Unofficial Notes

2024 NTIA Spectrum Policy Symposium

February 1, 2024

Washington, D.C.

Financial, Valuation, and Industry Consulting

NOTICE: These notes were taken live at the NTIA's 6th Annual Spectrum Symposium in Washington, D.C. February 1st, 2024. They are a good-faith representation of our impressions of the events and what was said by participants. However, we cannot guarantee the accuracy of any specific comment. These notes are not endorsed by the NTIA in any way. This document is not a recommendation to buy or sell any security. Please consult with appropriate professional advisors before making significant business decisions. Comments and corrections are welcome.

49 West 38th Street, 12th Fl New York, NY 10018 ■ +1 212.433.4800 ■ info@SummitRidgeGroup.com

EXECUTIVE SUMMARY

NTIA's sixth annual Spectrum Policy Symposium (the "Symposium") took place at the National Press Club in Washington, D.C., on February 1, 2024. The Symposium focused on implementing the National Spectrum Strategy ("NSS"), which the White House released on Nov. 13, 2023, along with a presidential memorandum on "Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy."

The event included keynote speeches by key policy-makers from the White House, the Department of Commerce, and the Federal Communications Commission. Keynote speeches and panel discussions focused on the implementation of the four "pillars" of the National Spectrum Strategy, how they can be implemented by the Administration, and the National Spectrum Strategy's impact on spectrum management coordination and national spectrum policies.

The main takeaway is that, although the National Spectrum Strategy identified over 2700 MHz of spectrum for potential mobile broadband, it is going to be a challenging road to actually making most of that spectrum available. Most of the spectrum needs to be offered via dynamic spectrum sharing ("DSS") with incumbent government users, particularly the Department of Defense (the "DoD").

The challenges of negotiating DSS for mobile broadband use with the DoD include there being: 1) No agreed upon working definition of harmful interference vs. benign interference; 2) No clear metrics to consider, or process to follow when evaluating the use of a particular band; 3) No clear decision-making process or decision-making hierarchy; 4) Limited ability for the DoD to share data about their equipment and usage due to security concerns.

Table of Contents

MORNING SESSION

A. Welcome

Initial remarks and MC: Scott Harris, NTIA Sr. Spectrum Advisor

- Made a bad spectrum joke[1]
- The theme of the Symposium was the implementation of the National Spectrum Strategy

Welcome Video: Gina Raimondo, U.S. Secretary of Commerce

- Dept of Commerce's goal is to make the US more competitive
  - Making a lot of tech investments – also important for national security
- Spectrum is an important component – need to modernize the US approach
  - 2700 MHz has been identified for research

Welcome and Introductory Remarks: Alan Davidson, Assistant Secretary of Commerce

- Thanks to Scott Harris and to Gina Raimondo, who has done a lot to support spectrum even before becoming Secretary of Commerce
  - An exciting time for spectrum policy – events like today give important feedback
  - We are asking a lot more from devices, particularly connectivity, driven by spectrum
- The same demands driving the private sector are driving federal uses as well. Can only meet demand with a coherent long-term strategy that offers more certainty to the private and public sectors *[AM Comment: During the conference, no one pointed out that 5G growth is stalling. While long-run spectrum demand will undoubtedly increase, the US wireless sector has been in a lull for a year or so while it 1) digests the spectrum it currently has; and 2) implements technologies such as Massive MIMO that dramatically improve spectral efficiency]*
  - Need to use technology better
  - Need to grow the ecosystem of spectrum workforce

B. Keynote Speeches

Don Graves, Deputy Secretary, U. S. Department of Commerce

- National Spectrum Strategy is essential to maximize national economy and security
  - Spectrum is our most valuable asset and key to our future

[1] "Did hear about the marriage of two antennas? The wedding was OK, but the reception was great"

    - Adversarial nations are challenging us everywhere, including China who is challenging the US on 5G and eventually 6G. President Biden understands this
    - Mentions BEAD *[AM Comment: not sure what BEAD has to do with spectrum, but presumably he was discussing the larger theme of connectivity]*
    - Mentioned O-RAN test bed
- Need forward-looking spectrum management

Anne Neuberger, Deputy National Security Advisor for Cyber and Emerging Technologies, National Security Council

