

Federal Register Notice: 89 FR 12871, <https://www.federalregister.gov/documents/2024/02/20/2024-03400/request-for-information-on-the-national-spectrum-research-and-development-plan>, February 20, 2023.

Request for Information on the National Spectrum Research and Development Plan

Federated Wireless, Inc.

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March 21, 2024

Ms. Mallory Hinks
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314
USA

Re: Request for Information on the National Spectrum Research and Development Plan

Dear Ms. Hinks -

Federated Wireless, Inc. (“Federated Wireless”), the industry leader in the development and deployment of commercial dynamic spectrum management solutions (“DSMS”),¹ offers these comments² in response to the Request for Information (“RFI”)³ on the National Spectrum Research and Development Plan (“R&D Plan”) issued by the National Science Foundation (“NSF”) that seeks to “identify key innovation areas for spectrum research and development” that will achieve “measurable advancements in state-of-the-art spectrum science and engineering.”⁴

We appreciate the opportunity to share our perspectives on this matter, which is of critical importance to the implementation of the National Spectrum Strategy (“NSS”) and to sustained U.S. leadership in advanced wireless technologies and services. We hope our expertise in the development and deployment of groundbreaking DSMS technology and products will prove useful to NSF as it develops an R&D Plan that will identify priority areas and recommend productive directions to improve spectrum management and usage.

¹ Federated Wireless is a certified Spectrum Access System (“SAS”) administrator for the Citizens Broadband Radio Service (“CBRS”) band and an approved Automated Frequency Coordination (“AFC”) system operator for the 6 GHz band.

² This document is approved for public dissemination. The document contains no business-proprietary or confidential information. Document contents may be reused by the government in the National Spectrum R&D Plan and associated documents without attribution.

³ National Science Foundation, Request for Information on the National Spectrum Research and Development Plan; available at <https://www.federalregister.gov/documents/2024/02/20/2024-03400/request-for-information-on-the-national-spectrum-research-and-development-plan> (“RFI”).

⁴ RFI.

1. Recommendations on strategies for conducting spectrum research in a manner that minimizes unnecessary duplication, ensures that all essential spectrum research areas are sufficiently explored, and achieves measurable advancements in state-of-the-art spectrum science and engineering. This includes, but is not limited to, the following:

- ***Methods/approaches to increase coordinated investment in R&D amongst government agencies, academia, civil society, and the private sector***
- ***Structural and process improvements in the organization and promotion of Federal and non-Federal spectrum R&D***

In order to assure that spectrum research results in measurable advancements, Federated Wireless recommends that the R&D Plan focus on 1) areas and projects that can be solved in the near-term; and 2) projects that include federal to federal, federal to commercial, and commercial to commercial sharing.

Furthermore, we strongly urge the federal government to refrain from “reinventing the wheel,” particularly as it relates to DSMS technology and tools. There exist today commercial solutions that can and should be leveraged by the federal agencies to manage spectrum resources without the need for new federal development efforts. The commercial sector is willing and able to continue to invest in these DSMS capabilities and should be incentivized to do so. That being said, we recognize and encourage targeted federally funded research and development to enhance these capabilities as described in response to Question 2 below.

2. Recommended priority areas for spectrum research and development, as well as productive directions for advancing the state-of-the-art in those areas. Areas of interest include, but are not limited to, the following:

- ***Spectrum utilization efficiency***
- ***Spectrum resilience and assured access for critical mission applications and passive scientific observation***
- ***Dynamic spectrum access and management***
- ***Spectrum situational awareness at scale***
- ***Automatic and rapid mitigation of interference problems***
- ***Modeling for coexistence analysis***
- ***Topics relevant to each of the above include, but are not limited to, the following:***
- ***Technical methods, designs, and processes***
- ***Economic-, market-, social-, and human-centric concerns***
- ***Business and economic models***
- ***Protection of citizen privacy, sensitive government missions, and business proprietary data***

