Before the
DEPARTMENT OF COMMERCE
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMINISTRATION
Washington, DC 20230

In the Matter of	)	
	)	
Development of a National Spectrum Strategy	)	Docket No. 230308-0068
	)	
	)	

COMMENTS OF THE PUBLIC INTEREST SPECTRUM COALITION

PUBLIC KNOWLEDGE
OPEN TECHNOLOGY INSTITUTE AT NEW AMERICA
ACCESS HUMBOLDT
AMERICAN LIBRARY ASSOCIATION
NEXT CENTURY CITIES
BENTON INSTITUTE FOR BROADBAND AND SOCIETY
SCHOOLS, HEALTH & LIBRARIES BROADBAND (SHLB) COALITION
UNITED CHURCH OF CHRIST MEDIA JUSTICE MINISTRY
X-LAB

Kathleen Burke
Policy Counsel
Admitted to the Bar under D.C. App. R. 46-A (Emergency Examination Waiver)
Public Knowledge
1818 N Street NW, Suite 410
Washington, DC 20036

Michael Calabrese
Director, Wireless Future Project
Open Technology Institute at
New America
740 15th Street, N.W., Ste 900
Washington, DC 20005

April 17, 2023

TABLE OF CONTENTS

Before the
DEPARTMENT OF COMMERCE
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMINISTRATION
Washington, DC 20230

In the Matter of	)	
	)	
Development of a National Spectrum Strategy	)	Docket No. 230308-0068
	)	
	)	

COMMENTS OF THE PUBLIC INTEREST SPECTRUM COALITION

Public Knowledge; the Open Technology Institute at New America; Access Humboldt; the American Library Association; the Benton Institute for Broadband & Society;[1] the Schools, Health & Libraries Broadband (SHLB) Coalition; United Church of Christ Media Justice Ministry; Next Century Cities; and X-Lab (collectively the Public Interest Spectrum Coalition, "PISC") are pleased to submit these comments to the National Telecommunications and Information Administration (NTIA) in response to its Request for Comments (RFC) on the development and implementation of a National Spectrum Strategy (NSS).[2]

I. SUMMARY

For decades, telecommunications experts, regulators, and industry representatives have expounded on the ever growing demand for access to our nation's airwaves. Despite advances in technology that have turned junk bands into prime spectrum, spectrum greenfields have dwindled to near extinction. Meanwhile, our nation's ad hoc approach to freeing up our underutilized airwaves has not once managed to fully satiate technology's appetite for spectrum. It is time for a new approach.

[1]

[2] *See* 88 Fed. Reg. 16244 (March 16, 2023); https://ntia.gov/issues/national-spectrum-strategy.

PISC applauds NTIA for pursuing a National Spectrum Strategy (NSS) that goes beyond identifying which specific bands should be repurposed and seeks to develop an ongoing process for managing our nation's spectrum resources. PISC urges NTIA to put the needs of the public first in its NSS by adopting guiding policies that are rooted in public interest values, maximizing spectrum access and bandwidth abundance through spectrum sharing, establishing a pipeline that will meet our nation's spectrum needs, recasting efficiency using metrics that serve the public, and prioritizing diversity, equity, and inclusion (DEI).

Guiding Policies

The core of a good strategy contains three elements: a diagnosis of critical challenges, guiding policies that inform a general approach, and specific actions that seek to achieve the guiding policies. NTIA's RFC fails to consider several key issues that will help it create a NSS that embodies these three elements. First, the RFC makes no mention of a critical spectrum management challenge—the ever widening digital divide and access to wireless services for underserved communities. Second, the RFC does not provide or seek comment on guiding policies that should inform the actions it will outline in the NSS.

PISC urges NTIA in conjunction with the FCC to consider the critical challenges facing our nation by the ever widening digital divide and adopt guiding policies that will lead us towards a wireless future that serves and includes *all* Americans. These guiding policies should include:

- **Maximize Spectrum Access & Bandwidth Abundance by Promoting Spectrum Sharing & Investing in Spectrum Reuse Technologies.**
- **Optimize Interference Metrics to Reflect Actual Interference and Current Advances in Technology.**
- **Recast Efficiency Using Metrics that Serve the Public Interest.**

- **Prioritize Diversity, Equity, and Inclusion.**
- **Minimize the Negative Effects that Auction Revenues Have on Spectrum Policy.**

Spectrum Sharing

A decade ago the President's Council of Advisors on Science and Technology (PCAST) recommended a new paradigm of spectrum sharing to "unlock the data-carrying capacity of spectrum in an unprecedented way." PISC's first and most basic recommendation is that the NSS explicitly embrace and extend this new paradigm by calling for faster forward progress in unlocking a potential abundance of currently unused or underutilized spectrum capacity. The Citizens Broadband Radio Service (CBRS) should be embraced as a model of the sort of three-tier dynamic sharing framework that can enable diverse users and use cases to gain local access to spectrum and use an occupied band more intensively while protecting even incumbent users as vital as the U.S. military. To promote more intensive use of underutilized bands, PISC's specific recommendations include:

- Explicitly recognize that CBRS and coordinated three-tier spectrum sharing have been one of the government's most successful spectrum policy innovations, fully protecting incumbents and enabling very innovative and diverse local access to spectrum.
- Avoid unnecessarily stringent protections in shard bands for incumbent users that impose unnecessary costs or continue to leave valuable spectrum capacity fallow.
- Endorse and establish a rapid implementation timeline for NTIA's proposal to develop a federal Incumbent Informing Capability that can facilitate more intensive sharing both among federal agencies and with private sector uses.
- Endorse opportunistic access on a use-it-or-share-it basis in underutilized bands as a default approach aimed at expanding local spectrum access for small and non-traditional ISPs in rural, tribal and other underserved areas, as well as for enterprises, venues, schools, libraries and other community anchor institutions.
- Specify that in shared bands Priority Access License areas—particularly in the lower 3 GHz band—should be no larger than census tracts, with limited terms and relatively low power, a combination that promotes more intensive use by a very wide range of users and

use cases, promoting innovation and competition, and reprising the rules adopted in its original 2015 CBRS Order.

- Recommend that Congress broaden the purpose of the Spectrum Relocation Fund, modernizing it to serve as a revolving fund not only to reimburse federal users to migrate off bands, but to facilitate more intensive sharing or more efficient use of other federal bands—including bands where the FCC decides the public interest is best served by unlicensed or shared/lightly-licensed access.
- Include a decision that NTIA and the FCC will coordinate to facilitate bidirectional sharing and authorize federal users to have at least secondary and opportunistic access to *all* licensed commercial bands on a non-interference basis.

Spectrum Pipeline

PISC fully supports the NTIA's goal of identifying, studying and reallocating access to at least 1,500 megahertz, but with a crucial caveat: the number of megahertz identified for "more intensive use" is far less important than pursuing a balanced spectrum policy that unleashes substantially more quality spectrum for unlicensed, exclusively licensed, and shared/lightly-licensed use. A starting presumption should be that roughly equal amounts of additional mid- to upper-mid-band spectrum should be made available for each of these three distinct and essential paths to the spectrum access needed to meet the future needs of households, enterprises and community anchor institutions. In addition, PISC recommends the NSS should:

- Include a plan and timeline to conduct an inventory of actual spectrum use in prime low- to upper-mid bands, including by frequency, geography, time and power; there currently is a huge opportunity cost to regulators knowing the allocations – but not the actual use – of spectrum they manage.
- Adopt a periodic review of *all* spectrum bands using a pre-determined set of questions and criteria based on the public interest goals underpinning our spectrum policy to determine when a band is ripe for repurposing or more intensive sharing.
- Recognize that enabling the multi-gigabit connectivity and affordability of Wi-Fi 7 applications and use cases in every location—especially in high-traffic settings such as schools, offices and venues—will require additional wide channels of unlicensed access.

- **Short term**: immediately begin a consultation aimed at authorizing unlicensed operations on 7125-7250 MHz on an indoor-only, low-power (LPI) basis, thereby enabling a fourth 320-megahertz channel for use by next generation Wi-Fi.

- **Longer term**: study the remainder of the 7 GHz band—up to 8.4 GHz—with a goal of making at least a fifth 320-megahertz channel available for unlicensed sharing and ideally contiguous to the U-NII-9 band (7125-7250 MHz).

- Include a plan to study and make available for at least opportunistic shared use all of the band segments from 2900 to 3450 MHz on a non-exclusive, lightly-licensed basis.

    - **3100-3450 MHz**: Informed by the PATHSS report, endorse and expedite a balanced approach that optimizes shared access to the entire 350 megahertz with a framework similar if not identical to the three-tier CBRS model.

    - **2900-3100 MHz**: Study the adjacent band below as a potential candidate for dynamic spectrum sharing to inform a coherent band plan for the lower 3 GHz band as a whole.

- Study and Identify substantial new upper mid-band spectrum for coordinated sharing of the band in a manner that meets the needs of the widest variety of local users and use cases, including through the authorization of the sort of automated frequency coordination framework.

    - **37-37.6 GHz**: decide if federal operations will have a priority status and then seek further comment and finalize a shared light-licensing framework, including whether an automated frequency coordination system is needed or warranted.

    - **12.7-13.25 GHz**: propose coordinated sharing of the band and, particularly in frequencies where incumbent users will remain primary, adopt an open access framework that meets the needs of the widest variety of local users and use cases.

    - **10-10.5 GHz**: Identify the band for study and determine if at least fixed point-to-point terrestrial sharing can be coordinated by automated frequency coordination in all or part of the band without disrupting incumbent federal users.

Recasting Efficiency

The definition of efficiency in spectrum changes depending on the metric that it seeks to maximize. For example, efficiency can mean eliciting the highest utilization of a band by focusing on technical usage; providing the greatest benefit to consumers by serving the most

number of people at the lowest cost; or extracting the maximum revenue from a band by auctioning spectrum off to the highest bidder. Focusing on just one of these metrics leads to unbalanced spectrum policy since each metric favors a single use-case. For example, efficient usage inevitably favors unlicensed, while maximizing revenue inevitably favors exclusively licensed. Instead, PISC recommends that the NSS balance any and all efficiency metrics that play a role in promoting the public interest, include:

- **Economic Impact** which takes a holistic view of the economic value a particular spectrum use creates for society.
- **Consumer Impact** which focuses on how many end users are served by a particular spectrum use and how much end users have to pay for services.
- **Technical Usage** which values spectrum uses and access models that maximize data submissions over spectrum.

Diversity, Equity, and Inclusion

The NSS should should recognize that it is always better to prevent inequities than to remedy them after the fact by adopting a policy of only adopting spectrum policies that are beneficial, or at least net neutral to DEI. Specifically, PISC recommends the the NSS include:

- A policy of asking more detailed questions about DEI throughout spectrum policy and rulemaking procedures, including questions such as:
    - Do the rules adopted facilitate direct access by traditionally marginalized communities, or otherwise affirmatively prevent traditional patterns of exclusion?
    - What performance metrics, monitoring efforts, and enforcement provisions can our spectrum regulators adopt to make sure that new spectrum policies do not perpetuate inequities?
    - How do assigned power levels, interference mitigation, or other factors interact with the assigned frequencies?
    - Do the spectrum policies proposed raise the cost or limit flexibility in a manner that promotes DEI or perpetuates inequality?

- A plan to leverage federal labs, research grants, and other government resources to conduct and fund spectrum research that seeks to understand and address the impact spectrum policy has on DEI.
- Policies that uphold the Federal Trust Relationship our nation has with Tribes by providing Tribes access to the spectrum on their tribal lands. Such policies include:
    - Holding a Tribal Priority Window prior to every spectrum auction.
    - Permitting Tribes to access federal spectrum on tribal lands.

II. VALUE-BASED GUIDING PRINCIPLES ROOTED IN PUBLIC INTEREST GOALS SHOULD SERVE AS THE FOUNDATION OF THE NATIONAL SPECTRUM STRATEGY (NSS).

The NSS should include guiding policies based on the core public interest principles embedded in the Communications Act. In *Good Strategy Bad Strategy* Richard Rumelt demonstrates that there is an essential kernel of strategy separating the good strategies from the bad ones. This kernel includes 3 elements—*a diagnosis* that simplifies reality by identifying which aspects of a situation are critical, *a guiding policy* that provides an overall approach for dealing with these challenges, and *a set of coherent actions* that are based on the guiding policy.[3]

NTIA's Request for Comments offers a diagnosis for several critical challenges when it comes to regulating our spectrum resources: developing a process for identifying spectrum bands that can be repurposed to meet the demand for spectrum,[4] getting stakeholders to work together openly and transparently,[5] and embracing innovative technologies that expand the capacity or usability of spectrum.[6] The RFC also asks pointed questions that will help NTIA create a set of coherent actions to address these challenges. Unfortunately, two things are missing. First, the RFC ignores a critical spectrum management challenge—the ever widening digital divide and

[3] Richard P. Rumelt, *Good Strategy Bad Strategy: the Difference and Why It Matters*, 77 (2011).
[4] 88 Fed. Reg. 16245 (March 16, 2023).
[5] *Id.* at 16246.
[6] *Id* at 16247.

access to wireless services for underserved communities. Second, the RFC fails to provide or seek comment on the second element of a good strategy—a guiding policy.

We need guiding policies that are rooted in core public interest principles to help policymakers move us towards a wireless future that serves and includes *all* Americans. Adopting concrete guiding policies that are rooted in core public interest principles will also help policymakers determine which bands are ready for repurposing or more intensive use, move beyond the out-dated zero-sum game approach to spectrum policy, and embrace innovations that expand what is possible in spectrum policy.

A. The NSS Should Serve the Public Interest By Seeking to Provide Telecommunication Services to *All* Americans.

The public interest underpins the spectrum management authority of both the FCC and the NTIA. Section 102 of the Telecommunications Authorizations Act of 1992[7] states that "NTIA shall seek to advance," among other policies, "[p]romoting the benefits of technological development in the United States for all users of telecommunications and information facilities."[8] Additionally, one of the core purposes of the FCC is to provide access to radio communication for *all* Americans. The NSS must adhere to these public interest mandates and serve the goals that underpin our spectrum regulators—including moving us towards a future that serves and includes *all* Americans.

