

The NATIONAL SPECTRUM STRATEGY AND IMPLEMENTATION PLAN

MONISHA GHOSH

The past few months have witnessed a number of spectrum-related events and announcements that should be of interest to academic researchers working in the field of spectrum technology and policy and guide future research efforts in this field. The December 2023 column [1] went to press just as The National Telecommunications and Information Administration (NTIA) in the U.S. released its National Spectrum Strategy (NSS) on November 13, 2023 [2], where the bands 3.1–3.45 GHz, 5.03–5.091 GHz, 7.125–8.4 GHz, 18.1–18.6 GHz and 37.0–37.6 GHz were identified for study over the next 2 years for possible allocations to commercial wireless services. Shortly following this release, the International Telecommunications Union (ITU) held the World Radiocommunications Conference 2023, WRC-23, during November 20 – December 15, 2023 in Dubai [3]. The February 2024 column [4] reported on some of the outcomes of WRC-23, specifically a number of study items that will be pursued by the ITU-R, the Radiocommunication Sector of the ITU, to be completed in time for WRC-27, and encouraged researchers to contribute to this effort. Most recently, the NTIA released the NSS Implementation Plan (IP) on March 12, 2024 [5], detailing a process and timeline for executing the strategy laid out in the NSS. This column will describe the main aspects of the NSS and the IP that will be of interest to researchers in the field.

THE FOUR PILLARS OF THE NATIONAL SPECTRUM STRATEGY (NSS)

The NSS laid out a long-term strategy with four pillars and twelve strategic objectives as follows:

- Pillar One: A Spectrum Pipeline to Ensure U.S. Leadership in Advanced and Emerging Technologies, for both Federal and non-Federal use.
- Pillar Two: Collaborative Long-Term Planning to Support the Nation's Evolving Spectrum Needs.
- Pillar Three: Unprecedented Spectrum Innovation, Access, and Management through Technology Development.
- Pillar Four: Expanded Spectrum Expertise and Elevated National Awareness.

Each of the above pillars have accompanying strategic objectives to help guide the outcomes. Most importantly, the following four spectrum bands were identified for study over the next 2 years:

- **3.1–3.45 GHz:** This band was studied over the past 2 years by the NTIA, Department of Defense (DoD), industry and academia in the Partnering on Advancing Trusted and Holistic Spectrum Solutions (PATHSS) group within the National Spectrum Consortium (NSC) [6]. The aim was to investigate if and how this band could be shared between DoD uses (primarily radar) and commercial wireless. That process concluded in 2023 that sharing between Federal and non-Federal uses may be possible with appropriate interference mitigation and spectrum management. The NSS seeks to extend this prior work and develop the necessary mechanisms that will enable dynamic spectrum sharing in this band.
- **5030–5091 MHz:** This band already has an open Notice of Proposed Rulemaking (NPRM) [7] seeking to permit deployment of Unmanned Aircraft Systems (UAS), including networked control that will permit beyond visible line of sight operation.
- **7125–8400 MHz:** This is a federal band with a number of different mission-critical incumbents, including fixed and mobile terrestrial and satellite links, space research and earth exploration satellites in different portions of the band. It will be challenging to add non-Federal services to the band while protecting Federal incumbents from harmful interference.

- **18.1–18.6 GHz:** This band is currently primarily allocated to Federal and non-Federal satellite services: these will be expanded to include space-to-space allocations.
- **37.0–37.6 GHz:** This band is currently allocated to Federal and non-Federal mobile and fixed terrestrial and satellite services. The studies will further develop a co-equal, shared framework to enhance utilization of the band.

Additionally, the strategy emphasizes that dynamic spectrum sharing (DSS) will be rigorously studied especially in the context of sharing in the 3.1–3.45 GHz and 7.125–8.4 GHz band and proposes the development of a DSS testbed to experiment in real-world sharing conditions.

THE NATIONAL SPECTRUM STRATEGY IMPLEMENTATION PLAN (IP)

The IP [5], which lays out a plan to achieve the objectives of the strategy, is a thoughtful, detailed document that should be read by all academic researchers interested in spectrum research since one of the foundational principles of the plan is to develop a collaborative framework between industry, government and academia. It covers not only the technical aspects of spectrum coexistence and sharing, but also the workforce needs of the future. Proposed education activities include making policymakers aware of technical aspects of spectrum use. The 4 pillars and 12 strategic objectives laid out in the strategy are addressed by 36 projected outcomes, each with specific deliverables, responsible agencies and timelines, as summarized in the Implementation Plan Summary Table in [5]. Here, we highlight some of the outcomes which should be of interest to the academic research community since the plan specific mentions academic collaboration for the following:

- **Outcome 2.2(a):** A value-based model to inform spectrum policy decisions. This activity, in collaboration with the National Science Foundation (NSF) and academia will tackle the difficult questions surrounding how to evaluate different spectrum uses in a fair and balanced manner. This is a necessary step in order to maximize spectrum utility by either shared or exclusive use between Federal and non-Federal users. This activity has an estimated start date of March 2026 and will last 12 months.
- **Outcome 3.1(a):** A process to identify enabling technologies for spectrum-dependent systems to enhance spectrum efficiency and foster coexistence. This activity will develop new technologies that improve spectrum coexistence among different users of the band. This activity has an estimated start date of October 2025 and will last 6 months.
- **Outcome 3.1(c):** A roadmap for improving receiver resistance to harmful interference. Receiver standards were addressed in a Federal Communications Commission (FCC) Notice of Inquiry [8] and subsequent policy statement [9], but only for non-Federal bands. This activity has an estimated start date of October 2025 and will last 9 months.
- **Outcome 3.1(d):** Recommendations for potential investment based on assessment of smart spectrum management technologies. This activity has an estimated start date of March 2026 and will last 6 months.
- **Outcome 3.2(c):** Process for a national (including government, industry, and academia) assessment and certification of spectrum R&D infrastructure and tools. This activity has an estimated start date of March 2026 and will last 6 months.
- **Outcome 3.2(d):** Data collection and spectrum utilization program, including data collection and measurement campaigns involving academia. This activity has an estimated start date of October 2025 and will last 12 months.

- **Outcome 3.2(f):** Advanced dynamic spectrum sharing demonstration and report, focusing on innovations in 3.1 – 3.45 GHz beyond the spectrum sharing mechanisms adopted by the Citizen Band Radio Service (CBRS). This activity has an estimated start date of March 2024 and will last 18 months.
- **Outcome 3.2(g):** National DSS Testbed. Instead of a single testbed, this will be a federated network of testbeds allowing experimentation in multiple sites, including experiments conducted by NSF funded researchers. This activity has an estimated start date of March 2024 and will last 18 months.
- **Outcome 4.1(b):** Agency spectrum workforce programs, with involvement from academia. This activity has an estimated start date of March 2024 and will last 12 months.
- **Outcome 4.2(a):** Senior-level spectrum training and awareness materials repository, created in collaboration with the Congressional Spectrum Caucus, Federal and non-Federal agencies and academia. This activity has an estimated start date of September 2024 and will last 12 months.

CONCLUSIONS

With the conclusion of WRC-23 and the release of the NSS Implementation Plan, a number of new bands have been identified for study over the next 2–4 years. The bands of immediate interest for commercial wireless applications (both cellular and Wi-Fi) are the 3.1–3.45 GHz and 7.125–8.4 GHz, both worldwide and in the U.S. There are a number of technical

challenges, mostly related to sharing with co-channel and adjacent channel Federal incumbents that will need to be addressed before these bands can be made available for non-Federal use. Dynamic Spectrum Sharing will be a key technology that will be critically evaluated for adoption in these bands.

REFERENCES

- [1] M. Ghosh, "World Radiocommunications Conference 2023, WRC-23," *IEEE Wireless Commun.*, vol. 30, no. 6, Dec. 2023, pp. 4–4. DOI: 10.1109/MWC.2023.10355082.
- [2] The National Spectrum Strategy, https://www.ntia.gov/sites/default/files/publications/national_spectrum_strategy_final.pdf.
- [3] ITU World Radiocommunication Conference 2023 (WRC-23), <https://www.itu.int/wrc-23>.
- [4] M. J. Marcus and M. Ghosh, "ITU-R Study Group Issues for 2023-2027 of Likely Interest to Wireless Researchers," *IEEE Wireless Commun.*, vol. 31, no. 1, Feb. 2024, pp. 4–5. DOI: 10.1109/MWC.2024.10438980.
- [5] The National Spectrum Strategy Implementation Plan, <https://www.ntia.gov/sites/default/files/publications/national-spectrum-strategy-implementation-plan.pdf>.
- [6] National Spectrum Consortium, <https://www.nationalspectrumconsortium.org/working-groups>.
- [7] FCC NPRM, Spectrum Rules and Policies for the Operation of Unmanned Aircraft Systems, https://docs.fcc.gov/public/attachments/FCC-22-101A1_Rcd.pdf.
- [8] Notice of Inquiry, Promoting Efficient Use of Spectrum through Improved Receiver Interference Immunity Performance, <https://docs.fcc.gov/public/attachments/FCC-22-29A1.pdf>.
- [9] Policy Statement, Promoting Efficient Use of Spectrum through Improved Receiver Interference Immunity Performance, <https://docs.fcc.gov/public/attachments/FCC-23-27A1.pdf>.