- *Cost-effective hardware supporting more dynamic spectrum usage*
- *Use of artificial intelligence and machine learning techniques*
- *Testbed development*
- *Assessment and certification of advanced systems*

In addition to the list above, which is an excellent start, Federated Wireless recommends that the following research areas also be prioritized in the R&D Plan:

- Improvements to existing DSMS implementations, such as the CBRS SAS and 6 GHz AFC, to enable even greater spectrum efficiency. For example, today, the SAS manages commercial access to the band by listening for naval radar operations via a network of environmental sensing capability (“ESC”) sensors, via an online scheduling portal, or through static exclusion zones. In many cases, commercial CBRS operations can be interrupted for longer periods of time or over larger geographic areas than necessary to protect actual incumbent use. The use of more real-time information, provided via automated notification, to manage access to frequencies and assign transmit power levels would improve shared spectrum access usage by commercial users. Similarly, the use of advanced propagation models would enable far more efficient use of available spectrum as compared to the outdated and overly conservative models that have been used historically. Finally, revision to incumbent protections requirements based on real-world measurements, rather than theoretical modelling, could greatly improve spectrum sharing and efficiency. Federal R&D funds should be targeted at these specific near-term improvement opportunities.
- Spectrum requirements and access challenges for non-traditional mobile network operators, including enterprises, municipalities, educational institutions, and other non-traditional operators.
- Virtualization of radio access network (“RAN”) functions and a common, Open RAN Intelligent Controller (“RIC”) with Service Management and Orchestration (“SMO”) capability. Having a commercial-ready, common RIC/SMO platform will facilitate a wide community of developers to build applications to make more efficient use of 5G networks and spectrum on a massive scale and tailored to the use cases needs of various enterprises. Without such a platform, technology and solution development will remain hampered by the limitations associated with the closed, vendor-locked and preferred network configurations of large mobile network operators and their preferred suppliers.
- A common spectrum management platform for federal agencies to collect and analyze data about current real-world usage, while taking issues like cybersecurity into account. This platform could use cloud-based spectrum management, artificial intelligence/machine learning (“AI/ML”), advanced antenna technology, open and

interoperable network architectures, cognitive transceiver technologies, advanced RF microelectronics, simultaneous transmit and receive, and edge intelligence.

- Improvements in workforce efficiency through use of autonomous vehicles, machine learning, and augmented/virtual reality applications.
- Low-rate initial production (“LRIP”) of new software and hardware solutions aimed at Open RAN and spectrum management advancements.
- Spectrum sharing between terrestrial networks (3GPP, Wi-Fi) and non-terrestrial networks (LEOS, MEOs). Sharing/quasi non-cooperative and integrated operations should both be explored.

3. Recommendations on grand challenge problems for spectrum R&D. Grand challenges are selected research problems that if attacked will help motivate and coalesce R&D efforts. Such problems have the following characteristics:

- ***The goal can be concisely articulated to stakeholders outside the field***
- ***Success or failure is clear***
- ***Achieving success requires advancing the state-of-the-art in multiple areas***

As described in response to the previous questions, Federated Wireless recommends that the government initiate R&D projects that, together with industry experts, can leverage cloud-computing and automation to maximize the efficiency of federal use, while also enabling more responsive, real-time sharing of spectrum between federal and non-federal users. With each iteration of DSMS technology, we have been able to greatly accelerate access to new spectrum bands. Rather than reinvent the wheel with each new band, however, we should build upon the successes of prior dynamic sharing frameworks and identify opportunities to iterate and improve.

We also recommend that market adoption challenges faced by small and medium-sized enterprises should be a focus area and that solutions developed through the R&D Plan should be able to be exported globally and become self-sustaining through commercial adoption. We recommend grant proposals contain statements on the project’s relevance to commercial success and steps to transition from testbed to commercial operation. We also encourage the R&D Plan to include collaboration with organizations that can develop a statement of objectives and statement of work in a format agreed by a consortium or consensus of companies. Finally, non-traditional innovators should not be burdened by traditional federal acquisition regulation accounting or compliance processes, which will otherwise limit participation, especially by small and medium sized enterprises.