The public interest purpose of the FCC is evident throughout the Communications Act of 1934 (the Act)[9] and is the "primary criterion for apportioning spectrum in the United States to

[7] *Codified at* 47 U.S.C. § 901. The NTIA was initially created by Executive Order 12046 in 1978. Congress codified the NTIA as part of the Telecommunications Authorization Act of 1992. *See* 47 U.S.C. § 901(b)(6). The Telecommunications Authorization Act of 1992 functions as the NTIA's enabling statute, and the findings and policies of Section 102 of the TAA serve the same purpose as Section 1 of the Communications Act for the FCC.
[8] 47 U.S.C. § 901(c)(1).
[9] *See, e.g.*, 47 U.S.C. § 303.

non-federal users.[10] Section 309(a) requires the Commission to determine whether a spectrum license application will serve "the public interest, convenience and necessity" and limits the Commission's authority to grant a license unless it finds that it will.[11] Similar to the FCC, NTIA's spectrum authority is also underpinned by a need to serve the public interest. Section 901(c)(4) of the NTIA Organization Act requires NTIA to foster "full and efficient use of telecommunications resources, including effective use of the radio spectrum by the Federal Government, in a manner which encourages the most beneficial uses thereof in the public interest."[12] In 2002, the Spectrum Policy Task Force (SPTF) recognized that "the overarching goal of effective spectrum policy is to maximize the potential public benefits to be derived through spectrum-based services and devices."[13]

Although Title III does not provide a specific definition of what will serve the public interest, other parts of the Act provide objectives that help define the public interest. For example, Section 1 of the Act provides the Commission's purpose, which also underlies the Commission's spectrum management objectives. It states that the FCC is:

> to make available, so far as possible, to all the people of the United States, without discrimination on the basis of race, color, religion, national origin, or sex, a rapid, efficient, Nation-wide, and world-wide wire *and radio communication service* with adequate facilities at reasonable charges, for the purpose of the national defense, for the purpose of promoting safety of life and property through the use of wire and radio communications…[14]

---

[10] U.S. Dept. of Commerce, Spectrum Policy for the 21st Century—the President's Spectrum Policy Initiative:
Report 1 at 9 (June 2004), https://www.ntia.doc.gov/files/ntia/publications/spct_pol_part_1_rl.pdf.
[11] 47 U.S.C. § 309(a).
[12] 47 U.S.C. § 901(c)(4).
[13] F.C.C., Spectrum Policy Task Force Report, ET Docket No. 02-135 at 11-12 (Nov. 2002), https://docs.fcc.gov/public/attachments/DOC-228542A1.pdf [hereinafter SPTF Report].
[14] 47 U.S.C. § 151 (emphasis added).

These provisions provide a definition of what serves the public interest—providing reliable, affordable, telecommunications services for all; securing our national defense; and promoting public safety.

Although NTIA's purpose does not explicitly include the same access for all pillar as the FCC's stated purpose, NTIA is tasked with advancing several policies that implicitly include this mandate:

1. "Promoting the benefits of technological development in the United States *for all users of telecommunications and information facilities*"[15]
2. "Fostering national safety and security, *economic prosperity, and the delivery of critical social services through telecommunications*."[16]
3. "Facilitating and contributing to the *full development of competition, efficiency, and the free flow of commerce* in domestic and international telecommunications markets."[17]

Each one of these policies implicitly includes providing access to *all* Americans. As Deputy Secretary Graves recently discussed at US Telecom's 2023 Connectivity Forum, economic prosperity will require equitable access to telecommunications services so that everyone can participate in our society.

Even if NTIA's policies did not implicitly include the FCC's own purpose of providing access to telecommunications services to *all* Americans, a NSS should still seek to advance this goal because our spectrum resources are co-managed by the FCC and the NTIA. Our NSS must serve the public interest purposes of both agencies——including the goal of providing access to reliable and affordable telecommunications services to *all* Americans—if it hopes to succeed in advancing our nation's telecommunications goals.

[15] 47 USC § 901(c)(1) (emphasis added).
[16] 47 USC § 901(c)(2) (emphasis added).
[17] 47 USC § 901(c)(3) (emphasis added).

The ever-widening digital divide and the lack of telecommunications access to communities of color, rural areas, and tribal nations is a critical issue that our NSS should seek to address—not only by making it easier for wireless broadband companies to serve people in the U.S., but also by allowing people in the U.S. and marginalized communities to control their own use of spectrum. Unlicensed spectrum, for instance, has a democratizing effect that puts consumers in the driver's seat, rather than being subject to the service offerings of licensed companies. As discussed in Section V of these comments with regard to DEI, making unlicensed and shared spectrum available to disadvantaged sectors of the society strengthens our democracy. By leveraging our spectrum resources effectively, our nation can finally move towards a future that serves and includes *all* Americans.

B. Backcasting from Public Interest Principles Empowers Us to Envision the Future We Want and Create Policies that Will Help Us Get There.

The spectrum policies that are enacted today will impact what technologies are developed and how quickly they are adopted. Vice versa, future technological advances will impact what policies are possible. The symbiotic relationship between spectrum policy and wireless technology makes it possible to do more than predict and prepare for the future, it also empowers us to envision the technological future we want and create guiding policies that will help us get there. This approach, known as "backcasting," is ideal for "long-term complex issues, involving many aspects of society as well as technological innovations and change."[18]

Backcasting from principles identifies a set of principles that define a desirable future, instead of predicting a detailed specific future. Policymakers can then use these principles to develop guiding policies, helping move society towards a desirable future aligned with our

[18] Karl H Dreborg, Essence of Backcasting, 28 Futures 813, 814 (1996).

values. For example, backcasting from principles, by filling in the blank, can help us define what it means to maximize the public benefit:

> ***In a desirable future that maximizes the public benefits of our telecommunications system_____.***
>
> - …all Americans regardless of race, color, religion, national origin, or sex are able to access affordable and reliable telecommunications services.
> - …spectrum is used effectively to meet the needs of all spectrum users—both federal and non-federal.
> - …there is ample spectrum available for developing innovative technologies that will help improve safety and health; maintain a strong national defense system; increase access to education, economic, and cultural opportunities; and provide other public benefits to society.
> - …society decides what technologies succeed—not regulatory regimes that protect entrenched incumbents at the expense of new entrants.
> - …all stakeholders work together to meet the public's telecommunications needs.

The critical challenges that were defined earlier, tell us where we are. These conditions tell us where we want to go. Now, we can backcast and determine which guiding policies will help us move towards a wireless future that serves and includes *all* Americans.

C. The NSS Should Include Guiding Policies That Serve the Public Interest AND Address the Critical Challenges Facing Spectrum Regulators.

A good guiding policy "channels action in certain directions without defining exactly what shall be done."[19] This helps by "reducing the complexity and ambiguity in the situation" and prevents the development of incoherent actions that cancel one another out.[20] The following guiding policies are rooted in core public interest principles and will help policymakers identify the spectrum bands that will serve the public interest by being repurposed, shift the out-dated

[19] Rumelt at 84.
[20] *Id.* at 85.

zero-sum game approach to spectrum policy, and move us towards a future that serves and includes *all* Americans.

1. *Maximize Spectrum Access & Bandwidth Abundance by Promoting Spectrum Sharing & Investing in Spectrum Reuse Technologies.*

The NSS should seek to maximize spectrum access and bandwidth abundance by promoting spectrum sharing and investing in spectrum reuse technologies.[21] Constraining spectrum access increases consumer costs by decreasing competition and limits innovation by creating barriers for new entrants. Ultimately, the future of a healthy wireless ecosystem lies in more widespread, equitable, and local access to spectrum. By promoting shared access models and investing in technologies that maximize spectrum sharing and reuse, policymakers can increase spectrum access and abundance, an essential component to a thriving, competitive and affordable wireless ecosystem.

2. *Optimize Interference Metrics to Reflect Actual Interference and Current Advances in Technology.*

The NSS should seek to optimize interference metrics based on actual interference and current advances in technology.[22] Interference protection is perhaps the most overlooked area in which technological advancements have changed what is possible in policy.[23] This makes it a prime area for reevaluating future access models and opportunities to increase access to

---

[21] *See* Kathleen Burke, *Back to the Spectrum Future: The 20th Anniversary of the Spectrum Policy Task Force*, 28, 30-32 (Jan. 2023), https://publicknowledge.org/wp-content/uploads/2023/01/Back-to-the-Spectrum-Future_Kathleen-Burke_January-2023-1.pdf.

[22] *See* Burke at 28-30.

[23] For example, MIMO (multiple-input multiple-output) technology uses multiple antennas to send and receive multiple versions of the same signal—creating signal diversity that significantly improves performance and reduces error rates. It is even possible to use this system to "cancel-out" interference. Yet, even though this technology has been around for more than 15 years, the FCC still uses single antenna interference metrics for MIMO systems. *MIMO*, Wikipedia (last accessed Jan. 24, 2023), https://en.wikipedia.org/wiki/MIMO; *See also*, Milembolo Miantezila Jr. et al., *Interference Cancellation Based Spectrum Sharing for Massive MIMO Communication Systems*, 11 Sensors 3584 (2021), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8196734/.

spectrum. Two principles regarding interference that the NSS should embrace are: (1) Minimizing harmful interference and maximizing frequency sharing is a mutual obligation of band entrants and incumbents, and of transmitters and receivers; and (2) No spectrum user has a guarantee of zero interference; the expectation must be limited to a regulatory effort to strike the best balance between private risks/costs and the overall public interest.

3. Recast Efficiency Using Metrics that Serve the Public Interest.

The NSS should seek to recast efficiency using metrics that serve the public interest.[24] In practice, the metric by which efficiency is determined can vary greatly. Efficiency can mean maximizing the utilization or the consumer impact of a band. But, most often today, efficiency seems to mean maximizing the economic value derived from a band for the government or a service provider. Unfortunately, spectrum policies designed to maximize revenues often do not serve the public interest purposes of our nation's wireless systems. Instead, policymakers should adopt efficiency metrics that promote the public interest, such as economic impact, consumer impact, and technical usage—treating these metrics as factors that they must balance to maximize the public benefits of our nations spectrum resources.

4. Prioritize Diversity, Equity, and Inclusion.

The NSS should seek to prioritize diversity, equity, and inclusion.[25] Spectrum policy can impact diversity, equity, and inclusion in multiple ways—by allowing carriers to shift investment away from traditionally marginalized communities to focus on the most profitable urban areas, or alternatively, by making it possible for traditionally marginalized communities to provision themselves. Policymakers should recognize that it is always better to prevent an inequality from

[24] *See* Burke at 14-20.
[25] *See* Burke at 55-71.

happening than to try to remedy it after the fact and only adopt policies that have a beneficial or at least net neutral impact on diversity, equity, and inclusion.

5. Minimize the Negative Effects that Auction Revenues Have on Spectrum Policy.

The NSS should seek to minimize the negative effects that auction revenues have on spectrum policy.[26] FCC, NTIA and Congress should abide by the Communications Act prohibition on considering auction revenue in making spectrum allocation decisions. At its inception, spectrum auctions were supposed to distribute licenses competitively in the hopes of achieving Pareto efficiency. Unfortunately, spectrum auctions are more often used as a pay-for tool to maximize the government's revenue and fund initiatives that are unrelated to our nation's telecommunications goals. Most often, spectrum that is auctioned as a pay-for is limited to exclusive licenses since they raise the most money, even when exclusive licensing is not the best access model for meeting our nation's telecommunication needs. By recycling the revenues from spectrum auctions back into the telecommunications sector through a standing default fund that invests in digital equity and affordable broadband, we can minimize the distorting impact of auction "pay-fors" on spectrum policy. Additionally, since exclusively licensed spectrum is inherently inequitable, policymakers should favor using the proceeds from those auctions and reinvesting them into equitable purposes.

III. THE NSS SHOULD SEEK TO MAXIMIZE ACCESS AND BANDWIDTH ABUNDANCE BY EMBRACING SPECTRUM SHARING.

As the world goes wireless, the demand for wireless connectivity and spectrum continues to increase rapidly. This surging demand and contentious FCC proceedings to allocate more spectrum for 5G has created an impression that spectrum is scarce. It is true that the low- and

[26] *See* Burke at 14-22.

mid-band spectrum most valuable for wide-area mobile services has become more and more difficult to clear and repurpose for exclusive licensing. However, contrary to assumptions of scarcity, innovative and forward-looking spectrum policies can unlock an abundance of wireless bandwidth in a larger number of underutilized bands—and for an increasingly diverse range of users and use cases—through dynamic spectrum sharing.

The President's Council of Advisors on Science and Technology (PCAST) forecast this new reality a full decade ago, in 2012, concluding that a new paradigm can "unlock the data-carrying capacity of spectrum in an unprecedented way."[27] The PCAST report concluded: "The essential element of this new Federal spectrum architecture is that the norm for spectrum use should be sharing, not exclusivity."[28] This new "normal," as the PCAST report saw it, informed President Obama's 2013 Executive Memorandum, which in its preamble stated: "Where technically and economically feasible, sharing can and should be used to enhance efficiency among all users and expedite commercial access to additional spectrum bands, subject to adequate interference protection for Federal users, especially users with national security, law enforcement, and safety-of-life responsibilities."[29]

PISC's first and most basic recommendation is that the NSS explicitly embrace and extend this new paradigm by calling for faster forward progress in unlocking a potential abundance of currently unused or underutilized spectrum capacity. As we recommend in the Pipeline section below, an important innovation would be an immediate inventory of actual

---

[27] Report to the President Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth, President's Council of Advisors on Science and Technology (July 2012), at 11. Available: https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/pcast_spectrum_report_final_july_20_2012.pdf.

[28] *Id.* at vi.

[29] Barack Obama, "Presidential Memorandum: Expanding America's Leadership in Wireless Innovation" (June 14, 2013), https://obamawhitehouse.archives.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovation.

spectrum usage. This inventory can be used to identify and target bands for repurposing or an appropriate mechanism to coordinate new shared use.

A. The CBRS Three-Tier Sharing Framework is a Proven Success that Should be Extended to Other Bands, Particularly Federal Bands

CBRS authorizes both licensed and opportunistic (lightly-licensed) access to unused spectrum in the 3550-3700 MHz band long used for U.S. Navy radar systems. Spectrum Access Systems (SAS) certified by the FCC coordinate a unique and dynamic sharing framework that enables coexistence among a three-tier hierarchy of users: incumbent licensees (primarily U.S. Navy radar), Priority Access Licenses (PALs), and opportunistic General Authorized Access (GAA) users. Multiple, competing SASs are responsible for ensuring incumbent services are fully protected from harmful interference and that PAL operators are protected from each other and from GAA users.

