PRESIDENT'S NATIONAL SECURITY TELECOMMUNICATIONS ADVISORY COMMITTEE

Mr. Scott Charney
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1 Microsoft Way
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The Honorable Joseph R. Biden
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Mr. President:

This letter is in response to your tasking to the National Security Telecommunications Advisory Committee (NSTAC), requesting our perspective and recommendations on the implementation of the National Spectrum Strategy (Strategy) as it pertains to dynamic spectrum sharing (DSS).[1]

As discussed in the Strategy, wireless services have become essential for citizens to function in the 21st Century providing reliable and affordable high-speed internet access. The administration has recognized the importance of getting high-speed broadband access to all Americans, including through wireless investment and infrastructure deployment that requires predictable spectrum access. The administration has also recognized that critical U.S. government services and missions rely on predictable spectrum access on the ground, in the air, at sea, and in space operations to protect our national security here and abroad.

Demand for spectrum is growing rapidly as more innovations occur in wireless and spectrum dependent technologies. There are many spectrum-dependent national security missions operating in the midband due to unique characteristics of this particular spectrum, to meet

[1] There are differing views within the NSTAC on a variety of spectrum access issues. Some members prefer re-purposing spectrum on a full-power, licensed basis. Others view existing sharing models such as Wi-Fi and Citizen's Broadcast Radio Spectrum (CBRS) as a preferred way to make spectrum available and as essential for indoor wireless broadband. Others favor a low-power sharing approach such as a next generation CBRS for sharing with national security systems. And yet still other members observed that there are other spectrum sharing conversations occurring outside of DSS. We do not attempt to reconcile those issues here and instead focus on issues that should be considered to enable DSS in instances where policymakers decide on that approach.

specific mission requirements, which continue to grow. Industry also views midband spectrum as desirable to expand coverage and capacity to meet the growing demand.

Dynamic Spectrum Sharing[2], or DSS, is identified in the Strategy as, "one key to meet these growing demands, and the United States is uniquely positioned to embrace a whole-of-Nation approach to advance the state of technology for dynamic forms of sharing."[3] Other efforts are also underway to study which spectrum bands may be candidates for repurposing for commercial use. The strategy puts into motion a "moonshot" effort to advance the state of potential dynamic forms of spectrum sharing in collaboration with industry, with a goal to "advance research, create investment incentives, and set forth measurable goals for advancing the state of technology for spectrum access."[4] To accomplish this goal, the Strategy looks to establish a national testbed for the next generation of DSS. The implementation of the testbed is expected to yield useful information about DSS, and the administration should avoid pre-determining the outcome or settling on specific technological solutions in advance.

The purpose of this letter is to provide the NSTAC's perspective as the administration develops an Implementation Plan for the Strategy (Implementation Plan) focused on DSS. Many of the companies NSTAC members are affiliated with filed comments in the National Telecommunications and Information Administration's (NTIA) proceeding to develop the Implementation Plan. We encourage the administration to review the record in the NTIA proceedings as they develop the Implementation Plan.

The NSTAC highlights several items for consideration as the DSS processes in the Strategy are implemented. Most notably the following:

- The Implementation Plan should acknowledge that the need for spectrum is growing for both commercial wireless services and federal national security (or national security) missions. In the past, it has taken several years to make new spectrum available for commercial use and, spectrum policy has not explicitly considered the need for federal, national security technologies and capabilities to adapt to changing technology and emerging threats. For example, next generation radar systems will require an even larger spectrum footprint given the threats they are intended to detect and protect against. Thus, it is important that we develop a plan in the near term to appropriately consider the increasing demands of federal and nonfederal spectrum technologies and users.
- The Implementation Plan should establish aggressive timelines and ensure that necessary steps are taken to confirm the viability of these processes, while preventing technical studies and testbeds from becoming an unnecessary source of delay. Investment in the

[2] This letter uses the phrase "dynamic spectrum sharing" to reflect the same meaning adopted by NTIA in the Strategy. It does not refer to the 3GPP technology of the same name that allows a carrier to use a spectrum band for either LTE and 5G operations, depending on traffic demands. See, e.g., Samsung, "Dynamic Spectrum Sharing" (Jan. 2021). Retrieved from Dynamic Spectrum Sharing | Samsung Business Global Networks.
[3] National Telecommunications and Information Administration, National Spectrum Strategy (2023). Page 13. Retrieved from https://www.ntia.gov/report/2023/national-spectrum-strategy-pdf..
[4] National Telecommunications and Information Administration, National Spectrum Strategy (2023). Retrieved from https://www.ntia.gov/report/2023/national-spectrum-strategy-pdf..