- Need to sit in a room with the doors closed to resolve hard problems
- The largest user of spectrum, the US Government, needs to get on board with modern spectrum management National strategies are not done every year and need to be forward-looking
    - In a battle with the PRC, the only country with the means and intention to change the world order
- Spectrum is like telegraph and railroads were 100+ years ago
    - Want every child to have access to connectivity
    - Need access to spectrum to make this happen
    - National security depends on reliable, continuous connectivity
- The easy pickings are done, and spectrum is getting congested *[this theme was repeated many times throughout the event]*
    - Strategy offers a pipeline for new spectrum and dynamic sharing
    - Study of 2700 MHz to be completed in under two years – not open-ended
- Using AI and Edge computing so DoD and other entities can use it alongside commercial users
    - Many advantages to making more spectrum available, and President Biden understands this – spectrum keeps people safe everywhere around the world

Anna Gomez, Commissioner, Federal Communications Commission

- Has worked at FCC, NTIA, State Department, and private sector
    - Collaboration makes good policy
    - National Spectrum Strategy began two years ago
    - Updated MOU between FCC and NTIA and lots of collaboration
- NTIA now drafting an implementation plan for Spectrum Strategy
    - Process needs to move with alacrity *[AM Comment: I admit, I need to look up the definition of "alacrity." It means "cheerful readiness, promptness, or willingness." This word choice may be significant. The complexity of the process may hinder it from simply moving "rapidly"]*
    - NTIA does not have an interest itself in any spectrum band
    - New committee of stakeholders to advise the NTIA set-up by President Biden
- Auction authority is critical to moving the process forward

- Will need to coordinate more closely as spectrum demand grows and it is harder to identify greenfield spectrum
- Dynamic spectrum sharing will be increasingly needed – but terms will need to be reliable to induce the private sector to invest
  - Thirst for wireless spectrum is global
  - Need to build relationships with regulators around the world as well as with industry
- Lots of work ahead *[AM Comment: Major Understatement IMHO]*

C. Pillar 1 Panel Discussion: A Spectrum Pipeline to Ensure U.S. Leadership in Spectrum-based Technologies

Description: Industry and government require more spectrum than ever to innovate, supply consumers with new and emerging services, and carry out critical missions for the benefit of the American people. Accordingly, the National Spectrum Strategy identified 2,786 megahertz of spectrum for in-depth, near-term study for repurposing. The bands will be studied for terrestrial wireless broadband, innovative space services, unmanned aviation, and more.

Moderator: Charles Cooper

- Spectrum must be made available for existing and new uses for federal and non-federal uses
- Federal agencies may have access to a federal relocation budget

James Assey, Executive VP, NCTA

- Spectrum is not about one service or another, but about connectivity that is needed for everything. Demands continue to increase
- The [National Spectrum] Plan is ambitious, but it should be
  - Potential to make a new Gbps wi-fi channel at 7 GHz
  - Need to have actionable progress soon
  - Likely to be an iterative process of collaboration - no “eureka” moment
  - MHz to MHz spectrum comparisons are not really comparable

Robert Hampshire, Deputy Assistant Secretary for Research and Technology, Department of Transportation

- Spectrum strategy was a large task pulling together all of the different perspectives

  - Very exciting time in transportation including vehicle to infrastructure (V to X) potentially using 5.9 GHz and other spectrum
  - Integration jet packs and similar into air space is a big challenge
- Department of Transportation has the most spectrum outside the DoD, including GPS. Also working on PNT (Positioning, Navigation, Timing) services that are complementary to other service
- Often the split between federal and non-federal spectrum is not always clear – regulated entities for example

Jennifer Warren, VP–Regulatory Affairs & Public Policy, Lockheed Martin

- Lots of common drivers between spectrum demands of federal and commercial users
  - Next generation radar capabilities in the lower mid-band are significant – it's not all just communication application
  - Lower mid-band is also used for fighter planes. WRC refused to consider lower mid-band for IMT
- Collaboration is at the heart of what needs to happen, and process is important
  - Process should be about both technical and operational feasibility – need spectrum heads to co-lead. Technical alone is not enough – need to have the agency impacted to be in the meeting so there is input into how it works.
  - It can be good to have academics and those who can do simulations and modeling
  - Some bands will require classified access
  - Should be transparent, and the public should have access to the data when possible
  - Not all is for 5G