In addition, the rules for CBRS include a use-it-or-share-it provision that authorizes any operator to coordinate access to both the GAA portion of the band and to unused PAL spectrum on an opportunistic basis. The SAS database thereby facilitates—on an automated basis at low cost—intensive spectrum sharing that both protects U.S. Navy operations and ensures that all the spectrum in the 3.5 GHz band is available for use. Because Navy radar is often operating on ships in motion, an environmental sensing capability (ESC)—a network of spectrum sensors along the U.S. coastline—detects incumbent naval radar use of the band and alerts the SAS to move new terrestrial commercial operations to non-interfering channels. More than 4,300 certified installers help to ensure the protection of incumbents in the band, which adds "belts and suspenders" to a license by rule framework coordinated by certified Spectrum Access Systems.

Automated frequency coordination in CBRS has completely protected (and in some respects over-protected) Navy radar and other incumbents. The FCC's Technological Advisory

Council (TAC) stated in their December "lessons learned" report on CBRS that there have been no publicly-reported harmful interference to U.S. Navy operations.[30] The U.S. Department of Defense likewise agreed that Spectrum Access Systems have fully protected U.S. Navy radar operations. Last November DoD official Vernita Harris called CBRS a "win-win situation" since "the U.S. military can continue to use critical radars systems while commercial users have leveraged CBRS in a variety of sectors, ranging from real estate to health care to utilities."[31] She went on to state that "[w]ith its use of the SAS, CBRS has eliminated many labor-intensive tasks, reduced opportunities for human error, and enabled over 228,000 CBRS devices (as of May 2022) to operate in the band and not interfere with DoD operations."

PISC recommends that the NSS echo and reference the TAC report's warning that unnecessarily stringent protections for incumbent users can both impose unnecessary costs and continue to leave valuable spectrum capacity fallow. The TAC concluded that "a large number of conservative assumptions are built into the CBRS protection framework (propagation parameters, interference protection criteria, etc.) to the extent that optimal shared spectrum efficiency may not have yet been achieved." As an example, the TAC cited reliance on the Irregular Terrain Model (ITM) to estimate propagation loss does "not take into account attenuation due to clutter, such as [from] buildings and foliage, hence the propagation loss is often underestimated, and predicted interference levels are overestimated."[32]

---

[30] FCC Technological Advisory Council, "Recommendations to the Federal Communications Commission Based on Lessons Learned from CBRS," at 2 (Dec. 2022) ("TAC Report"), https://www.fcc.gov/sites/default/files/recommendations_to_the_federal_communications_commission_based_on_lessons_learned_from_cbrs.pdf.

[31] Vernita D. Harris, "A Spectrum Sharing Success Story: Citizens Broadband Radio Service," Electromagnetic Spectrum Enterprise Policy & Programs, Department of Defense, LinkedIn Blog (Nov. 14, 2022), available at https://www.linkedin.com/pulse/spectrum-sharing-success-story-citizens-broadband-radio-harris/.

[32] TAC Report, *supra*, at 2; see also Clegg, Andrew, "Propagation in the 3.5 GHz CBRS Band," WInnComm 2019, available at https://winnf.memberclicks.net/assets/Proceedings/2019/TS1.3%20Clegg%20updated.pdf.

1. The CBRS Three-Tier Sharing Framework Has Achieved Unprecedented Success.

The NSS should explicitly recognize that CBRS has been among the FCC's most successful spectrum policy innovations, one being replicated by regulators in the United Kingdom, Germany, Sweden and more than a dozen other nations (albeit with manual coordination to date).[33] Incumbent military operations have been fully protected and, in less than three years of commercial operations, the scale of deployment and innovation in the band has far exceeded expectations. The OnGo Alliance, an association of more than 200 companies making commercial use of CBRS, reported in September that deployments already include more than 240,000 base stations (CBSDs) and nearly 500 certified client devices (EUDs).[34] Six months later the number of deployed CBSDs exceeds 300,000.

This diverse and rapid profusion of CBRS deployments include many very localized and innovative wireless network deployments that would either not be possible or overly expensive in a wireless ecosystem that depended only on large-area and exclusive licensing. "Warehouse managers, including the U.S. Marine Corps, use CBRS to track inventory. Manufacturers use it to increase efficiency and reduce risk to workers. The City of Las Vegas built a massive CBRS network to bring broadband access to students during the height of the pandemic and has now committed to using CBRS to build the largest open private network in the U.S. for its small businesses and schools."[35]

---

[33] *See, e.g.*, Ofcom, "Shared Access Licenses," https://www.ofcom.org.uk/consultations-and-statements/category-1/enabling-opportunities-for-innovation ; "CBRS Leading a Global Trend of Private LTE/5G: HP," *Communications Daily* (April 13, 2023).

[34] "OnGo Alliance Marks Important Milestones for CBRS Networks, Illustrating Substantial Momentum for Private, Fixed and Neutral Networks," OnGo Alliance Press Release (Sept. 28, 2022), available at https://ongoalliance.org/news/ongo-alliance-marks-important-milestones-for-cbrs-networks-illustrating-substantial-momentum-for-private-fixed-and-neutral-networks/.

[35] *See* Linda Hardesty, "NTT Builds Municipal Private Wireless Network for City of Las Vegas," *Fierce Wireless* (Sep. 28, 2022), https://www.fiercewireless.com/private-wireless/ntt-builds-municipal-private-wireless-network-city-las-vegas; Harold Feld, "Don't Let Special Interests Tie the FCC's Hands," *Washington Examiner* (Dec. 9,

Dozens of Tribes, schools and libraries, and other unconnected communities are relying on CBRS to extend the reach of their broadband networks and to enhance their communities' connectivity.[36] School districts in Texas, Colorado, California and other states responded to the pandemic remote learning crisis by leveraging CBRS to connect tens of thousands of low-income students at home directly to the school's network, ending the "homework gap" for good. For example, in Fresno, CA the school district used CARES Act funds to to rapidly deploy a CBRS network connected 18,000 low-income student households directly to the school's network (as of last September) by relying on GAA spectrum and "schools as towers."[37] The district, which has 70,000 students in total, plans to extend the network to cover the vast majority of its students without reliable home internet by the end of the current school year. Similarly, Texas schools in Fort Worth, McAllen, Dallas, Castleberry and Harris County have begun deploying fixed wireless network that rely on CBRS spectrum to close the homework gap for students who cannot afford a broadband connection.[38]

2022), available at https://www.washingtonexaminer.com/opinion/dont-let-special-interests-tie-the-fccs-hands. *See also* JMA Wireless, "JMA Brings Semper Fi 5G to Georgia Marine Corps Facility" (March 24, 2021), https://jmawireless.com/jma-brings-semper-fi-5g-to-georgia-marine-corps-facility/; Wireless Infrastructure Association, *Baicells Helps Las Vegas Improve Connectivity for Students with Private CBRS Network*, WIA.org (Sept. 8, 2021), https://wia.org/baicells-helps-las-vegas-improve-connectivity-for-students-with-private-cbrs-network/.

[36] Leveraging spectrum to deploy new wireless connections from a community anchor institution can often provide a low-cost, yet financially sustainable solution to connect surrounding households. *See* Dr. Raul Katz, "The 'To and Through' Opportunity: An Economic Analysis of Options to Extend Affordable Broadband to Students and Households via Anchor Institutions," New America and Schools Health & Libraries Broadband (SHLB) Coalition (Aug. 2022), available at https://www.shlb.org/uploads/Policy/Policy%20Research/Off-Campus-Deployment-Economic-Assessment-final.pdf.

[37] Michael Calabrese and Matthew Marcus, "Case Studies of School and Community Networks Able to Close the Homework Gap for Good," New America and Schools Health & Libraries Broadband (SHLB) Coalition report, at 25-29 (August 2022), available at https://newamericadotorg.s3.amazonaws.com/documents/Anchor-Nets-Case-Studies-revisedFINAL_091422.pdf.

[38] *Id*. at 52-59.

2. *The Unprecedented and Proven Success of the CBRS Approach Can be Enhanced and Extended to Other Bands*

The CBRS framework could achieve even more success by extending the framework into additional bands with enhanced policies—such as implementing a federal Incumbent Informing Capability (IIC) to improve spectrum sharing and making PALS more accessible.

a. An Incumbent Informing Capability Can Facilitate More Effective Sharing in CBRS and Federal Bands

PISC strongly supports NTIA's proposal to develop a federal Incumbent Informing Capability that can facilitate more intensive sharing both among federal agencies and with private sector uses. As the FCC's Technological Advisory Committee recommended in its CBRS "lessons learned" report last December, "detecting incumbent activity solely by the use of dedicated sensors should be avoided."[39] Passive sensing is least burdensome for incumbent operators, but the implementation in the CBRS band has demonstrated it can be costly to deploy, often inaccurate (due to false positives), and overly preclusive, resulting in suboptimal utilization of prime spectrum. We agree that "other options should be explored, including Informing Incumbent Capability (IIC), a limited version of which has been deployed by DoD in the CBRS band."[40]

NTIA describes the IIC as "a mechanism for more reliably informing 'new entrants' in a shared spectrum band when incumbent federal systems are operating in close proximity and thus need to be protected."[41] The IIC can incorporate a "process to resolve interference in real time (*i.e.*, while the incumbent operations are underway) to prevent impacts to vital federal

[39] TAC Report, *supra*, at 2.
[40] *Id*.
[41] Michael DiFrancisco, Edward Drocella, Charles Cooper and Paul Ransom, "Incumbent Informing Capability (IIC) for Time-Based Spectrum Sharing," National Telecommunications and Information Administration (NTIA)—Office of Spectrum Management (Feb. 22, 2021), https://www.ntia.doc.gov/report/2021/ntia-report-incumbent-informing-capability-iic-time-based-spectrum-sharing#:~:text=The%20IIC%20is%20a%20mechanism,Spectrum%20Coordination%20System%20(SCS).

operations."[42] PISC strongly agrees with NTIA that it should be a priority to create a government-side SAS with "the capability to evolve over time toward a dynamic spectrum sharing paradigm in selected bands where 'everyone informs'," and aligns with the agency's Vision Statement of "anytime anywhere access to spectrum for all users."[43]

PISC suggests that the NSS should strongly endorse and lay out an aggressive implementation timeline for standing up a federal IIC. The IIC could greatly accelerate the sharing of wide swaths of underutilized federal spectrum—particularly in bands currently dedicated in whole or large part to military radar use (e.g., 3.1-3.65 GHz, 10 GHz, portions of 5 GHz). There is strong bipartisan support in the U.S. Congress. In 2022 a provision funding the creation of the IIC, along with a requirement that federal spectrum users supply it with operational information, passed the U.S. House as part of a larger bill to renew FCC auction authority.[44]

b. The FCC Should Reprise the 2015 CBRS Order and Make PALs More Accessible and Dynamic

Unfortunately, in 2019 the FCC reversed a key pillar of the agency's original vision for CBRS, enlarging the PALs to the size of counties and making licenses permanent rather than available for periodic re-auction. Virtually every stakeholder other than mobile carriers and their equipment suppliers argued that making PALs permanent and as large as traditional cellular licenses would preclude most of the innovative and localized use cases that the CBRS rules were specifically designed to catalyze. While the shift to more traditional licensing of PALs has greatly limited the ability of enterprises, WISPs, campuses, large venues and others to acquire interference-protected spectrum, the explosion of deployments using PAL and especially GAA spectrum has clearly demonstrated the need and demand for localized and affordable access to flexible and lightly-licensed spectrum.

[42] *Id*. at 2-3.
[43] *Id*. at 7.
[44] Spectrum Innovation Act of 2022, H.R. 7624, 117th Congress (2021-22), passed July 27, 2022.

An irony is that although some opponents of CBRS still try to characterize its three-tier sharing framework as an "experiment," the 2019 changes means the FCC has yet to implement and yield the full potential of the framework recommended by PCAST or even of the original 2015 Report and Order. In their excellent analysis of spectrum sharing, former FCC officials John Leibovitz and Ruth Milkman explain that the "FCC essentially created a system of paid prioritization of spectrum access. The PALs were intended to be more dynamic than traditional FCC spectrum licenses, providing exclusionary rights in a very geographically granular and time-limited way."[45] The FCC's unanimous R&O in 2015 purposely sought to create and automate this uniquely localized, diverse and intensive form of spectrum access in a shared band:

> Ultimately we adopt a hybrid framework that selects, automatically, the best approach based on local supply and demand. Where competitive rivalry for spectrum access is low, the GAA tier provides a low-cost entry point to the band, similar to unlicensed access. Where rivalry is high, an auction resolves mutually exclusive applications in specific geographic areas for PALs. Finite-term licensing facilitates evolution of the band and an ever-changing mix of GAA and Priority Access over time.[46]

PISC recommends that PAL license areas in dynamically shared federal bands—and particularly in the lower 3 GHz bands proximate to CBRS operations—should be no larger than the size of census tracts, which would achieve the more ambitious purpose that the Commission adopted in its original 2015 CBRS Order reversed under the current FCC. Very small-area licenses in shared bands—and especially in bands not available for commercial use at high power and over very large contiguous geographies—serve the public interest by making direct access to interference-protected mid-band spectrum available and affordable to a far larger and diverse set of potential bidders. This would add a more affordable and right-sized option for the

[45] John Leibovitz and Ruth Milkman, "Taking Stock of Spectrum Sharing," at 17 (Sept. 2021).
[46] F.C.C., Report and Order and Second Further Notice of Proposed Rulemaking, In the Matter of Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354 at ¶ 5 (rel. April 21, 2015), https://www.fcc.gov/ecfs/document/60001029681/1.

many WISPs, campuses, utilities, venues and enterprises for whom even county-sized licenses may be too large and expensive. Similarly, even if relatively low power limits are not strictly needed to protect incumbent operations, it should be the preferred policy because it greatly increases spectrum re-use as well as the number and diversity of users and use cases that can be coordinated into a band.

The Commission should also dedicate a substantial portion of each shared federal band—particularly if it is a large block of contiguous spectrum—for opportunistic, General Authorized Access. That is, as in CBRS, a large portion of each shared band should be effectively open and unlicensed, but with the same Part 96 registration and SAS coordination requirements that govern GAA use under CBRS. Extending the CBRS framework, and again combining PALs and GAA spectrum under common technical rules, would reinforce and amplify the innovative benefits of the 3.5 GHz band. In particular, spectrum allocated as GAA adds much-needed network capacity for providers that purchase PALs while also offering competitive and smaller network operators such as rural providers, schools, and office and manufacturing campuses a way to deploy broadband networks in a quick and cost-effective manner.