commercial wireless ecosystem and federal national security technologies and capabilities require a clear understanding of the spectrum access environment.[5]

- For there to be any path to success, the processes put in motion by the Implementation Plan should be based upon a common and widely accepted set of characteristics of what constitutes "dynamic spectrum sharing." The Implementation Plan should define the critical aspects of DSS needed across a range of different use cases and bands to be studied in the testbeds, and that could accelerate co-existence between commercial and federal uses.
- For DSS to succeed, robust technical analysis is needed. This necessitates studying the operating environment as well as the operating parameters. This should include information about the inputs and assumptions made in interference analyses and the technical parameters of the current and expanding federal capabilities, to accurately assess the viability of varying commercial spectrum access frameworks. Approaches that have already been implemented or proven in other bands should not be subject to testbeds. Testbeds should, instead, work to advance the evolution of the next generation of sharing technologies, or be implemented where there are new use cases.
- Ensuring the ability of the Department of Defense (DoD) to meet its mission requirements in face of evolving threats is of paramount importance to the NSTAC. This does not necessarily mean that all aspects of the DoD's use of spectrum remain unchanged. However, effective sharing cannot exist when neither commercial systems nor federal systems are able to operate as needed due to a lack of consistent, reliable access to spectrum.
- The administration should consider how to establish an enforcement authority. It is important to clarify which entity has the enforcement role, to include adjudication and remediation, in instances when there are issues with conformance to a DSS arrangement.
- The Implementation Plan's deliverables should also consider the need to leverage and lead international standardization efforts. DSS solutions should not be exclusively applicable to the U.S., but rather can be exported to other countries with similar concerns and spectrum environments. The U.S. should innovate and maintain technological leadership in implementing DSS, while considering interoperability with the North Atlantic Treaty Organization (NATO) allies and other national security partners, as the U.S. engages in international standards bodies.
- Finally, there have been previous efforts to address the feasibility of sharing, generally, including most recently through the Emerging Mid-Band Radar Spectrum Sharing, or EMBRSS report, and DoD's Partnering to Advance Trusted and Holistic Spectrum Solutions ("PATHSS") task group. The Implementation Plan can build upon these efforts; however, any successor process should be organized from inception to also include the interest of the communications and defense industries, and other stakeholders.

[5] Electromagnetic Spectrum Superiority Strategy Released. (2020, October 29). *U.S. Department of Defense*. Retrieved from https://www.defense.gov/News/Releases/Release/Article/2397850/electromagnetic-spectrum-superiority-strategy-released/.

We elaborate on each of these areas in the following section.

Scope, and Timing

The Implementation Plan must consider all the critical use cases of spectrum including the entire communications industry, federal national security missions, other federal agencies, affected industries, manufacturers, satellites, and end users including consumers, enterprises, and combatant commands as well as international allies. Any approach must consider how to make spectrum available on terms enabling investments by both federal and nonfederal interests.

Depending upon the spectrum access model, spectrum acquisition and network deployment costs are a key consideration. Other considerations include: federal procurement timelines, current and future connectivity needs, existing and future threats, and the need to maintain a strong deterrence profile. Enabling investments by both federal and nonfederal interest can pave the way for the U.S. to lead the world in wireless communications technology and continue to lead the world in national security technologies.

The objective of DSS frameworks is to promote even greater use of heavily utilized spectrum by creating opportunities for co-existence between existing and new spectrum uses. New DSS frameworks potentially can advance co-existence between and among otherwise incompatible technologies and uses. Mutually acceptable coexistence cannot mean zero risk to those sharing spectrum; rather, it means risk management will be a shared responsibility among users. Furthermore, an effective dynamic sharing regime minimizes risk by design and mitigates the residual risk to levels acceptable to all parties, to ensure that investments in the sharing regime and spectrum utilization are incentivized.

As a threshold matter, the Implementation Plan should establish an operational understanding of the key characteristics of DSS which may differ between use cases and bands. In terms of study scope, dynamic sharing approaches that are band specific, or reliant on band specific technical solutions but that can serve to expand use of spectrum, should <u>not</u> be excluded from consideration.