4. Recommendations on spectrum R&D accelerators such as the following:

- ***Shared public datasets***

- *Open-source software/projects*
- *Cost-effective flexible radio platforms*
- *Benchmarks and competitions*
- *Testbeds, research infrastructure, and collaboration support*

To accelerate schedules and deliverables and leap ahead of global competition, it is important to ensure that access to funding is made available in the immediate future, rather than 8-10 years from now. To have meaningful impact on U.S. leadership in this space, we recommend that the R&D Plan endorses front-loading funding and prioritization of projects that have practical outcomes and a focus on commercial readiness.

Furthermore, the majority of the R&D Plan's support should go to small and medium enterprises to address operational and market adoption challenges, such as commercial readiness of development, security, and operations (DevSecOps), scale and availability, enterprise and security integration, monitoring and management, end-to-end testing, etc. Increasing and easing spectrum access for more enterprises to launch commercially relevant capabilities and supporting development of a common vendor-neutral RIC/SMO platform should be two areas that can be exported globally and become self-sustaining.

Federated Wireless encourages the R&D Plan to include Open Testing and Integration Centers ("OTICs") that can be operated over time and will support new product and application development and testing. While academic and government-run OTICs are important contributors, industry and use-case focused OTICs will be critical to ensure solutions make it to market and become self-sustaining.

We also recommend the R&D Plan expand existing Department of Defense ("DoD") investments in 5G testbeds to the surrounding communities for dual use commercial and military use cases. The NSC could provide industry consensus on prototype, trial and testbed approaches.

The R&D Plan should include the development of an open database of government research solicitations and corresponding results that can be input to a large language model ("LLM") and then queried by the public and government agencies. Such an approach will result in efficient coordination across the federal agencies and would significantly reduce the cost of understanding the state-of-the-art in spectrum research.

Open data sets (identified as an accelerator) are quite important for ML and were a key enabler for LLMs. However, if we want Large RF Models ("LRFMs") we need truly large, tagged, curated RF data sets, which is a significant undertaking and should be included in the R&D Plan. Furthermore, AI for RANs is a critical technology for 6G and would have overlapping data, but only partially. A similar initiative to establish a large open database of RAN metrics and operational data should be undertaken.

NSF should take a more active lead in the development of open 3GPP and ORAN software repositories.

5. Recommendations on near-term Federal activities to make progress towards anything identified in responses 1–4.

Updating and improving propagation models and incumbent protection requirements should be top priorities for the R&D Plan.

6. Recommendations on a process to refine and enhance the R&D plan on an ongoing basis.

N/A

7. Terminology and definitions relevant for spectrum R&D.

- ***One term of interest is “Dynamic Spectrum Sharing” which is a focus of the National Spectrum Strategy but was not defined.***

Federated Wireless recommends that the terms “Dynamic Spectrum Sharing” and “Dynamic Spectrum Management Systems or Solutions” be defined as follows:

DSS (also referred to as Dynamic Spectrum Access or DSA) is the use of software, cloud-computing, automation, as well as alternative spectrum licensing approaches to enable more efficient use of spectrum by multiple network operators and/or end users.

DSMS are the technology and tools, including cognitive radios, spectrum sensing and environmental sensing technologies, spectrum access systems, and dynamic frequency coordinators, that together support DSS to dramatically improve spectrum utilization, increase the reach and reliability of wireless communication systems, and reduce the cost and complexity of deploying and managing wireless networks.

8. Other topics.

N/A



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Conclusion

Federated Wireless appreciates the opportunity to provide these comments on the NSS R&D Plan. Federated Wireless recommends that the R&D Plan focus initially on updating propagation models and fine-tuning incumbent protection requirements. We also encourage funds be directed towards projects that will solve spectrum access challenges by diverse users, invest in the development of open interfaces to manage network control, configurability, and optimization, and those that are focused on solving real-world commercial and operational challenges.

Respectfully submitted,

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