B. The NSS Should Apply A Default Policy of Use-It-or-Share-It to Underutilized Bands

PISC believes that authorizing opportunistic access on a use-it-or-share-it basis in underutilized bands should be embraced by the National Spectrum Policy as a default approach aimed at expanding local spectrum access for small and non-traditional ISPs in rural, tribal and other underserved areas, as well as for enterprises, venues, schools, libraries and other community anchor institutions.[47] Opportunistic access policed by an automated coordination mechanism can empower a wide variety of small and alternative providers to use fallow

[47] *See* Michael Calabrese, "Use It or Share It: A New Default Policy for Spectrum Management," Open Technology Institute at New America (March 2021), https://tinyurl.com/m7v2rkre.

spectrum in local areas to provide high-capacity broadband and other services, while retaining the licensee's right to exclusive use of that spectrum whenever the carrier commences service. The failure to move faster to authorize unused federal spectrum for at least opportunistic shared use (such as on a GAA, basis) has an enormous opportunity cost as we enter an era where bandwidth abundance is in reach

A use-it-or-share-it authorization expands productive use of spectrum without risking harmful interference or undermining the deployment plans of primary licensees. The FCC has already adopted several world-leading precedents in opportunistic spectrum sharing that all apply a variation of the use-it-or-share-it approach—including CBRS, TV White Spaces and an unlicensed underlay across 1,200 megahertz between 5925-7125 MHz. These precedents, and the proven effectiveness of automated frequency coordination mechanisms, can pave the way to an authorization of opportunistic access as the default policy for a far larger number of underutilized and newly-allocated bands.

Indeed, the FCC's forward-looking approach to incorporating a use-it-or-share-it approach in CBRS—where the SAS assigns GAA users to vacant PAL spectrum on a local and opportunistic basis—is being recognized and replicated globally. In June 2021 the European Union's Radio Spectrum Policy Group issued an opinion urging more innovation and experimentation in spectrum sharing: "The RSPG seeks to nudge a change of mindset: all considerations in the field of spectrum by policy makers, spectrum managers, users and industry should be done by pursuing better spectrum efficiency through more spectrum sharing, including by following the principle of 'use-it-or-share-it'."[48]

[48] European Commission, Radio Spectrum Policy Group, "RSPG Opinion on Spectrum Sharing—Pioneer Initiatives and Bands," RSPG21-022, Final (June 21, 2021), https://radio-spectrum-policy-group.ec.europa.eu/system/files/2023-01/RSPG21-022final_RSPG_Opinion_Spectrum_Sharing.pdf.

A use-or-share approach promotes important public interest goals, including more intensive use of fallow spectrum capacity, lowering barriers of entry to a diverse range of uses and users. This in turn facilitates innovation and competition, improving choices and lowering costs for consumers, and promoting service in rural and other underserved areas, thereby helping to narrow the digital divide.[49] This approach can not only protect incumbent users—and accommodate their changing use—where appropriate the use of a dynamic spectrum management system can also provide a glide path for transitioning the use of a band over time, while avoiding stranded devices or users.

Unleashing opportunistic, shared access to unused spectrum also creates a general incentive for licensees to build out more quickly and to make greater efforts to lease or sell unused spectrum, facilitating secondary markets. As two of our groups explained at length in comments responding to the Commission's proceeding on secondary markets in 2019, a use-it-or-share-it rule expands productive use of spectrum without risk of harmful interference and without undermining the deployment plans of primary licensees.[50] Authorizing opportunistic, shared access to fallow commercial spectrum creates a general incentive for licensees to build out services more quickly, or to make greater efforts to partition or lease their spectrum. This will reduce spectrum warehousing and increase access to operators ready to deploy, but who lack spectrum access in a local area.

C. The NSS Should Recommend Broadening the Scope of the Spectrum Relocation Fund to Reimburse Agencies the Facilitate More Intensive Sharing

It is important to be clear that just because a frequency band is not fully or frequently utilized in a particular geographic area this does not mean it is not serving its assigned purpose,

[49] *Id*. at 20-27.
[50] Comments of OTI and Public Knowledge, *Partitioning, Disaggregation and Leasing of Spectrum*, WT Docket 19-38 (June 3, 2019).

or that its incumbent users can be relocated. As noted above, this is true for many military bands in particular, since there are no close substitutes, systems are hugely expensive and long-lived, and it is more and more difficult (if not impossible) to find comparable spectrum for relocation. While in many such cases "clearing" a band of its current licensee and reassigning it exclusively to private sector licensees cannot be justified, there is nevertheless tremendous communications capacity that could be productively used at no cost or harm to the incumbent—just as the U.S. Navy today shares radar spectrum in the CBRS band with both licensed and lightly-licensed (GAA) users.

In some bands, NTIA, in consultation with the FCC, has determined that it is feasible to relocate incumbent federal users to accommodate reassignment of frequencies on a licensed basis by auction (e.g., PALs in CBRS, mobile carrier licenses in 3450-3550 MHz, AWS-3). This scenario for repurposing by auction is facilitated by the Spectrum Relocation Fund created as part of the Commercial Spectrum Enhancement Act (CSEA) of 2004.[51] The problem is that two decades later, the CSEA is outdated and falls far short of enabling more intensive commercial and public sharing of many underutilized federal bands where an auction is not possible or does not serve the public interest compared to other sharing and access frameworks. While only a tiny fraction of federal spectrum could be cleared and auctioned in the near future—primarily because most bands serve critical national security and other functions—a far greater number of bands could be shared more intensively by leveraging dynamic spectrum management systems.

Federal spectrum incumbents need the resources to take affirmative steps to enable more intensive access and band-sharing by other users. This could be a win-win for the military in

[51] Commercial Spectrum Enhancement Act (CSEA), Title II of Pub.L. No. 108-494 (Dec. 23, 2004); 47 U.S.C. 928(d)(2). CSEA created the Spectrum Relocation Fund so that federal agencies can recover the costs associated with relocating their radio communications systems from bands designated by Congress for reallocation to commercial use.

particular. New and upgraded federal systems could be designed and procured with sharing and the broader public interest in spectrum access in mind—and not only in the very limited case of a band being cleared entirely of federal use.[52] The CSEA also does not permit reimbursements from the Spectrum Relocation Fund (SRF) for the sort of upfront research, planning and administrative costs associated with an aggressive effort by NTIA and its sister agencies to identify and study underutilized bands that would be appropriate for repurposing and/or dynamic sharing. For example, the SRF should be a potential funding source for "Pioneer Bands" that the NTIA could designate in collaboration with FCC, which would grant Special Temporary Authority (STAs) to commercial deployments or prototypes in federal bands. Ideally such an initiative would also be in partnership with NTIA's Institute for Telecommunications Services, which could provide test ranges and objective technical expertise.

PISC therefore suggests that the NSS recommend that Congress amend the CSEA to broaden the purpose of the Spectrum Relocation Fund, turning it into a revolving fund not only to reimburse federal users to migrate off bands, but to facilitate more intensive sharing or more efficient use of other federal bands—including bands where the FCC decides the commercial use is based on unlicensed or shared/lightly-licensed basis. Enhancing agency budgets with revenue tied to the purpose of upgrading to state-of-the-art equipment, we believe, would prove to be a far stronger and more focused incentive than giving agencies the option to lease unused capacity on secondary markets (which, if it ever generated more than trivial amounts of revenue, could not be counted on to increase the agency's overall resources since OMB or Congressional appropriators could view it as an offset).

[52] *See* Michael J. Marcus, "New Approaches to Private Sector Sharing of Federal Government Spectrum," Issue Brief #26, New America Foundation (June 2009).

PISC is not suggesting that auction funds set-aside to reimburse federal agencies for a planned relocation should be redirected. Rather, a modest change could permit all of the revenues flowing into the SRF to remain in the fund; and once OMB determines that the relocation costs approved for a particular auctioned band are covered, other funds should be available for an expanded scope of reimbursement to NTIA and to individual federal agencies that facilitate shared commercial access to underutilized spectrum.

D. The NSS Should Generally Authorize Bi-Directional Sharing on an Opportunistic Basis

Often neglected in debates over consolidating or sharing federal bands with unused capacity is the need for a spectrum pipeline for future federal use. An inventory of actual spectrum usage (proposed in the next section) and a NTIA survey of federal users could be key inputs for an assessment and pipeline relevant to a number of needs, including a migration path for incumbent uses that could fulfill their mission in less commercially valuable spectrum, as well as the planned development of new uses. Another overlooked need that could be met immediately is periodic or opportunistic access to unused spectrum by the military and other federal users (e.g., FBI surveillance, 5G on military bases, connectivity in National Parks and other geographically-remote locations). A practical example of this on a large scale would be military training exercises in desert or other remote areas where commercial spectrum, though licensed, has not been deployed or is barely in use.

PISC groups have long supported bidirectional sharing between what are largely (and somewhat arbitrarily) considered federal and commercial bands. PISC proposes that the NSS include a decision that NTIA and the FCC will coordinate to authorize at least secondary and opportunistic access to *all* licensed commercial bands on a non-interference basis. If the private sector can share federal bands—putting unused spectrum to use so long as it does not cause

harmful interference to federal operations—then this sharing should be reciprocal. Of course, this concept of "bidirectional sharing" is nothing new; it's just something that either sharing technology or the politics of spectrum policy have not supported in the past.

IV. THE SPECTRUM PIPELINE SHOULD FOLLOW A BALANCED APPROACH THAT ALLOCATES SUBSTANTIALLY MORE SPECTRUM FOR UNLICENSED, EXCLUSIVELY LICENSED AND LIGHTLY-LICENSED SHARED ACCESS.

In its Request for Comments, NTIA states that in collaboration with the FCC it "endeavors 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." PISC fully supports this goal, with the caveat that the number of megahertz identified for "more intensive use" is far less important than pursuing a balanced spectrum policy that unleashes more quality spectrum for unlicensed, exclusively licensed, and shared/lightly-licensed use. PISC believes that if the bands identified for more intensive use happen to add up to 1,500 megahertz, a starting presumption of the National Spectrum Policy should be that roughly equal amounts of additional mid- to upper-mid-band spectrum should be made available for each of these three distinct and essential paths to the spectrum access needed to meet the future needs of households, enterprises and community anchor institutions.

PISC believes a NSS should prioritize policies that balance licensed, unlicensed and shared/lightly-licensed allocations for fixed and mobile services alike; that adopt auction frameworks that make interference-protected spectrum available in much smaller geographic areas and at lower power; and that move quickly to determine which federal bands cannot be cleared off for auction, so that instead either an unlicensed underlay (as in the 5 and 6 GHz bands) or coordinated shared access on a lightly-licensed basis (as in CBRS and the 70/80/90 GHz bands) can be implemented.

A. A Balanced Approach to Spectrum Management is Increasingly Critical to Facilitate Spectrum Sharing and to Meet Growing Demand by Diverse and Local Users and Use Cases.

There are two basic reasons why the NSS should aim to make substantially more mid-band spectrum available on a licensed, unlicensed and shared/lightly-licensed basis. First, we need more of all three categories of spectrum access because the world's most robust and productive wireless ecosystem will not be built out by mobile carriers alone or solely with exclusively licensed spectrum. America's "5G" and future "6G" wireless ecosystems, like the current 4G wireless ecosystem, will rely on a combination of big national or regional carrier networks for truly "mobile" connections (for use 'on the go') and a far larger number of complementary, high-capacity and customized networks deployed by individual enterprises, households and community anchor institutions to meet their particular needs at a lower cost.

Today Wi-Fi makes broadband data on smartphones and laptops more available, faster and far more affordable. Wi-Fi already carries at least 80 percent of all mobile device data traffic. In a 5G world, indoor and customized small cell networks using Next Generation Wi-Fi, private LTE and other technologies enhance the ecosystem and fuel advanced applications such as home and industrial IoT, virtual reality and near-real time interactive video. This distinction between spectrum for coverage (which fits the traditional cellular licensing model) and spectrum for capacity in localized areas (which is the rationale for unlicensed and lightly-licensed, shared spectrum) is even more relevant for 5G in light of the fact that an increasing share of mobile device data traffic (more than 80 percent) is consumed indoors, on a nomadic and not mobile basis.

A second basic reason to make mid-band spectrum available on a licensed, unlicensed and shared/lightly-licensed basis is that a guiding goal of the Communications Act is to "encourage the deployment on a reasonable and timely basis of advanced telecommunications

capability to all Americans."[53] While there are heated disagreements about progress towards this goal, there is no question that we can and must do better in addressing the rural and low-income digital divides. Rural, small town, Tribal and historically marginalized communities are most likely to find themselves on the losing side of the digital divide. More mid-band unlicensed (in the 5.9, 6 and 7 GHz bands) and lightly-licensed shared spectrum (in the lower 3 GHz band, as well as upper mid-band) can serve as the public infrastructure that enables higher-capacity and more affordable wireless broadband connectivity in underserved areas.

B. The NSS Should Include A Spectrum Inventory of Actual Spectrum Usage And a Regular Process to Identify Underutilized Bands Using Public Interest Based Criteria.

PISC proposes that the NSS include a plan and timeline to conduct an inventory of actual spectrum use in prime low to upper-mid bands. While tables of allocations and databases documenting assignments are available, regulators are mostly flying blind with respect to the degree to which each band of spectrum is actually in use (or not), including where, when, at what power levels and for what purposes. While the NTIA and FCC have made enormous progress in recent years identifying both federal bands (e.g., 3.5 GHz) and commercial bands (e.g., C-band) with enormous unused capacity, identifying these opportunities and knowing what sharing mechanisms are feasible or optimal is a challenge that will increasingly benefit from a more current and granular understanding of how intensively prime spectrum is actually being used (and how not). This should be coupled with a commitment in the NSS to periodically review all bands using public interest metrics to determine when and how a band can be repurposed in the future.

[53] 47 U.S.C. § 1302(a).

1. NTIA and the FCC Need a Comprehensive Spectrum Inventory of Actual Usage to Meet Our Nation's Spectrum Needs.

A core challenge for spectrum policy today is that in low- and mid-band frequencies (certainly below 16 GHz) every band is assigned and occupied to some degree; every incumbent believes its use of the band serves an important, sometimes crucial public purpose (and often this is true); and, despite this, the vast majority of the spectrum capacity in the band is unused at most times and in most places. In recent years the FCC and NTIA have addressed this challenge successfully with innovative frameworks in multiple bands.