Users' demand for spectrum continues to grow. Given the time it has taken in the past to make new spectrum available, there is a need to set mechanisms in place now to create a stable investment environment for both new commercial and federal technology and to understand and mitigate any implications for federal systems.

Transparency

The Implementation Plan and its deliverables should provide early clarity regarding the study processes and principles, including their timing, inputs, and outputs. Such processes should be data-driven—consistent with the administration's focus on data-based decision-making—and increase transparency into current and future federal and potential future non-federal spectrum use.

For DSS to succeed, robust technical analysis is needed. This means studying the operating environment and parameters. This should include information about the inputs and assumptions made in interference analyses, and the technical parameters of the current and expanding federal capabilities, to accurately assess the viability of varying commercial spectrum access frameworks. NTIA can facilitate sharing such information with relevant industry stakeholders, through its co-leadership of studies with the federal agencies.

Incumbent federal systems users should be as transparent as possible to enable meaningful evaluation of the spectrum for commercial use. The goal should be to facilitate transparent discussions, as envisioned in the strategy and presidential memorandum, with stakeholder input fully and responsibly considered. The study forum and its outcomes should be informed by balanced discussions between incumbents (including reflection of planned and future procurements and deployments) and possible new commercial entrants. To reach the objective of a transparent, inclusive process with the broadest possible involvement, expanded access to secure information is needed by all parties involved in the process. We recommend the use of the PATHSS process with noted changes, or a similar successor process, by which industry, academia, and other relevant stakeholders were provided at both Controlled Unclassified Information (CUI) and classified access. We elaborate on these processes in the next section.

Build and Improve Upon Previous Efforts

In October 2021, the DoD and the National Spectrum Consortium launched the PATHSS Task Group to explore whether sharing was feasible in the 3.1-3.45 GHz band for commercial 5G access in support of the DoD's Emerging Mid-Band Radar Spectrum Sharing (EMBRSS) feasibility assessment, which was required by the 2021 Infrastructure Investment and Jobs Act. The DoD's formation of the PATHSS Task Group provided a forum for multiple relevant industries, academia, and the Defense Department to exchange sensitive and classified information on current and projected military and commercial requirements in these bands. In September 2023, the DoD completed and submitted to the Department of Commerce its EMBRSS report.

The creation and use of the PATHSS Task Group sets a new standard for spectrum sharing collaborations and should be used to inform further spectrum studies involving federal and nonfederal spectrum co-existence studies. PATHSS provided a crucial step in establishing greater trust and a mutual understanding of the challenges and opportunities in any band across the military and, should be expanded upon for any spectrum sharing process. While the NSTAC supports the processes involved in developing the EMBRSS report, not all NSTAC members agree with its conclusions. Any successor processes should be conducted from the start with an agreed scope, objectives, and input from the wireless and defense industries, as well as any other affected industry in a band being studied, as well as other stakeholders (e.g., academia, federally funded research and development centers, etc.).

Department of Defense Considerations

Ensuring the ability of the DoD to meet its mission requirements in the face of evolving threats and pacing challenges is of paramount importance to the NSTAC. While this does not necessarily mean that all aspects of DoD's use of spectrum should remain unchanged, it does mean that the Department should be able to deploy the capabilities necessary to ensure its global leadership and competitive edge in national security technology for effective deterrence now and into the future. Effective DSS must ensure that both commercial systems and federal systems are able to operate as needed.

Spectrum sharing approaches must provide economic and social benefits while ensuring DoD's ability to meet its present and future mission requirements. The imperative to protect DoD's capabilities also entails a detailed and transparent analysis, categorizing, and evaluating DoD's spectrum requirements domestically and abroad, including its interoperability with the NATO members and other international allies. The Implementation Plan should recognize that dynamic sharing frameworks must be designed so that DoD and other federal users have sufficient spectrum to operate, and meet our national security and other requirements.

Spectrum coexistence between disparate systems is crucial in any sharing approach. It is imperative that DSS, or access management systems, prevent commercial users from harmful interference to essential federal operations, while ensuring commercial users can use the same spectrum. One of several potential dynamic sharing approaches is the development of a real-time spectrum management system: a system that allocates spectrum to authorized users and coordinates their access in dimensions of use such as location, indoor or outdoor use, frequency, time, or power. The NSTAC understands that real-time spectrum management system is critical for co-existence with national security systems, as many are always "on," for example, ballistic missile defense radars that are always searching for incoming threats.