[AM Comment: Lockheed Martin is in an unusual spot. It is a commercial company, but much of its spectrum is related to serving DoD-related activities]

Jonathan Campbell, Legal Advisor–Wireless, International & Space, Office of the Chairwoman, Federal Communications Commission

- Things that help commercial users can also help federal users
  - Demand is growing, so time is not on our side – cooperation is critical
  - Will simultaneously move forward on other spectrum management plans – just released an order for more efficient use of 70- 90 GHz band
  - Will work on flexible use rules to foster innovation
  - Many of the bands identified are also ripe for global harmonization
    - 5 GHz is important for drones – working with FCC and NTIA
    - Lower 37 GHz – earmarked for shared non-federal and federal use

- Some ongoing work at the FCC can support the goals of the Spectrum Strategy
- 18 GHz is used for satellite, but potentially other use options as well
- FCC is working on in-space servicing and manufacturing

- Want a glide path for putting identifying spectrum into use ASAP – but need auction authority – optimistic it will be restored *[AM Comment: I don't fully agree with the urgency argument given the current slowing 5G rollout, but perhaps it is a matter of perspective – making additional spectrum available will take time given the complex issues, so we need to start soon]*
  - Process will only benefit from an array of voices

Umair Javed, Senior VP for Spectrum, CTIA

- Starting 2024 without auction authority and less spectrum than our rivals
- Strategy is very important
  - Used the example of Kodak, which previously dominated photography – they had a digital strategy but did not put enough resources behind it as they did not see the speed that digital would take over
  - Need to define the vision of where we want to be in two years so we can chart a path towards it
- In addition to "what technology" is being developed, but also "who is benefiting" from it. Mid-band spectrum is critical to allowing 5G speeds to increase by 40% in a single year and allowing FWA to create new competition
- Collaboration is important
  - Need to cultivate a healthy dissatisfaction with the status quo and not wait for crisis to act
  - NTIA should be in charge of spectrum allocation
  - Don't want incumbents to have control over the process as they have invested interests
- Need to consider where we are as a country – leading the world on spectrum allocation, but trailing the work on mid-band spectrum for widescale use

D. Pillar Panel 2 Discussion: Collaborative Long-Term Spectrum Planning to Support the Nation's Evolving Spectrum Needs

Description: The Strategy calls for a new collaborative framework to right-size the nation's spectrum planning processes. The goal is to eliminate jurisdictional silos and to establish a single system that will be evidence-based, data-driven, collaborative, and transparent. The

new framework is also envisioned as a way to match and deconflict federal and non-federal spectrum uses.

Moderator: Derek Khlopin

- Some work to identify problem upfront may reduce the need for additional data collection

John Kuzin, VP – Spectrum Policy & Regulatory Counsel, Qualcomm

- Opening spectrum is important for the economy and thus international leadership
- Interference is the common enemy. Interference that stops communication is harmful interference. Not all interference is harmful
    - Over-protective interference requirements is not a good idea as it shuts down valuable uses
    - Successful collaboration is based on trust and need trust to use evidence-based decisions
    - Especially with respect to interference and whether it is damaging
- Learned a lot from the C-band interference claims related to altimeters
    - A lot can be done with a common baseline of knowledge
- A lot more can be done with spectrum than is currently done
    - Lots of work done in committees is done via working groups
    - Testing takes time – can work be done upfront to see if interference can be eliminated? Also, how important the applications involved are? Endless testing can waste a lot of time

Flynn Rico-Johnson, Deputy Chief of Staff, Congresswoman Doris Matsui

- Want to make a downpayment on a sustainable way to make spectrum policy decisions
    - Want to establish consensus methodologies *[AM Comment: This is a great goal, but there seems to be little consensus on good consensus methodologies, especially given the diverse stakeholder interests and technical challenges facing allocation of additional spectrum in the U.S.]*
    - Have a unique opportunity to bring ideas to life – looking forward to what the NTIA does

Brett Kilbourne, representing the Utilities Technology Council (UTC)