For example, the dynamic three-tier sharing framework and Spectrum Access Systems that govern the new Citizens Broadband Radio Service is (as described above) an exemplary model for working around a vital incumbent service that either cannot relocate or where it would cost too much and take far too long. Prior to CBRS, NTIA initially identified the 3.5 GHz band as a possible candidate for sharing; but it really took a combination of a specific recommendation by the President's Council of Advisors on Science and Technology (PCAST) and White House support to move to a Notice of Inquiry and eventually the final rules that in three short years have resulted in more than 300,000 deployed access points by hundreds of very diverse operators and users.

In short, there is a huge opportunity cost to what NTIA and the FCC do not know about the actual use of spectrum they manage. Do we know the degree to which many other valuable bands are actually being used or not? Do we know geographically where or where not valuable bands are in actual use? Do we know when? Do we know whether the use is predominantly outdoors, or indoors, and at what power levels? We are learning more about certain bands as they are taken up on an almost ad hoc basis—e.g., the still vacant ITS band at 5.9 GHz, the 4.9 GHz band, the 12.7-13.25 GHz band.

This is progress, but PISC maintains that today, looking forward, a NSS must endeavor to conduct an inventory of at least the federal bands below some upper-mid-band threshold and use that data to target the next few bands that are most feasible to achieve an outcome of more spectrum access on an unlicensed, exclusively licensed and shared/lightly-licensed basis. The Table of Allocations is conceptually designed as a sort of property map—it tells us what types of services can operate where—but it is nearly useless when it comes to understanding actual use and the opportunities for repurposing and sharing.

Frequency bands are often allocated for a critical use, but that may be actually operating at relatively few locations; or it may have mostly phased out years ago; or the channelization and/or technology advances are making it possible to operate on far less spectrum. NTIA has studied bands, but the agency's Spectrum Use Reports only cover bands up to 7.125 GHz and don't seem to have been updated since 2015.[54] Similarly, the FCC's Spectrum Dashboard was a breakthrough a decade ago—but it is basically a mapping of assignments (not actual use), it only covers spectrum up to 3.7 GHz, and it no longer appears to receive updates. On a more comprehensive basis, the Universal Licensing System can tell us what licensees have been assigned rights to operate on particular frequencies and within certain (typically overly large) geographic areas, but it neither reports actual use or cessation of use.

PISC therefore suggests that the NSS include a plan and timeline to conduct a spectrum inventory of actual use in prime low to upper-mid bands. It can begin with a modest range of frequencies if appropriate, perhaps initially up to 16 GHz. If the initiative is transparent and invites public input, much of the information (e.g., spectrum usage measurements) could be crowdsourced by the private sector. Incumbents should be strongly encouraged to provide missing data; and, ideally, any presidential order to implement the NSS should require it.

[54] *See* https://ntia.gov/other-publication/federal-government-spectrum-compendium.

2. *NTIA and the FCC Should Establish a Regular Periodic Review of All Spectrum Bands Using Predetermined Public Interest Criteria to Determine When a Band Is Ripe for Repurposing.*

NTIA asks how it can reassess its prior determinations and balance periodic review of its spectrum priorities with regulatory certainty that protects the investment-backed expectations of spectrum users.[55] Whether or not it compiles an inventory of actual spectrum use, PISC urges NTIA to adopt a regular review of *all* spectrum bands using a pre-determined set of questions and criteria based on the public interest goals underpinning our spectrum policy to determine when a band is ripe for repurposing. By providing transparency about what NTIA and the FCC will consider when it reviews a band for repurposing, this set of questions and criteria can provide enough regulatory certainty for spectrum users to either continue on their current business course or shift their business operations to better meet the needs of the nation.

Essentially, NTIA and the FCC need a regular, periodic process to determine which bands can and should be repurposed or adapted to help us achieve our nation's telecommunication goals. Determining this requires answering questions like the following:

- Which federal users and commercial services are no longer meeting the needs of the public or serving our nation's goals?
- Which federal users and commercial services can continue to serve the public interest while occupying less spectrum and/or sharing their spectrum with new uses and services?
- In bands that are not utilized intensively, is actual spectrum usage limited in time, location (e.g., outdoors but not indoors, space but not terrestrial), and/or frequency? What spectrum coordination mechanism is best suited to unlock that fallow capacity to facilitate new uses and to address unmet needs?
- What additional spectrum bands or shared capacity do federal users and service providers need that will help us achieve our nation's telecommunications goals?
- Which access models can best fill connectivity gaps and expand access to critical telecommunications systems to underserved Americans, including Tribes?

[55] 88 Fed. Reg. 16246-16247.

NTIA and the FCC should use these questions as a starting point for creating a set of public criteria to determine when a band should be repurposed or adapted. A periodic review of *all* spectrum bands should be performed on a regular interval. For commercial bands, this review could be incorporated into the license renewal process. Transparency around the criteria used in this review along with advance notice that it will occur at the time of license renewal, would give licensees enough information to provide a degree of regulatory certainty that is balanced with our nation's need to achieve its communications goals.

C. Unlicensed Spectrum: NTIA and FCC Should Study and Aim to Extend Unlicensed Access at Least another 450 MHz Above and Contiguous to 7125 MHz for at Least Low-Power, Indoor-Only (LPI) Use

Unlicensed spectrum is what ultimately makes both mobile and fixed broadband service more available, fast and affordable to consumers and businesses nationwide. Far more unlicensed spectrum will be needed in five-to-ten years to distribute the multiple gigabits of bandwidth that will be available and needed for new applications to all the users and devices in our nation's homes, offices, schools and other venues. Wi-Fi is the workhorse of the Internet. Low-cost, off-the-shelf routers and devices easily and affordably offer access to wide channels of unlicensed spectrum that provide high-capacity connectivity in homes, at work, at school, in libraries, restaurants, retailers, and virtually every public place. The vast majority of data consumed on smartphones and other mobile devices—more than 80% in the U.S. and Europe—flows over Wi-Fi networks, never touching mobile carrier spectrum or infrastructure.[56] The share of data traffic offloaded via Wi-Fi is likely to increase further as new high-bandwidth

[56] Comcast, "Xfinity Rated as the Fastest Internet Provider Inside and Outside of the Home," (Jan. 25, 2023), https://corporate.comcast.com/press/releases/xfinity-ends-2022-rated-fastest-internet-provider#:~:text=Xfinity%20Mobile%20blends%20WiFi%20and,mobile%20traffic%20runs%20over%20WiFi ("[m]ore than 80 percent of mobile traffic runs over WiFi").

applications, such as augmented and virtual reality (AR/VR) are used most frequently at home, work and other indoor locations.[57]

While the FCC's historic 2020 Order authorizing unlicensed sharing across four band segments from 5925 to 7125 MHz will fuel the new Wi-Fi 6E connectivity coming to market today, there is no question that next generation Wi-Fi 7 and Wi-Fi 8 will be far more useful to consumers. With advances that will leverage channel sizes up to 320 megahertz with deterministic, interference-minimizing protocols, the next two generations of Wi-Fi will be able to affordably support all of the very high-bandwidth, low-latency applications expected to populate our homes, offices, schools and public spaces a decade hence. This will be crucial to making applications such as AR/VR—and whatever evolves into what we refer to today as the "metaverse"—available affordably in every household with fast fixed broadband access. However, supporting these applications and use cases in every location with backhaul—and especially in high-traffic settings such as schools, offices and venues—will require additional wide channels of unlicensed access.

In the short term, PISC urges NTIA and FCC to immediately begin a consultation aimed at authorizing unlicensed operations up to 7250 MHz on an indoor-only, low-power (LPI) basis, thereby enabling a fourth 320-megahertz channel for use by next generation Wi-Fi. Longer term, PISC believes the NSS should study the remainder of the 7 GHz band—up to 8.4 GHz—with a goal of making at least a fifth 320-megahertz channel available for unlicensed sharing and ideally contiguous to the U-NII-9 band (7125-7250 MHz). We further believe this new allocation

[57] *See, e.g.*, Cisco Annual Internet Report (2018-2023) White Paper, Cisco (Mar. 9, 2020), https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.html (stating Wi-Fi is expected to continue to handle more than half of all Internet traffic for the foreseeable future); *see Global Economic Value of Wi-Fi*, Wi-Fi Alliance, at 14 (Sep. 2021), https://www.wifi.org/download.php?file=/sites/default/files/private/Global_Economic_Value_of_Wi-Fi_2021- 2025_202109.pdf.

can be expedited by deciding initially to limit this additional unlicensed underlay to LPI devices. This connectivity will also be more effective and affordable if it is contiguous to the top edge of the current unlicensed 6 GHz band, which is currently limited to LPI use.

1. Short Term: Open 7125-7250 GHz for unlicensed LPI use

NTIA and FCC agreement on the viability of a proceeding to authorize LPI use of the 125 megahertz just above the current upper border of the unlicensed LPI band (7125 MHz) should not even need to wait for the publication of the NSS. The federal fixed-link incumbents in this band segment can have exactly the same protection from LPI use as do commercial fixed links in the U-NII-5/7 band segments. No AFC coordination is needed since all use would be restricted to the form factor the FCC requires for LPI operation in the band just below (e.g., plug-in power only, no weatherization, no external antenna).

Extending unlicensed access up to 7250 MHz enables an additional 80 and an additional160 megahertz channel for Wi-Fi 6E devices already in use. It would also add an additional 320 megahertz channel for Wi-Fi 7, expected to be widely available in 2024, and Wi-Fi 8, which is already in development. In addition to greater capacity and faster throughput, extending the band to 7250 MHz would also help to provide the channel diversity needed in dense networking environments, such as multi-dwelling unit buildings.

2. Longer Term: Open at least one additional 320 megahertz channel above 7250 GHz for LPI use

The pandemic work and school closures highlighted how critical it is to have affordable, high-capacity internet connectivity throughout every household and supporting every device. Even homes with gigabit-capable fiber or cable service are discovering that today's Wi-Fi is constrained in supporting multiple users engaged in video conferencing, streaming video, gaming and other high-bandwidth applications—let alone emerging real-time applications such

as augmented and virtual reality. The next generation of Wi-Fi technology can deliver these benefits everywhere—including in MDUs and other high-traffic areas—if there is sufficient unlicensed spectrum to support a sufficient number of channels up to 320 megahertz wide. A sufficient number of very wide channels yields consumer benefits beyond distributing multi-gigabit connectivity, including improved energy efficiency, reliability, very low latency, and location capability. Wi-Fi 7 chips and routers will be available this year for pre-standard release and although many can channelize up to 7250 MHz, the sooner that chip and device makers know what they have to work with, the earlier and greater the benefits will be to consumers and the economy.[58]

For all of these reasons, PISC strongly recommends that the NSS should make it a priority to study the extent to which the 7 GHz band can be shared with federal incumbents for unlicensed use. We believe the goal should be to initially identify at least 450 megahertz in the band for an unlicensed underlay that is initially limited to LPI operations and, if feasible, contiguous to the current 6 GHz unlicensed allocation. The NSS should also study the potential to make this same spectrum—or as much as possible—available for standard power use, relying on the FCC-certified Automated Frequency Coordination systems and any future federal-side Incumbent Informing Capability, as needed.

D. Lightly-Licensed Shared Access: A Dynamic, Three-Tier Framework Modeled on CBRS Should be Extended to the 3100-3450 MHz and Other Bands

Extending and adapting the three-tier CBRS framework is likely the most expeditious and productive way to make federal radar and other bands below 3450 MHz available for 5G-capable

[58] In addition, an IEEE standards initiative (the 802.11bn Project) is planning to extend the 320 megahertz channel scheme to at least 7250 MHz. See IEEE Standards Association, Project 802.11bn, https://mentor.ieee.org/802.11/dcn/23/11-23-0480-00-0uhr-uhr-proposed-par.pdf.

networks and services.[59] Among other advantages, the Commission can leverage the Spectrum Access Systems (SAS) already operating in the nearby CBRS band to coordinate General Authorized Access (GAA) in local areas where and when the spectrum is not in use by military operations.

PISC recommends that the NSS include a plan to study and make available for at least opportunistic shared use all of the band segments from 2900 to 3450 MHz. The 2012 PCAST report emphasized the potential for what it called a shared-use "spectrum superhighway" across the vast, nearly 1,000 megahertz expanse of federal radar bands between 2700 and 3650 MHz.[60] Even prior to PCAST, NTIA had identified this entire 950 megahertz as a potential candidate for shared commercial use and specified the 3550-3650 MHz band for "fast-track evaluation" in its ten-year plan.[61] Responding to PCAST's recommendation, the FCC in 2015 made that top 100 megahertz the centerpiece of its CBRS three-tier sharing innovation. In 2020 a NTIA technical study identified the top 100 megahertz in the 3450-3550 MHz band as the most promising portion for accommodating commercial use on a shared basis.[62] The Trump administration ultimately decided that most radar operations in 3450-3550 MHz could be consolidated into other parts of the band, allowing the FCC to propose a more traditional "exclusive" licensing

---

[59] *See* Reply Comments of New America's Open Technology Institute, *Facilitating Shared Use in the 3.1-3.55 GHz Band*, WT Docket No. 19-348 (March 23, 2020).

[60] The PCAST Report's "highest recommendation is that the President issue an Executive Order to prioritize 1,000 MHz of Federal spectrum for review and implementation to create the Nation's first shared-use spectrum superhighways." *PCAST Report* at 7.

[61] U.S. Dept. of Commerce, *Plan and Timetable to Make Available 500 Megahertz of Spectrum for Wireless Broadband*, at 7 (Oct. 2010), https://www.ntia.doc.gov/files/ntia/publications/tenyearplan_11152010.pdf; *see also* U.S. Dept. of Commerce, *Quantitative Assessments of Spectrum Usage* (Nov. 2016) (finding potential opportunities for sharing spectrum existed in the 3.5 GHz band), https://www.ntia.gov/files/ntia/publications/ntia_quant_assessment_report-no_appendices.pdf.

[62] *See* Edward Drocella, Robert Sole, Nickolas LaSorte, *Technical Feasibility of Sharing Federal Spectrum with Future Commercial Operations in the 3450-3550 MHz Band*, NTIA Technical Report 20-546, at viii-ix (rel. Jan. 2020). "In the aggregate and in some cases individually, the federal systems use the entire band throughout the United States and its possessions, including near and over the most populated areas." *Ibid*.

approach based on an auction that would also reimburse DoD for costs (as provided under the Commercial Spectrum Enhancement Act).

