e.*, GSO-GSO and NGSO-NGSO system sharing), inter-system (*i.e.,* GSO-NGSO system sharing), and where feasible, inter-service (*e.g.*, the 12.7-13.25 GHz band is actively shared between non-federal Fixed Service, non-federal Fixed Satellite Service (Earth-to-space, both GSO and NGSO system), and a federal Deep Station Network receive-only earth station managed by NASA). The satellite industry is also examining ways to share spectrum to provide direct satellite-to-smartphone communications using spectrum licensed to terrestrial mobile operators. Sharing between non-federal systems and services is facilitated not only by FCC rule, but also through operator-to-operator coordination. The National Spectrum Strategy should therefore consider ways to further promote and incentivize such coordination—for example, by implementing information sharing guidelines among stakeholders—which is essential for maximizing the efficient use of spectrum.

1-8. What incentives or policies may encourage or facilitate the pursuit of more robust federal and non-federal spectrum sharing arrangements, including in mid-band and other high priority/demand spectrum? For example, does the current process for reimbursement of relocation or sharing costs adequately incentivize the study or analysis of spectrum frequencies for potential repurposing? Are there market-based, system-performance based or other approaches that would make it easier for federal agencies to share or make spectrum available while maintaining federal missions? At the same time, what mechanisms should be considered to meet some of the current and future federal mission requirements by enabling new spectrum access opportunities in non-federal bands, including on an "as needed" or opportunistic basis?

Intelsat believes that adopting policies to allow commercial spacecraft to operate on federal bands when serving U.S. Government customers will open up valuable spectrum in a relatively short amount of time to the benefit of Government users and missions. Due to the high cost of launching and maintaining satellites, Intelsat has, in numerous instances, contracted with Government customers to host federal payloads aboard its spacecraft.[15] This experience with hosted payloads has given Intelsat considerable insight into how to improve existing federal and non-federal sharing arrangements.

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[15] *See Hosted Payloads*, Intelsat, https://www.intelsat.com/solutions/professional-satellite-services/hosted-payloads/ (describing Intelsat's hosted payload program and listing several examples of recent hosted payloads including NASA's Tropospheric Emissions: Monitoring of Pollution ("TEMPO") payload, the Federal Aviation Administration's L-band hosted payload, and the U.S. military's LEASAT program).

One next step that should be considered is supporting a policy where the FCC licenses the commercial spacecraft to use federal bands for the purpose of serving U.S. Government customers. Intelsat envisions a system whereby commercial operators apply to the FCC to include federal bands on their spacecraft. Notification and coordination would be handled through the existing process for shared federal/non-federal bands. The operational limitations, including a condition that the spectrum be restricted for use by federal customers only, could be reflected in the conditions of a space station grant. Neither commercial satellite operators nor their Government customers should be required to seek separate authority from NTIA prior to operation. Permitting commercial spacecraft licensed by the FCC to include federal bands for the limited purpose of serving Government customers provides greater flexibility to satellite operators and their Government customers seeking to put federal spectrum to use.

Pillar # 2–Long-Term Spectrum Planning

2-1. Who are the groups or categories of affected stakeholders with interests in the development of the National Spectrum Strategy and participating in a long-term spectrum-planning process? How do we best ensure that all stakeholders can participate in a long-term spectrum planning process in order to facilitate transparency to the greatest extent possible, ensure efficient and effective use of the nation's spectrum resources?

Development of the National Spectrum Strategy should aim to ensure that all relevant stakeholders—including operators, consumers, policymakers, and other interested parties—are heard and that their opinions are given due consideration. To strike this delicate balance, the U.S. Government should take a holistic approach to crafting its strategy, particularly with respect to 5G and other next generation technologies or services, and make decisions that acknowledge the benefits of space-based services alongside mobile broadband and other terrestrial wireless services. The National Spectrum Strategy should not be viewed as a zero-sum game. Everyone benefits from a robust and well-thought-out spectrum strategy that simultaneously supports U.S. Government, enterprise, and consumer interests.

Pillar #3–Unprecedented Spectrum Access and Management Through Technology Development

3-1. What innovations and next-generation capabilities for spectrum management models (including both licensed and unlicensed) are being explored today and are expected in the future to expand and improve spectrum access (and what are the anticipated timelines for delivery)?