- Have concerns about interference, especially unlicensed in 6 GHz
    - Collaborative framework should include all stakeholders and create opportunities in CSMAC and IRAC, for example, for input
- Need high standards for interference protection when life is on the line – can't fix after the fact
    - Need to change how we think about spectrum and how we use it

- There is a qualitative aspect of how spectrum helps society – there are other non-commercial uses that matter, such as for utilities that protect critical infrastructure
    - May lose time if we try to rebuild the wheel
- Need a level of trust to accept the evidence – will the data be shared?
    - Some spectrum bands might be easier than others and might allow for some significant early wins *[AM Comment: Seems like a smart approach]*
- Putting NTIA in the role of evaluating alternative spectrum use is a good thing
    - Can work with people, but need a recognition that we can't compromise critical infrastructure. Needs some harmonization of spectrum policies – e.g., urban planning for spectrum

Mary Brown, Advisor to WIFI Forward

- Wireless will add $1.8 trillion to the US economy by 2025
    - The wi-fi industry is enthusiastically embracing spectrum strategy implementation.
    - Concerns are the time needed to get the collaborative process underway
        - Suggest that NTIA builds on what it already has (CSMAC and IRAC, etc.) – An advisory committee could potentially work on national security issues
        - Perhaps subcommittees might work
- Technical issues around harmful interference are at the core of many sharing issues.
- 5G power is 4x that of wi-fi. Need to see if power restriction will still allow meaningful use
    - Need deadlines on questions to try to keep it on track. Will not be easy
    - Some work has been done to crystalize the questions put in front of groups – which may help move things along
    - What does FCC spectrum policy mean when the NTIA hands off a recommendation? What are the processes, if any, attached to that? *[AM Comment: It seems there are still some fairly basic procedural issues that need to be resolved]*
- For all stakeholders, we need people in the room who understand the physical layer and understand what will or won't work
    - Should pick spectrum band [to start making available for commercial use] where we have a head start and can go forward – get some quick wins

Tomasz Wojtaszek, Director, Radio Frequency Management Division, Office of the Chief Information Officer, NOAA

- Satellites are up for 15-20 years, so we need confidence that the spectrum will be able so we can plan long-term *[AM Comment: True, but most NOAA GEO satellites are remote sensing satellites only downlink to a few spots, so they can usually work around new spectrum allocations if given a few small exclusion zones. LEO satellites usually have much shorter lives, perhaps five years]*

- CSMAK can't handle sensitive or proprietary information *[AM Comment: This could be a real limiting factor in dealing with DoD, or even some commercial data]*
    - Data from all stakeholders is important – can't take data from only one of the stakeholders
- Need a consistent and clear process; these are important decisions
    - Need to balance different spectrum uses and educate people on the importance of spectrum

AFTERNOON SESSION

- Afternoon MC: Alan Davidson, NTIA Director
    - 3 GHz is too an important a band to give-up on

E. Keynote Speeches

Arati Prabhakar, Director, White House Office of Science and Technology Policy

- Spectrum Policy was helpful, lots of people had to participate to get to where we are today.
    - Congress needs to act
- Telecom history has been one of innovation
    - Spectrum management is much more difficult now that most has been allocated
    - Some spectrum at higher frequencies is still available *[AM Comment: but usually with lower use potential with current technology, although the history of wireless has been a slow march to higher frequencies as technology evolves]*
    - Innovation is needed – not a zero-sum game

John Sherman, Chief Information Officer, U.S. Department of Defense

- NTIA is a great partner
- DoD understands that spectrum is critical for the national economy and way of life, as well as defense
    - Radar guiding missiles in the Red Sea are using lower 3 GHz spectrum – also ground-based and navel radar
    - DoD provided data for the national spectrum plan – interested in working on DSS for 3.1-3.45 GHz
        - Need to figure DSS out as it will unlock other pieces of spectrum – it's moon-shot
        - Not even the PRC has figured this out
    - Build on CBRS – need to make it machine/AI-driven as opposed to people
        - Will work hard to unlock CBRS
    - DoD is also a user of 5G, including for soldier communications on base, IoT, smart warehouse, field usage, and autonomous vehicles – O-RAN is important
    - Looking at potential paid relocation for some spectrum *[AM Comment: As others in the press have noted,[2] this was interesting – I wasn't expecting this from the DoD]*