PISC urges the NTIA and FCC to take a more holistic and balanced approach to authorizing private sector access to the lower 3 GHz band. Even if a portion of this large tract of spectrum can be cleared to a degree that would merit an auction, PISC strongly believes it is in the public interest to designate most of the frequencies between 2900 and 3450 MHz for a three-tier sharing framework similar to CBRS, with small-area PALs and GAA use coordinated across the entire band by a dynamic spectrum management mechanism.

1. 3100-3450 MHz: An opportunity to extend the CBRS framework

PISC strongly believes that the lower 3 GHz spectrum that is currently used extensively for Department of Defense radar systems can be most productively used on a local, relatively low-power and shared basis subject to coordination by the Spectrum Access Systems already proven to protect U.S. Navy radar in the 3550-3650 MHz band. Like the previously underutilized 3.5 GHz band, there is every indication that at least a large portion of this band can be shared with military operations and likely more intensively in the future if an incumbent informing capability becomes available (as we described and recommended above). A similar three-tier sharing framework in this band would also have a multiplier effect because of its proximity to the CBRS band and the potential to make far more spectrum locally available for both small-area licensing and opportunistic General Authorized Access under common technical rules.

How much of the 3 GHz below 3450 MHz can be cleared or shared will depend on the outcome of the Partnering to Advance Trusted and Holistic Spectrum Solutions ("PATHSS") report expected later this year.[63] According to NTIA spectrum use studies, the sub-bands below

[63] *See, e.g.,* C. Todd Lopez, "Spectrum Sharing is Way Ahead to Maintain Economic Dominance," DOD News, U.S. Department of Defense (Sept. 21, 2022),

3450 MHz are more congested with systems from all branches of the military and thus less amenable to clearing.[64] An effort to replace and move military systems to different spectrum, even if feasible, is likely to be unduly disruptive, cost tens of billions of dollars, and take a decade or longer. This view is reflected in the recommendations of a 2019 report by DoD's Defense Innovation Board, which concluded that in a reasonable time frame, dynamic sharing would be far more feasible and acceptable from the military's perspective.[65] A major benefit of a CBRS-like three-tier sharing framework in the lower 3 GHz is it could accelerate and optimize private sector access to the entire band without the need and expense of clearing federal incumbents and relocating their operations to some other band.

There is also the additional challenge of what alternative band 3 GHz military systems can move to given that all comparable spectrum is assigned and in use for other incompatible services. Unlike many commercial wireless services, there are no close substitutes for military radar systems available from private wireless operators. The previous administration's insistence on a piecemeal approach that required the military to minimize use of the 3450-3550 MHz band only made this more difficult by hastily consolidating more incumbent systems into the sub-bands below.

---

https://www.defense.gov/News/News-Stories/Article/Article/3165774/spectrum-sharing-is-way-ahead-to-maintain-economic-dominance-defense-official-s/.

[64] U.S. Dept. of Commerce, *Feasibility of Commercial Wireless Services Sharing with Federal Operations in the 3100-3550 MHz Band*, at 11 (July 2020) ("NTIA July 2020 Report") ("the lower portion of the band is more congested and includes additional systems that have not been analyzed"), available at https://www.ntia.doc.gov/files/ntia/publications/ntia_3100-3550_mhz_mobile_now_report_to_congress.pdf.

[65] Defense Innovation Board, *The 5G Ecosystem: Risks and Opportunities for DoD*, Recommendation #1, at 28 (April 2019), available at https://media.defense.gov/2019/Apr/04/2002109654/-1/-1/0/DIB_5G_STUDY_04.04.19.PDF ("DoD stands to significantly benefit if it shares some of its sub-6 GHz spectrum."). *See also* Milo Medin and Gilman Louie, "Clearing the Air on 5G," *Texas National Security Review* (March 13, 2020), available at https://warontherocks.com/2020/03/clearing-the-air-on-5g/ ("Sharing spectrum could take just two to three years instead of the 5 to 10 years that vacating requires, would cost millions of dollars instead of billions, and would not put national security operations at risk.")

PISC believes that, informed by the PATHSS report, the NSS provides a perfect opportunity for the Biden administration and FCC to revisit the PCAST recommendations and ensure that there is a balanced approach to "sharing" that makes lower 3 GHz spectrum accessible to *all* stakeholders on both an interference-protected and opportunistic (GAA) basis. Even if a substantial portion of lower 3 GHz military spectrum can be cleared and auctioned, the FCC has an opportunity to extend opportunistic access across the entire 3100-3550 GHz band on a use-it-or-share-it basis. The Spectrum Access Systems in the nearby CBRS band have proven they can successfully manage co-existence between licensees (PAL holders), the Navy, and GAA users in the nearby 3550-3650 MHz band. Because of its proximity, the same SAS and sensing technology (if needed) can be almost immediately extended to manage the use-it-or-share-it rule in CBRS to the 3.45 GHz band.[66]

While CBRS is already facilitating innovation and competition by a diverse range of rural ISPs and enterprise users, extending a use-it-or-share-it authorization to adjacent military spectrum will give both Priority Access licensees and GAA users access to large swaths of contiguous GAA spectrum that can dramatically increase the capacity and quality of their networks. PISC recommends that the NSS make it a priority to endorse and expedite a balanced approach that optimizes shared access to the entire 350 megahertz with a framework similar if not identical to the three-tier CBRS model.

2. 2900-3100 MHz: Maritime radionavigation and weather radar

Looking further down the road, the NSS should also study the 2900-3100 MHz band as a potential candidate for dynamic spectrum sharing. Even lower in 3 GHz is the 2900-3100 MHz

[66] *See* Comments of Google, *Facilitating Shared Use in the 3.1-3.55 GHz Band*, WT Docket No. 19-348 (Nov. 20, 2020) ("Google 2020 Comments"). "Expanding SAS capabilities below the 3.55 GHz boundary to support such 'extended GAA' operation would be straightforward." *Ibid*.

sub-band allocated to federal and commercial shipborne radars required on most passenger and cargo ships for safety under an international maritime treaty, as well as for weather monitoring.[67] Similar to the 3100-3650 bands discussed above, it appears that the band could be open for licensed and/or unlicensed (GAA) shared use across most of the nation. The upper 100 megahertz of the band appears to be used entirely for maritime radionavigation. Like the CBRS band, coordination by one or more certified AFCs—and either the coastal sensing networks certified to protect Navy operations at 3550-3650 MHz, or the new IIC noted above—could enable at least low-power, opportunistic use even along most of the nation's coastlines (where a majority of Americans live).

The lower half of the band is the upmost portion of a 300 megahertz band (2700-3000) that is used for weather monitoring. A network of Next Generation Weather Radar (NEXRAD) systems operating in the 2700-3000 MHz band "provide quantitative and automated real-time information on (rainfall amounts/rates, wind velocity, wind direction, hail, snow, etc.) with higher spatial and temporal resolution than previous weather radar systems."[68] NEXRAD sites also collect data used to generate severe weather warnings. According to the Department of Commerce (NOAA), NEXRAD consists of relatively few (160) fixed sites.[69] Although NEXRAD sites may require a relatively large protection area, there is no reason to believe that coordination zones cannot be enforced by the same AFC mechanism (e.g., a SAS) that would be safeguarding maritime radar operations.

---

[67] *See* NTIA, Federal Government Spectrum Use Reports 225 MHz-7.125 GHz, "2900-3100 MHz Report" (Dec. 1, 2015) ("NTIA 2900-3100 Use Report"), available at https://www.ntia.doc.gov/page/federal-government-spectrum-use-reports-225-mhz-7125-ghz. The International Convention for the Safety of Life at Sea (SOLAS) is an international maritime treaty that sets minimum safety standards in the construction, equipment and operation of merchant ships.

[68] NTIA 2900-3100 Use Report at 1.

[69] National Oceanic and Atmospheric Administration, National Centers for Environmental Information, "NEXRAD," https://www.ncdc.noaa.gov/data-access/radar-data/nexrad.

E. Coordinated Non-Exclusive Sharing: A Simpler Two-Tier Framework Modeled on the 6 GHz or 70/80/90 GHz Bands Can Unlock Unused Spectrum in Underutilized Bands, Particularly in Rural, Tribal and Other Less Populated Areas

PISC strongly supports the identification of substantial new upper mid-band spectrum for coordinated sharing of the band in a manner that meets the needs of the widest variety of local users and use cases, including through the authorization of the sort of automated frequency coordination framework that has proven to be successful in other bands, including the Citizens Broadband Radio Service ("CBRS") and for unlicensed sharing in the 6 GHz band. As described just below, the 12.7-13.25 GHz and 10-10.5 GHz bands are very underutilized bands that could provide local access to spectrum, on a coordinated and lightly-licensed basis, for both point-to-point and point-to-multipoint fixed wireless access. This will be particularly viable where it is needed most, which is in rural, tribal and other less-densely-populated communities still lacking fiber or more than one high-capacity home broadband option. PISC recommends that NTIA collaborate with the Department of Defense to study the degree to which the 10 GHz band can be shared—most likely subject to coordination by a geolocation database system—as a few of our groups proposed last year in a Petition for Rulemaking.[70] In addition, we urge NTIA and the FCC to agree on and propose a coordination mechanism for co-primary Federal and commercial sharing of the lower 37 GHz band.[71]

1. Lower 37 GHz Band: The need for co-primary sharing rules

The NSS should include a decision on a co-primary federal and non-federal sharing framework for this 600 megahertz millimeter wave band (37-37.6 GHz). The Commission designated this virtually greenfield spectrum for shared federal and non-federal use in its 2016

[70] [CITE]
[71] [CITE]

Spectrum Frontiers Order, which reallocated and reorganized the 37 and 39 GHz bands.[72] In that Order the FCC designated a total of 1,850 megahertz across the two millimeter wave bands for auction and set aside 600 megahertz at the bottom of the 37 GHz band to "create a space for both Federal and non-Federal users to share on a coequal basis and set out a process for defining how that sharing will be implemented."[73]

The Order provided that non-federal users would be authorized by rule (like CBRS) and receive Shared Access Licenses (SALs). "SALs will be widely available to provide easy access to spectrum, including for new innovative uses and for targeted access where and when providers need additional capacity," the Order stated.[74] Both federal and non-federal users will "access the band through a coordination mechanism, including exploration of potential dynamic sharing through technology in the lower 600 megahertz, which we will more fully develop.…"[75]

However, although the 37-39 GHz auction concluded in early March 2020, there has been virtually no progress since 2016 in establishing a framework for coordinated sharing. To its credit, the Commission has issued Special Temporary Authority to Starry and other internet service providers that find it effective for very high capacity fixed wireless access services. But uncertainty about future sharing rules is likely deterring many broadband providers and other uses. The 2016 Spectrum Frontier Order adopted some elements support a sharing framework similar to CBRS (e.g., site-based registration, a mechanism for dynamic coordination, and the same technical rules that apply to the rest of the 37 GHz band),[76][5] but it did not decide key

---

[72] FCC, Report and Order and Further Notice of Proposed Rulemaking, *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177 (July 14, 2016) ("*37 GHz Order & FNPRM*").
[73] *Id*. at ¶ 18. NTIA supported this outcome, as did spectrum sharing advocates such as Dynamic Spectrum Alliance, Starry and public interest groups. *See Id*. at ¶¶ 109-110 and Letter from Paige R. Atkins, Associate Administrator, Office of Spectrum Management, NTIA to Julius Knapp, Chief, Office of Engineering and Technology, FCC, at 4 (July 12, 2016).
[74] *37 GHz Order & FNPRM* at ¶ 117.
[75] *Id*. at ¶ 113.
[76] *Id*. at ¶¶ 448-449.

issues. The NSS should at a minimum decide if federal operations will have a priority status and then seek further comment to decide on a shared licensing framework and if an automated frequency coordination system is needed or warranted, depending on demand.

2. 12.7-13.25 GHz Band: A good fit for coordinated sharing

As the Commission recognized in its Notice of Inquiry last year, the 12.7-13.25 GHz band is lightly used by relatively few incumbents and holds enormous potential for more intensive use.[77] A shared-licensed framework would be a particularly good fit if the Commission decides not to relocate incumbent services to other bands, as OTI and PK explained in comments filed last October.[78] A major advantage of opening the 12.7 GHz band for coordinated shared use on a secondary basis is avoiding the costly, disruptive and lengthy process associated with clearing and relocating band incumbents.

Our groups urge the Commission to propose coordinated sharing of the band and to adopt an open access framework that meets the needs of the widest variety of local users and use cases. For this purpose, we believe the best approach would be light licensing and the authorization of the sort of automated frequency coordination framework that has proven to be successful in other bands, including CBRS and for unlicensed sharing in the 6 GHz band. A shared-license framework that includes both priority access licenses and opportunistic, general authorized access can enrich and diversity the nation's developing 5G wireless ecosystem in a way that specifically meets the needs of smaller wireless ISPs, innovators, community anchor institutions, and the tens of thousands of individual enterprises that will choose to customize their own private IoT, neutral host or access network. These approaches also provide the most direct means

[77] *Expanding Use of the 12.7-13.25 GHz Band for Mobile Broadband or Other Expanded Use,* Notice of Inquiry and Order, GN Docket No. 22-352, FCC 22-80 (rel. Oct. 28, 2022).
[78] *See* Comments of Open Technology Institute at New America and Public Knowledge, *Expanding Use of the 12.7-13.25 GHz Band for Mobile Broadband or Other Expanded Use,* Notice of Inquiry and Order, GN Docket No. 22-352, FCC 22-80 (rel. Oct. 28, 2022).

of providing access to businesses owned by people of color and women, and to anchor institutions and nonprofits that serve traditionally marginalized communities.