Research Areas for Testbeds

There are a variety of requirements that should be considered in implementing DSS which may vary depending upon the use case and/or business model. For commercial networks and for national security, predictability, and reliability "when, where, and how" they can use spectrum and at "what" power levels are critical concerns to meeting their service and/or mission requirements. Thus, the Implementation Plan should set as a research objective, discovering ways of dynamically sharing spectrum capable of meeting those requirements. [6]

There are several areas of research necessary for DSS, including the following: the predictability of available resources; efficient system performance measurements; real-time or near real time spectrum sensing in complex radio frequency (RF) environments such as mixed RF signals and heterogeneous systems when they are needed; management of mutual interference between networks of the same technology or across different technologies; and interference detection and mitigation-techniques.

[6] Depending on the specific band, use case and technology solution additional testing may or may not be necessary.

We recommend researching dynamic temporal sharing where networks and devices can change their operational parameters (frequency, bandwidth, power, beamforming, etc.) to minimize end-user impact. One example of temporal sharing involves government radar systems, which may use the band infrequently but require high degrees of protection and, in some instances, quick reaction time. This will require intelligent control of the radio resource parameters to enable dynamic techniques to address susceptibility to interference for incumbents, while maximizing commercial spectrum use.

DSS technologies also need to be capable of coping with malicious contention, handle failure modes and address improper and malicious deployments, mitigate electronic attack techniques; address cooptation and cybersecurity of commercial devices designed to occupy and share bands with national security systems; support graceful degradation of spectrum sharing that supports mission critical users without compounding problems through "fail open" designs; avoid revealing any aspects of military tactics, techniques, and procedures and enable national security systems to use more spectrum than previously allocated during mission critical events (an expansion of first-responder models for national defense scenarios). Coexistence between national security and commercial wireless systems needs to account for security risks to either or both national security systems and commercial wireless systems, which are part of the broader critical communications infrastructure sector. Security risks must be fully understood and carefully mitigated to minimize adverse impacts to national security missions and capabilities or commercial wireless systems.

Enforcement Authority

Another factor that should be considered in the context of DSS regimes is determining an enforcement authority. For example, it is important to clarify which entity has the role and requirement to adjudicate and guide immediate remediation of the situation when there are issues with conformance to a DSS arrangement. Any entity with the relevant authority will need personnel and technical capabilities to identify possible harmful interference. NSTAC members have a variety of views on the path to addressing enforcement issues.

Harmonization

Finally, when considering dynamic sharing solutions, the administration must acknowledge the benefits of global harmonization of spectrum allocations and uses to commercial wireless services, to U.S. national security capabilities, and to those of its allies and partners (reliant upon spectrum-dependent systems supplied by U.S. and allied manufacturers. Adding unique restrictions to certain bands could reduce or eliminate these benefits to either or both sectors. DSS solutions must, therefore, consider the impacts of de-harmonizing global spectrum allocations[7] on U.S. global defense operations and securing new harmonized spectrum allocations for commercial wireless operations, as well as the potential for significant economies of scale benefits for both the wireless original equipment manufacturers and defense industrial base, along with existing and new entrants and technologies into the space community.

Finally, global harmonization of specifications and standards supports economies of scale and attracts investment for commercial networks and national security equipment and technologies. DSS or other sharing models are a potential means to enable co-existence, while avoiding de-harmonization of existing federal spectrum bands. Existing harmonized, critical national security spectrum bands advance global allies' interoperable operations, training, and supports markets for the U.S. defense industrial base. Harmonization also affects the satellite industry which operate through International Telecommunications Union satellite coordination and cannot dynamically shift frequencies without impacting these agreements. The Implementation Plan's deliverables should recognize international standardization efforts, to export sharing solutions to other countries with similar concerns and spectrum environments while allowing the U.S. to innovate and lead in DSS technologies.

Conclusion

We appreciate the opportunity to weigh in on these critical issues. Spectrum is a critical issue for the commercial wireless industry and national security and other federal users. We hope this letter will provide helpful guidance as the administration implements the Strategy.

Sincerely,

Scott Charney
NSTAC Chair

[7] Some members believe that not all the spectrum bands under consideration are globally harmonized.