[2] Mike Dano, "DoD Hints at 'Paid-For' Relocation in Lower 3 GHz," LightReading (February 2, 2024): https://www.lightreading.com/network-automation/dod-hints-at-paid-for-relocation-in-lower-3ghz

- In the same line of business as NTIA – US needs to win economically and militarily

Cathy McMorris Rodgers, Chair, Energy and Commerce Committee, U.S. House of Representatives

- Lower 3 GHz band is being studying this for the second time – this time lead by the NTIA
  - Must make sure that resources are used as efficiently as possible
  - Need to identify opportunities for commercial use
- Sustainable spectrum policy is vital – PRC has one and this is giving them a sustainable advantage
  - Want to diversity telecom supply chain with O-RAN to get affordable alternatives
- Must solve the fund and replace shortfall *[AM Comment: Agreed 100%. However, Rip & Replace funding legislation, which both sides of the aisle seem to agree on, has been languishing for two years. What does that say about the prospect of getting Congressional legislation that may be needed to resolve thorny spectrum allocation and sharing issues?]*

F. Pillar 3 Panel Discussion: Unprecedented Spectrum Access and Management through Technology Development

Description: As spectrum needs grow and greenfield spectrum disappears, we must embrace and promote innovative technologies to expand the availability, capacity and usability of spectrum. The Strategy calls for an effort to advance research, create investment incentives, and set measurable goals for advancing spectrum-access technologies.

[AM Comment: This panel really highlighted the challenges facing allocating additional spectrum for DSS – there is still a lack of consensus on many basic issues, suggesting a lot of work remains]

Moderator: Paul Ransom

Dr. John Chapin, Special Advisor for Spectrum, National Science Foundation

- To meaningfully advance DSS, the NTIA should advance some DSS pilots so that data for the pilot can also be useful for making spectrum allocation decisions
  - Pilot should be something that operates in the real world – not just in a lab. Should look at things that can be considered in scale

    - Can a SAS predict interference accurately enough and fast enough to protect the incumbent user? If so, what are the tradeoffs and how much information needs to be shared?
- When the risk is high, trust must be high, but the opposite is true – may shrink the amount of time commitment to a solution to lower long-term concerns
        - Small experimental teams and academics – need to allow rapid experimentation and be accessible with little planning or paperwork
- Suggest a network of testbed sites – need a break for non-citizens for non-sensitive work – spectrum sandboxes – runs a program to support this

Dr. Andrew Clegg, Spectrum Lead, Google

- Government restricted CBRS to prevent any chance of interference of any kind
    - DoD has never contacted SAS to indicate they were experiencing any interference
        - This builds trust and maybe now some of the constraints can be relaxed
        - Now implementing new CBRS constraints that will significantly improve CBRS performance
    - Better to have liberal assumptions and then back off if there is interference *[AM Comment: This will likely be quite controversial]*
    - Short-term rules will be hard to implement with the APA process *[AM Comment: Great point]*
    - Some CBRS rules are based on standards, and you can change the standards over time – this might be easier to implement than dynamic rules
    - really good training data for AI or ML
    - Need to find ways for nearby GAA users to work together
    - Not a huge fan of testbeds – hard to design enough issues into the testbed
    - Need more information about government systems where possible (not secret ones). Release as much of the government master list as possible
- Most spectrum innovations start in the US and then more internationally – so we don't need to worry too much about what is happening internationally – our ideas will be exported

Dr. Charles Dietlein, Senior Research Engineer, Institute for Telecommunication Sciences

- Need more than one metric – just used on metric CBRS
    - In general, protections have been very conservative – need more curiosity about the issues
    - It's usually a more complex issue with multiple dimensions

- National spectrum testbed is good, but need to bring parties together earlier
    - Might align visions earlier