3. 10 GHz Band: A federal band that can be coordinated for fixed wireless access in underserved areas

NTIA and the FCC should coordinate with the goal of initiating a rulemaking proceeding to make the 10-10.5 GHz band available for coordinated, point-to-point use on a shared basis with federal and amateur users. Several PISC members are part of the Coordinated Sharing Coalition that filed a petition for rulemaking last fall, asking the FCC to make the 10-10.5 GHz band available for point-to-point use on a nationwide non-exclusive basis, with interference protection governed by an AFC system.[79] As described in the petition, additional backhaul spectrum is needed to support coverage and capacity in residential areas. Particularly in rural, tribal and less densely populated areas, the 10 GHz band can serve as an alternative to fiber backhaul and support improved broadband capacity and quality for video streaming, telehealth, and remote work and learning. More than 240 local wireless internet service providers (WISPs) have already filed in support of the petition, stating that open, coordinated access to the 10 GHz band for local PtP use would fill an important gap in the fixed wireless ecosystem.[80]

The Coalition proposed a regulatory framework designed to protect federal and amateur users from harmful interference through an AFC system that will manage spectrum access. PISC recognizes that the band is currently used for military radar and perhaps other systems. But because of its propagation quality, the growing congestion of bands available for low-cost fixed links, and the likelihood that fixed use could be coordinated by automated frequency

[79] *See* Coordinated Sharing Coalition, *Petition for Rulemaking, Amendment of Part 101 of the Commission's Rules to Enable Greater Commercial Use of the 10.0-10.5 GHz Band (filed Oct. 4, 2022).*
[80] *Ex Parte* Letter of 242 Wireless ISPs, *Amendment of Part 101 of the Commission's Rules to Enable Greater Commercial Use of the 10.0-10.5 GHz Band* (Dec. 8, 2022).

coordination without disrupting federal incumbents, PISC recommends that NTIA and the Commission collaborate to study the band and determine if initiating a NPRM is warranted.

IV. THE NSS SHOULD RE-CAST EFFICIENCY USING METRICS THAT SERVE THE BROAD PUBLIC INTEREST.

Efficiency can mean maximizing the utilization or consumer impact of a band. But, most often, efficiency seems to mean maximizing the short-term economic value derived from a band for the government or a commercial service provider. The issue is that often, spectrum policies that will maximize revenues do not embody the values of our telecommunications system or serve the goals of our nation. By recasting efficiency using metrics that serve the broad public interest, our spectrum regulators can create a framework for measuring efficiency that will better support our nation's long-term telecommunications goals.

A. Focusing on a Single Efficiency Metric Negatively Impacts the Spectrum Ecosystem.

Under a single metric to evaluate efficiency some spectrum policies will perform really well, and others will not—ultimately leading to a unitary ecosystem. For example, if efficiency is measured based solely on technical usage (how much data is being transferred across a frequency) unlicensed will always outperform licensed. While unlicensed plays a critical role in our wireless ecosystem, there are other important services that require the reliability of an exclusive license. Ensuring that many different use cases can access spectrum requires a multifaceted approach to efficiency.

1. There is no single universal metric for efficiency.

Efficiency in the context of spectrum policy means different things depending on the spectrum stakeholder using the term. The various spectrum efficiency metrics that stakeholders use fit into the following four categories:[81]

[81] *See* Burke at 19-20.

1. **Economic Value.** Under an economic value metric, spectrum efficiency is determined by looking at the monetary value a particular spectrum use generates either for the government or the service provider.

2. **Economic Impact.** Under an economic impact metric, spectrum efficiency is determined by looking at the value-add a particular use has on the overall economy.

3. **Consumer Impact.** Under a consumer impact metric, spectrum efficiency is determined by looking at how many consumers are served by a spectrum use and how much consumers are paying for a spectrum service.

4. **Technical Usage.** Under a technical usage metric, spectrum efficiency is determined by looking at how often and how much data is being transferred across particular spectrum frequencies.

Each of these metrics, if prioritized above the others, can lead to widely different spectrum policies with extremely different results. Such outcome disparities make transparency about the definition of efficiency and the metrics by which efficiency is measured incredibly important. Without such transparency, spectrum policy advocates can manipulate the value of efficiency that underpins our spectrum regulations to suit their own purposes, making it difficult, if not impossible, for policymakers to make informed spectrum management decisions.

2. Focusing on economic efficiency has negatively impacted spectrum policy.

The Coase theorem on economic efficiency has heavily underpinned how policymakers and advocates think about efficiency in the context of spectrum policy. In 1959, economist Ronald Coase argued for a market-based approach to assigning property rights in spectrum at auction as an alternative to the government's inefficient command-and-control approach.[82] Coase's proposal was based on the theory that those who will pay the most today for rights to a given frequency will also extract the highest and best value of that frequency—even if that means warehousing and re-selling their spectrum rights to another party at a later date. In ideal

[82] Ronald Coase, The Federal Communications Commission, 2 J. of L. and Econ. 1 (Oct. 1959).

economic conditions, Coase argued that this approach would achieve Pareto efficiency in the world of radio—an optimal state where no action or allocation would make one spectrum user better off without making another worse off.[83]

Auction proponents often use this theory to argue that the price paid at auction *is* a proxy for the public interest. But, even Coase acknowledged that there were public concerns—like pollution and monopolistic practices—that required a regulatory solution, rather than a market one.[84] Additionally, Coase's theory depends on maintaining an artificial scarcity of licenses. Innovations that permit unlicensed spectrum access, intensive spectrum re-use, and other forms of cooperative sharing did not exist when Coase was developing his views on spectrum management. While no one can doubt that these spectrum access regimes create enormous value—both economically and to society at large—they run contrary to the argument that auctions and secondary markets are the only means of putting spectrum to its "highest, best use."

Unfortunately, rather than achieving Coase's dream of Pareto efficiency, as policy spectrum auctions are too often used to maximize the government's revenue, often at the expense of the public and our national telecommunication's system. To date, federal spectrum auctions have raised more than $200 billion for the U.S. Treasury. Even though the FCC is statutorily forbidden from considering revenue when making auction decisions,[85] with billions of dollars on offer, estimates of the one-time revenue effects (and the CBO budget "score") has increasingly influenced auction considerations. Chairman Ajit Pai based his decision to auction the C-Band on four principles including the need to "generate revenue for the federal government."[86] While

[83] *See id.* at 27.
[84] *See id.* at 17, 29.
[85] 47 U.S.C. § 309(j)(7)(A).
[86] Letter from Aji Pai to the Honorable Roger Wicker, Chairman of the Committee on Commerce, Science, and Transportation (Nov. 18, 2019).

this principle never made its way into the agency's final Report and Order, it was included in other Commission documents announcing the C-Band auction.[87]

The issue with a revenue maximizing approach to economic efficiency is that in practice, it is often at odds with fostering a competitive ecosystem. An incumbent may value a license higher than a new entrant, "simply because of the greater market power the incumbent would enjoy without the new entrant."[88] Similarly, when there are competing technology standards, supporters of one standard may value a license more "if it creates a hole in the footprint of a competing standard."[89] For example, prior to the C-Block auction, the Global System for Mobile (GSM) communications did not have coverage in Chicago, but the Code Division Multiple Access (CDMA) standard did. By the time the auction closed in 1996, a GSM bidder had won the C-Block license for Chicago—but only "after a long fight with the largest CDMA bidder."[90] While this type of behavior may generate more economic revenue, it does so at the expense of the end consumer who ultimately pays for the increased spectrum costs and suffers from the anti-competitive result such barriers to entry create.

This is why Congress forbid the FCC from considering revenue from its auction decisions. It is also why it is important to recast efficiency using metrics that serve the public interest by fostering a balanced wireless ecosystem.

---

[87] *See* F.C.C., The C-Band: Repurposing Mid-Band Spectrum for 5G at 1 (February 6, 2020), https://docs.fcc.gov/public/attachments/DOC-362335A1.pdf ("...and it would generate significant revenue for the U.S. Treasury.").
[88] Peter Cramton, Handbook of Spectrum Auction Design, 57 (Oct. 2017)
[89] *Id.*
[90] *Id.*

B. The NSS Should Recast Efficiency as a Balancing Test Using Public Interest Metrics That Include Economic Impact, Consumer Impact, and Technical Usage.

The value of efficiency is baked into the statutory mandates of our spectrum regulators, making it an essential factor in spectrum management.[91] Fortunately, neither regulatory agency is restricted to a statutory definition of efficiency. This affords NTIA and the FCC flexibility to recast efficiency as part of the NSS. PISC recommends adopting a balancing test approach to efficiency using metrics that support the public interest, including economic impact, consumer impact, and technical usage.

Of the metrics stakeholders use today, only "economic value" fails to serve the public interest by giving more weight to the revenues generated by spectrum for the government and corporate interests than the value consumers and the overall economy receive from those spectrum uses.[92] The remaining metrics all play a role in promoting the public interest. For example:

- **Economic Impact** takes a holistic view of the economic value a particular spectrum use creates for society, not just the amount of money generated for the government and service providers. It includes the impact of a particular spectrum use on personal wages, job opportunities, and the overall economy.
- **Consumer Impact** focuses on how many end users are served by a particular spectrum use and how much end users have to pay for that service. Making sure all Americans receive affordable telecommunication services is a core public interest principle that this metric seeks to achieve.
- **Technical Usage** values spectrum uses and access models that maximize data transmissions over spectrum. This serves the public interest by valuing spectrum services that actually use their spectrum allocations to their fullest potential and devaluing services that leave spectrum fallow, refusing to build out service to less

[91] The Act directs the Commission to distribute licenses so "as to provide a fair, efficient, and equitable distribution of radio service…." 47 U.S.C. §307(b). And, NTIA is tasked with "promot[ing] efficient and cost-effective use of the spectrum" it assigns. 47 U.S.C. §903(d)(1).
[92] This was discussed in more detail earlier in this section.

profitable regions while also preventing competitors and new entrants from gaining access to spectrum.

Each of these efficiency metrics has the potential to provide significant benefits to the public. Instead of focusing on one over another, our NSS should treat these metrics as factors that policymakers must balance to maximize the public benefits of a particular spectrum decision.

V. THE NSS SHOULD PRIORITIZE DIVERSITY, EQUITY, AND INCLUSION.

Historically, the federal government has given little consideration to the implications of spectrum policy on diversity, equity, and inclusion (DEI). Just as economists believe that the market was race-blind, policymakers and advocates also believed that the technical decisions on wireless policy did not impact DEI or other "social" issues. Unlike telephone or cable service, which required explicit investment in red-lined communities to bring wires to homes, the dominant assumption thought was that wireless did not require any such investment because a single cell tower could cover a large enough footprint to provide service to both traditionally white neighborhoods and non-white neighborhoods.[93] A wireless carrier that wanted to serve wealthier and whiter communities in urban and suburban areas would naturally end up providing similar quality of service to the non-white neighborhoods simply as a function of the technology.

This sort of thinking created a blind-spot in spectrum policy. Policymakers and technologists failed to see that a license area that included marginalized communities, such as Tribal lands or low-income neighborhoods, in combination with requirements to build out to less than the entire population of a licensed area meant that providers could—and often did—choose not to serve the marginalized communities within their footprint. Without legal compulsion, traditionally marginalized communities remain marginalized even when there is not explicit

[93] Burke at 59.

racial animus. Moreover, because communities of color often over-index on wireless mobile phone use, equity arguments are made in favor of increased exclusive licensing even when those arguments ignore the true equitable impact of current policies.

Congress tried to avoid this result by explicitly instructing the FCC to adopt inclusive auction and spectrum policies.[94] Section 309(j)(3)(B) requires the FCC to design auctions that "disseminate licenses among a wide variety of applicants, including . . . businesses owned by members of minority groups, and women."[95] Section 309(j)(4)(C)[96] requires the FCC to consider how to assign "license areas and frequencies" to promote both license acquisition and generally ensure "economic opportunity" to minority-owned and women-owned businesses. Additionally, Section 309(j)(4)(D)[97] instructs the FCC to ensure that minority-owned and women-owned businesses "are given the opportunity to participate in the provision of spectrum-based services," and expressly instructs the FCC to consider bidding preferences to achieve these outcomes.

Even though these provisions go beyond ensuring diverse license ownership, until recently, the few efforts to address the DEI implications of spectrum policy have focused solely on license ownership.[98] Problems like discriminatory pricing and buildout to Tribes were respectively considered a general consumer protection issue or part of the general economic issues facing rural deployment—not issues of concern to technical spectrum policy. In short, despite clear statutory language to consider spectrum policy related factors such as "license area and frequency" as tools of inclusion, the general attitude of technologists was, "Radio waves

---

[94] Omnibus Reconciliation Act of 1993, P.L. 103-66, Section 6002.
[95] 47 U.S.C. § 309(j)(3)(B). The term "minority groups" is defined in Section 309(i)(3)(A) to "include[] Blacks, Hispanics, American Indians, Alaska Natives, Asians, and Pacific Islanders."
[96] 47 U.S.C. § 309(j)(4)(C).
[97] 47 U.S.C. § 309(j)(4)(D).
[98] For example, the FCC has primarily focused on using bidding credits for minority owner bidders or Tribal lands. *See* Tribal Lands Bidding Credits, F.C.C. (last accessed Jan. 24, 2023), https://www.fcc.gov/tribal-lands-biddingcredits#:~:text=The%20FCC%27s%20Tribal%20Lands%20Bidding,to%20or%20below%2085%20percent.

don't see race. Technical rules have nothing to do with either enhancing inclusion or aggravating inequality."[99]

The time has come to correct this "blind spot" in policy. PISC urges NTIA and the FCC to adopt a policy of only enacting spectrum policies that have either a beneficial or net-neutral impact on DEI. This guiding policy will require specific inquiry into the DEI implications of technical spectrum policies as well as investment in research to determine how spectrum access can promote DEI. Moreover, the unique relationship between Tribes and the Federal Government makes it all the more imperative that the NSS include policies that respect Tribal sovereignty and Tribal rights to the spectrum on their lands.

A. NTIA and the FCC Should Ask More Detailed Questions About DEI Throughout Their Spectrum Policy and Rulemaking Procedures

Although each spectrum policy will raise its own DEI issues, there are certain commonalities that the NSS should consider. In particular, the NSS should recognize that ***it is always better to prevent an inequality from happening than to try to remedy it after the fact.*** Combining this principle with the public interest backed guiding policies provides a starting point of inquiry for ensuring that spectrum policies have a beneficial or at least net neutral impact on DEI.

Even though the FCC and NTIA have started including a general DEI inquiry into their respective spectrum proceedings, there are more specific questions that spectrum policymakers should ask regarding the common spectrum policy issues that impact DEI. These include:

1. Do the rules adopted facilitate direct access by traditionally marginalized communities, or otherwise affirmatively prevent traditional patterns of exclusion?