Today's NGSO and GSO satellites are typically designed with multi-beam electronically steerable phased array antennas servicing Earth-fixed cells inside the satellite footprint. These antennas can be analog beamforming, digital beamforming, and hybrid beamforming, and their design makes spectrum sharing between different NGSO systems possible.

Operators of NGSO systems with multi-beam phased array antennas can facilitate spectrum sharing by creating an industry-run database used to share NGSO coordination data. Intelsat endorses sharing information on frequency reuse schemes, active operational satellites, satellite selection strategies, beam pointing, beam activation schedule, and actual operational parameters (*e.g.*, power levels, emissions, and antenna performance). An industry-run database would foster

a pro-competitive sharing framework, allowing multiple NGSOs to share the same spectrum simultaneously. By cooperating with one another, operators can better manage interference and foster the efficient use of already-scarce spectrum. The FCC recently raised the possibility of establishing a similar industry-run database for NGSO satellites in its recent draft Further Notice of Proposed Rulemaking on revising spectrum sharing rules for NGSO FSS systems.[16]

3-2. What policies should the National Spectrum Strategy identify to enable development of new and innovative uses of spectrum?

The National Spectrum Strategy should prioritize policies that will promote spectrum sharing among operators by, for example, adopting an industry-run database as described above for sharing NGSO coordination data.

3-3. What role, if any, should the government play in promoting research into, investment in, and development of technological advancements in spectrum management, spectrum dependent technologies, and infrastructure? What role, if any, should the government play in participating in standards development, supporting the use of network architectures, and promoting tools such as artificial intelligence and machine learning for spectrum coordination or interference protections? What technologies are available to ensure appropriate interference protection for incumbents in adjacent bands? What spectrum management capabilities/tools would enable advanced modeling and more robust and quicker implementation of spectrum sharing that satisfies the needs of nonfederal interests while maintaining the spectrum access necessary to satisfy current and future mission requirements and operations of federal entities? How can data-collection capabilities or other resources, such as testbeds, be leveraged (including those on Tribal lands and with Tribal governments)?

The U.S. Government should play a role in promoting the development of and investment in the technology to create and utilize industry-run databases that share NGSO coordination data. These systems should have the ability to restrict sensitive information on a more limited basis with security capabilities and redundancies built in. The U.S. Government can also play a role in developing standards for 5G/6G NTN technologies.

Additionally, the Government should encourage and participate in research and development in artificial intelligence and machine learning for spectrum coordination, as well as using dynamic resource allocation algorithms ("DRA") for interference protection.

3-4. NTIA is pursuing a time-based spectrum sharing solution called the incumbent informing capability (IIC) to support spectrum sharing between federal and non-federal users.4 What are some recommendations for developing an enduring, scalable mechanism for managing shared spectrum access using the IIC or other similar mechanism, with the goal of increasing the efficiency of spectrum use? What challenges do non-federal users foresee with potentially having limited access to classified or other sensitive data on federal spectrum uses and operations as part of

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16 *See Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems*, Report and Order and Further Notice of Proposed Rulemaking, IB Docket No. 21-456 (rel. Mar. 30, 2023).

the IIC or similar capabilities, and what recommendations do users have for ways to mitigate these challenges? What are the costs and complexities associated with automating information on spectrum use?

The time-based spectrum sharing solution called the incumbent informing capacity ("IIC") can be an input to the industry-run databases used to share NGSO coordination data and assign federal spectrum to non-federal systems. Some challenges that NTIA must consider when using this solution include security, timeliness of the available spectrum, and the best way to partition the available federal spectrum with non-federal systems.

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Intelsat appreciates the opportunity to help shape NTIA's National Spectrum Strategy and hopes that the changes proposed herein will create a more flexible, yet stable spectrum environment that nourishes innovation in the U.S. space economy.

Respectfully submitted,

By: */s/ W. Ray Rutngamlug*

W. Ray Rutngamlug
Associate General Counsel

Cynthia J. Grady
Assistant General Counsel

Intelsat US LLC
7900 Tysons One Place
McLean, VA 22102