Dr. Monisha Ghosh, Professor, Electrical Engineering, University of Notre Dame

- Lots of discussion of evidence-based, but it's hard because you need data from incumbent (DoD users), this is hard [since the DoD is limited in its ability to share due to national security concerns]
    - Transparency and cooperation is a challenge
- Really need to ask "what is interference?" and "what is harmful interference?"
    - Can't define it without reference to the technology deployed
    - Need to figure out a reasonable buffer, so there is some interference, but not harmful [AM Comment: It's amazing the sector has gotten as far as it has without having such basic issues resolved]
- GAA coexistence can be a challenge – need to understand what is happening today and in the future in adjacent bands
    - 5G today is not designed to be deployed in a shared environment – the standards need to change
    - Need to come to the realization that 6G spectrum will mostly need to be shared. New DoD systems should have some sharing ability built into it
- Testbeds have historically not been very successful as they tend to offer a very limited environment
    - Better to offer experimental licenses that would be the testbed in the real world
    - Sharing with high-power mobile is not possible in many government bands
    - Smaller license areas can help underserved areas
- UK and Germany are doing some CBRS spectrum sharing. We may be able to learn from them, but sharing takes time to work out

Dr. Brian Kelley, Principal Investigator & SME, FutureG Applied Research, DoD

- Might want to integrate a standards body into the approach so that the solution is viable for the industry
- Many DoD systems were not designed to work in a coexistence environment
    - Many ways to enable coexistence, but communities are not always talking to each other – need to know both systems
        - Need security trust, zero trust makes sense
    - If results are more "goal-based" then it's easier to allow breaks below the surface to get where you want to be
        - Software is now allowing machine learning to enable co-existence
- Agree that rapid experimental licenses are better than traditional test beds

- Test bed should be a logical idea as opposed to a physical location
- More publicly available spectrum may help small, underserved areas
- A major topic is the ability to integrate within the US, but also internationally via standards

G. ITS Overview and ISRT Conference Preview

William Kozma, Institute for Telecommunication Sciences ("ITS"), Boulder, Colorado

- Short video about ITS
- ITS works on various types of spectrum-sharing
- ISAR 2024: June 10th-June 14th
  - Lots of analysis of spectrum-sharing technologies
  - Focused on Mid-band clutter this year
  - A lot of new spectrum identified in the National Spectrum Plan are in areas with lots of clutter
  - How can we develop open, verifiable, and transparent analyses
  - Much of the work between propagation data and interference analysis is a mess
  - New to grow a new generation of spectrum engineers
  - Will have an international flavor with WRC study group 3, including 7.125 GHz sharing participating just before

H. Pillar 4 Panel Discussion: Growth of the Spectrum Workforce, Increasing Understanding of Spectrum, and Raised Awareness of Spectrum's Importance to the Country

Description: The Strategy has identified a clear vision for raising the profile of spectrum as a career field and for greater awareness by Congress, policymakers and the general public. The call is for ambitious education and workforce development goals, including the creation of a National Spectrum Workforce Plan.

[AM Comment: My fundamental concern with this panel is the idea that young people can, or should, be influenced to pursue any particular field. If there are jobs and growth, there will be plenty of candidates. The satellite industry was similarly facing an aging workforce until SpaceX lowered the cost of access to space with lower-priced launches and sparked a new wave of experimentation and innovation]

Moderator: Phil Murphy

- Lots of demand for new spectrum
- Spectrum plan calls for a developing next-generation workforce

RJ Balanga, Deputy Director, Spectrum Policy and Planning Division, NASA

- Runs SPEARS – Spectrum Educational Awareness
  - NASA has a good brand and is a great storyteller
  - Well positioned to inspire the next generation of technical professionals
- There is a spectrum workforce gap *[AM Comment: I'd be interested in seeing the data on that. The wireless sector is not growing much. Meanwhile, consolidation and technology seem to have reduced the demand for such talent]*
  - NASA's goals include supporting the national space strategy
    - Work with domestic and international partners
    - Work with emerging nations that want to be in the space race
- STEM has grown – what kind of initiative can we do to get more women in STEM?
  - Can help with curriculum to create interest in underserved minority areas
  - Also, look to remote work and hybrid work
  - US Telecommunications Training Institute in training workers abroad
- Spectrum has changed in the last 10-15 years. We have a paradigm shift in spectrum management. Need a wide range of skills, including technicians, coders, policy people, finance, etc.