The most direct way to address inequities perpetuated in spectrum related services is to enable businesses owned by people of color and marginalized communities

[99] Burke at 61.

to directly access spectrum. Unlicensed spectrum access and licensing by rule under Section 307(e) (such as that used for CBRS) make spectrum more accessible to those who cannot afford traditional exclusive licenses. When authorizing additional spectrum for exclusive licensed use, our spectrum regulators should consider whether the license area and other characteristics of the spectrum are likely to facilitate traditional patterns of underinvestment and exclusion. Other non-exclusive forms of spectrum access, such as point-to-point or point-to-multipoint authorized on a non-exclusive basis, may permit greater access and more innovative uses in traditionally marginalized communities, whether urban or rural.[100] This is particularly true since many communities of color often face significant barriers in access to capital, which are required for exclusive spectrum disseminated via auction.[101]

2. **What performance metrics, monitoring efforts, and enforcement provisions can our spectrum regulators adopt to make sure that new spectrum policies do not perpetuate inequities?**

Our nation's spectrum regulators should also adopt performance metrics or other strategies to monitor whether inequities are exacerbated after a spectrum decision is implemented. Regulators can use this information to adjust its spectrum policies, assess realistic penalties (including forfeitures into digital inclusion funds or partitioning of licenses to allow access to marginalized communities), and affirmatively prevent future inequities.

---

[100] It is a common assumption that rural communities—if not Native American—are predominantly white. This is not true, and we find significant inequalities between majority-white rural communities and majority-non-white rural communities. Spectrum policy should certainly distinguish between urban and rural issues—but should look at both urban and rural spectrum policy with a DEI lens. See Dominique Harrison, Affordability & Availability: Expanding Broadband in the Black Rural South, Joint Center for Political and Economic Studies (2021), https://jointcenter.org/wp-content/uploads/2021/10/Affordability-Availability-Expanding-Broadband-in-the-BlackRural-South.pdf; Kelsey Berkowitz & Jim Kesler, The Racial Equality and Economic Opportunity Case for Expanding Broadband, Third Way (2019), https://www.thirdway.org/report/the-racial-equality-and-economicopportunity-case-for-expanding-broadband.

[101] William D. Bradford, *Capital Markets Study Discrimination in Capital Markets, Broadcast/Wireless Spectrum Service Providers and Auction Outcomes* (2000), https://transition.fcc.gov/opportunity/meb_study/capital_market_study.pdf; Minority Business Development Agency, U.S. Department of Commerce by Robert W. Fairlie and Alicia M. Robb, *Disparities in Capital Access between Minority and Non-Minority-Owned Businesses: The Troubling Reality of Capital Limitations Faced by MBEs* (2010), https://www.mbda.gov/sites/default/files/migrated/files-attachments/DisparitiesinCapitalAccessReport.pdf; Symposium, Communications Equity and Diversity Council Diversity and Equity Working Group Federal Communications Commission, *Expanding Digital and Media Ownership Opportunities for Women and Minorities* (February 7, 2023), https://www.fcc.gov/news-events/events/2023/02/media-ownership-diversity-symposium.

3. **How do assigned power levels, interference mitigation, or other factors interact with the assigned frequencies?**

Even if marginalized communities are able to access the spectrum they need to self-provision their communities with services that traditional providers will not provide, technical regulations can significantly limit their flexibility and ability to provide critical services. For example, while predominantly non-white, low-income communities have used traditionally unlicensed spectrum in the 2.4 GHz band and 5 GHz band to bring affordable broadband access in urban core neighborhoods,[102] the low power levels adopted in the 6 GHz band limit the potential for this kind of use. This is not to say that such mitigation methods are unnecessary. To the contrary, especially for new uses in crowded spectrum environments, new mitigation techniques that limit use or drive up cost will be inevitable. But nowhere in the record of recent proceedings has the Commission considered the impact of interference mitigation methods such as limiting the power of unlicensed spectrum on DEI. Interference mitigation can involve multiple approaches, some of these will have greater impact on the ability of traditionally marginalized communities to use the new spectrum access regime than others. Going forward, the Commission should expressly consider the extent to which proposed interference mitigation requirements impact DEI by reducing the availability of spectrum in traditionally marginalized communities and limiting the usability of spectrum for marginalized communities. Conversely, the Commission should consider how other approaches can enhance the ability of these communities to take full advantage of the new spectrum access regime.

4. **Do the spectrum policies proposed raise the cost or limit flexibility in a manner that promotes DEI or perpetuates inequality?**

Technical rules drive the cost of devices and services. Some types of mitigation can significantly raise the cost of manufacturing devices or deploying service. For example, while some portions of the 6 GHz band can be used outdoors at higher power levels, this requires use of an automated frequency control system and limits on antenna height. Both of these requirements increase the cost of deployment which further diminishes the utility of the spectrum for innovative, low-cost uses. Additionally, the FCC's decision to require professionally certified installers for CBRS base stations has also limited the ability of low-income communities to create their own local wireless networks by adding a new requirement and by raising deployment costs. The minimal protection using a certified installer can provide against interference caused by faulty installation does not outweigh the barriers such a requirement creates for low-income and

[102] *See e.g.*, Red Hook Wi-Fi Initiative Homepage, (last accessed Jan. 24, 2023), https://redhookwifi.org/.

disadvantaged communities. Our spectrum regulators should consider the cost barriers created by such technical regulations.

Our nation's spectrum regulators must take responsibility for asking whether new spectrum access regimes permit marginalized communities to innovate, meet their needs, and enjoy the services and technologies developed by others. While much of the focus is on deployment of affordable broadband service through unlicensed spectrum and spectrum licensed by rule, the inquiry should not stop there. New technologies such as those used for augmented reality and virtual reality (AR/VR), or spectrum using medical devices and diagnostic tools, if not made available to marginalized communities on an equal and affordable basis, can aggravate existing inequalities or create new ones. By contrast, enabling flexible and affordable access can create new opportunities for traditionally marginalized communities to innovate and meet specific local needs.

B. The NSS Should Include Investing in Spectrum Research to Find and Develop New Ways to Use Spectrum Policy to Promote Diversity, Equity, and Inclusion

There is a knowledge gap between the companies and technologists urging the Commission to adopt certain spectrum policies or modify rules and public interest advocates pushing for more inclusive wireless systems. Few public interest advocates have the expertise or capacity to participate in technical proceedings around new wireless services, and those who do often lack the engineering expertise or financial resources to conduct the experiments and studies that are commonly used as evidence in these proceedings. Our NSS should help bridge this gap by leveraging our national labs to invest in spectrum research that seeks to promote DEI.

In a whole of government approach to using spectrum policy to eliminate the inequity and promote inclusion, NTIA's Institution for Telecommunications Sciences (ITS) could

undertake independent research advised by advocates and community members to find ways to expand spectrum access to promote DEI. According to the ITS mission statement on its website:

> The mission of ITS is to ADVANCE innovation in communications technologies, INFORM spectrum and communications policy for the benefit of all stakeholders, and INVESTIGATE our Nation's most pressing telecommunications challenges through research that employees are proud to deliver.[103]

Conducting research on new ways to use existing spectrum access to promote DEI falls squarely within this mission. The ITS could also research what rule changes could allow traditionally marginalized communities to take greater advantage of spectrum to promote equality and inclusiveness.

Similarly, research grants from federal institutions such as the National Science Foundation could fund research exclusively focused on the use of spectrum policy to promote DEI. This funding could go beyond technical funding. Such grants could, for example, fund research into barriers to adopting spectrum technologies "promot[e] economic opportunity and competition, and ensur[e] that new and innovative technologies are readily available" in traditionally marginalized communities.[104]

The NSS should include a plan to use these opportunities for DEI research and investigate what other resources the federal government can leverage to both conduct and fund spectrum research that addresses DEI challenges.

C. The NSS Should Embrace Our Nation's Federal Trust Responsibility to Tribes By Adopting Policies that Facilitate Tribal Access to Spectrum.

Native American reservations[105] occupy a unique position with regard to spectrum policy. NTIA and the FCC share a "Federal Trust responsibility" with other federal agencies to

[103] ITS: The Nation's Spectrum and Communications Lab, NTIA.gov (last accessed Jan. 24, 2023), https://www.ntia.doc.gov/office/ITS.
[104] 47 U.S.C. § 309(j)(3)(B).
[105] The term "Native American reservations" in this report includes federally recognized Alaskan Native Villages and Hawaiian Homelands.

recognize the "inherent sovereign powers" that Tribes have over their people and lands.[106] This includes an obligation to manage spectrum so that it benefits Tribes. In 2022, the FCC, NTIA, and DOI entered into a joint MOU in order "to promote the deployment, coordination, and development of broadband and other wireless communications services on, and expand access to spectrum over, Tribal lands and Hawaiian home lands."[107] Despite these efforts, Tribal reservations (especially in rural areas) remain among the least served areas in the United States for wireless services (and communications services generally).[108]

A chief cause of this lack of service is the unwillingness of licensees to serve rural tribal lands. Rural tribal lands are often home to relatively small and lower-income populations, which means that—carriers have higher costs to build out and less of a profit opportunity than the more affluent or populous parts of their license. Since carriers only have to provide coverage to a certain percentage of the population with their license area, carrier can often avoid building to these undesirable locations. Some tribes have attempted to use unlicensed spectrum to build their own wireless ISPs to serve Tribal lands. For these Tribes, the limitations of unlicensed access, such as significantly lower power levels than licensed spectrum, have limited the utility of this approach. Moreover, when the FCC repurposes spectrum use (such as opening TV white spaces to unlicensed use), the FCC must negotiate coordination with Mexico and Canada. As a consequence, until the FCC concludes these international negotiations, Tribes with land along the U.S. border cannot use the newly repurposed spectrum.

---

[106] *See* F.C.C., Notice of Proposed Rulemaking, In the Matter of Improving Communications Services for Native Nations by Promoting Greater Utilization of Spectrum Over Tribal Lands, 26 FCCRcd 2623 (2011) [hereinafter Tribal Spectrum NPRM].
[107] Memorandum of Understanding Among the U.S. Dep't of Interior and the Fed. Commc'ns Comm'n and the U.S. Dep't of Com. Nat'l Telecom. & Info. Admin (Nov. 11, 2022).
[108] Alexandra Walsh, Mary Moynihan, and Elizabeth Yin, Hacking Broadband Access in Tribal Lands, The Regulatory Review (Sept. 17, 2022), https://www.theregreview.org/2022/09/17/saturday-seminarhacking-broadband-access-in-tribal-lands/.

Although tribal self-provision may provide a viable coverage alternative, the cost of participating in—let alone winning—a spectrum auction acts as a significant barrier for most tribes. Additionally, the geographic area of most licenses extends well beyond tribal lands. To meet the performance metrics associated with these licenses, Tribes would need to deploy and operate a wireless network well outside their tribal lands.

Fortunately, there are ways to allow Tribes access to the spectrum on their lands without having to resort to traditional auctioned licenses. PISC urges NTIA and the FCC to adopt policies that will help Tribes get access to the critical spectrum they need as part of the NSS,

1. **Holding a Tribal Priority Window prior to every spectrum auction.** The Commission recently adopted a Tribal Priority Window that allowed Tribes to apply for the spectrum licenses covering their lands prior to the 2.5 GHz spectrum auction. During the window, the Commission received 418 applications and amendments from 266 Tribes despite the numerous challenges Tribes faced in completing their applications during the COVID-19 pandemic.[109] This success, not only demonstrates that the demand for spectrum access amongst Tribes is high, but also that the FCC has an effective mechanism for awarding licenses to Tribes outside the auction system.[110] The FCC's authority to create the Tribal Priority Window is not limited to the EBS band. To the contrary, it applies to any spectrum auctioned under the FCC's general authority—meaning that the FCC can, and should, adopt a policy of holding a Tribal Priority Window prior to every auction.[111]

2. **Permitting Tribes to access federal spectrum on tribal lands.** Section 927(b) of the Communications Act[112] allows the Secretary of Commerce, in conjunction with the FCC, to permit non-federal entities to share spectrum

[109] Mark Colwell, Success of Rural Tribal Window Demonstrates Need for Rural Education Window, Voqal (Sept. 9, 2020), https://voqal.org/success-of-rural-tribal-window-demonstrates-need-for-rural-education-window/.
[110] *See* Public Notice, *Wireless Telecommunications Bureau Waives 2.5 GHz Rural Tribal Window Specific Interim Deadlines* (rel. July 8, 2022) (noting that FCC had at that time issued 335 licenses to over 350 Tribes in 30 states), https://www.fcc.gov/document/25-ghz-rural-tribal-window-extension- performance deadlines.
[111] The success of the Tribal Priority Window should not justify forcing Tribes to operate their own networks. Rather, Tribes that want to provide service to their communities should have an opportunity to do so.
[112] 47 U.S.C. § 927(b).

> allocated for primarily federal use. In light of the Federal Trust Relationship, which creates a unique relationship between Tribal governments and federal agencies, it would serve the public interest to invoke this provision to permit Tribal governments access to federal spectrum on tribal lands—subject to rules established by the FCC. This access could be accompanied by formally recognizing that tribes have an interest in the electromagnetic spectrum on their tribal lands, restoring an additional measure of sovereignty to Native American Tribes. Additionally, CBRS-type band planning also demonstrates that non-federal entities can successfully share federal spectrum with federal users without causing harmful interference. The FCC (and federal users) can and should build off of the CBRS framework to develop sharing mechanisms unique to Tribal lands.

Our NSS should include policies that respect tribal sovereignty by allowing Tribes to access the spectrum on their lands. Such policies align with the Federal Trust relationship the governement and its agencies has with Tribes and will help address the service issues that disproportionately affect Tribal communities.

VI. CONCLUSION

NTIA has an opportunity to adopt a NSS that will not only secure our nation's future as a wireless leader but also serve the public by moving us towards a future that serves and includes *all* Americans. To achieve this, PISC urges NTIA to adopt guiding policies for the NSS that are rooted in the public interest, such as—

- **Maximize Spectrum Access & Bandwidth Abundance by Promoting Spectrum Sharing & Investing in Spectrum Reuse Technologies.**
- **Optimize Interference Metrics to Reflect Actual Interference and Current Advances in Technology.**
- **Recast Efficiency Using Metrics that Serve the Public Interest.**
- **Prioritize Diversity, Equity, and Inclusion.**
- **Minimize the Negative Effects that Auction Revenues Have on Spectrum Policy.**

These guiding policies should inform specific actions that will help our nation navigate towards an inclusive future that addresses the critical spectrum challenges we are facing today.

Respectfully submitted,

/s/ Kathleen Burke
Policy Counsel
Admitted to the Bar under D.C. App. R. 46-A (Emergency Examination Waiver)
Public Knowledge
1818 N Street NW, Suite 410
Washington, DC 20036

/s/ Michael Calabrese
Director, Wireless Future Project
Open Technology Institute at
New America
740 15th Street, N.W., Ste 900
Washington, DC 20005