Dr. Sheryl Genco, VP–Advanced Technology, Ericsson

- Ericsson brings you your cat videos, it's a hard-core engineering company
  - We have a strong passion for STEM education
  - Need to make the wireless industry fun to attract more
  - How can we energize people to go into spectrum?
- Ericson supports
  - The National Spectrum Consortium, including a national scholarship for women (Women in Spectrum scholarship) *[AM Comment: Are gender-based scholarships still legal? It seems the Department of Education under the Biden Administration is cracking down on them[3]]*
  - Ericsson does training for tower climbers – some STEM happens in the wild
  - Focus on continuous learning and upskilling
- I designed a STEM-focused K-8 school to interest kids in science
- Want engineers who have taken field theory

[3] Kim Elsesser, "Women's Scholarships and Awards Eliminated to be Fair to Men" (*Forbes*) April 13, 2022. https://www.forbes.com/sites/kimelsesser/2022/04/13/womens-scholarships-and-awards-eliminated-to-be-fair-to-men/?sh=6d3584e17fe2. See also, Department of Education, "Questions and Answers Regarding the ORC's (Office of Civil Rights) Interpretation of Title IX and Single Sex Scholarships, Clubs, and other Programs (January 14, 2021): https://www2.ed.gov/about/offices/list/ocr/docs/qa-single-sex-20210114.pdf

- Need to find new ways to get people into STEM. Also, need advanced technicians

Dr. Nick Laneman, Director of SpectrumX and Co-Director of the Wireless Institute at the University of Notre Dame

- Notre Dame's mission is to be a force for good
  - Leads the NFS's SpectrumX program
  - Want to contribute to public research
  - Develops faculty expertise as well
- Interesting journey – have seen a decline over the last 15 years in electrical engineering and related fields
  - Trying to understand "why" spectrum is important before teaching it
  - Try to identify opportunities for students and the path
  - Looking for new ways of collaborating with other faculty to get them involved
  - Have resources for high school and middle school teachers
  - Work with SPEARS to build interest to get students to take follow-up courses. Putting information on Coursera
- We can ask more from academia; academia is in a weird spot, and they are under pressure to show value *[AM Comment: This comment could be the basis of a conference in itself*

I. Forward: A Roundtable Discussion on Implementation Next Steps

Description: Where do we go from here? As the federal government moves forward under the Strategy, how do we ensure that what it envisions becomes reality? What challenges already face us in the implementation phase, and how can we overcome them? Looking forward, how do you expect the next iteration of the Strategy to evolve over time?

Moderator: Scott Blake Harris, Senior Spectrum Advisor and Director–National Spectrum Strategy, NTIA

- Senior-level people are involved in spectrum policy – this is not normal
- Implementation plan is six weeks away

Austin Bonner, Deputy Chief Technology Officer for Policy, White House Office of Science and Technology Policy (OSTP)

- Most important thing in the national presidential spectrum memorandum was Biden's vision to maximize the use of spectrum in a lot of areas
    - Joint management of FCC and NTIA
        - Added a spectrum advisory council and dispute resolution mechanism *[AM Comment: This was a very good idea]*
    - It was important to have senior-level buy-in with the council
        - Very senior-level people
        - Strong partnership between offices
- In-depth band studies and DSS are important aspects
    - Will need to implement hard things on a tight schedule over and over *[AM Comment: Agreed 100%]*
    - Surprised how engaged the private sector was – expect the private sector will be involved in spectrum band studies

Matthew Pearl, Director and Special Advisor for Emerging Technologies, White House National Security Council (NSC)

- Mechanism ensures that four spectrum plans are coordinated
- Important to have discussions about what assumptions are used *[AM Comment: That this is still being discussed shows how much work remains to be done]*
- The ISAC is the main forum for senior officials to ensure their voice is heard – it will be a critical body. IRAC is more working level for everyday things. ISAC is a senior agency principal.

- ISAC can have a technical sub-forum if they can't resolve something, the Whitehouse can get involved
- Partnership between OSTP and the National Security Council was terrific
- Agreement that US spectrum policy needed to change, and that presidential involvement was needed
    - Also supported by NITRD
- Biden will escalate disagreements that can't be resolved and make decisions in a timely manner *[AM Comment: Easier said than done]*
    - Will keep the private sector involved