**TPI SPECTRUM SERIES 2024**

**Spectrum Pipeline: Discussion of Reauthorization, Inventory, and Incentives in Exclusive Use and Shared Spectrum Bands**

Sarah Oh Lam:

So hello and welcome back to day two of the inaugural TPI Winter Spectrum Series. This series continues a celebration of the 30th anniversary of the first spectrum auction by the FCC in 1994. Last week we had our first day of panels and today we have an exciting discussion about the spectrum pipeline. Be sure to stay on right after this panel for a fireside chat with Dale Hatfield and Scott Wallsten at 11:30. So our panel this morning is entitled "Spectrum Pipeline Discussion of Reauthorization Inventory and Incentives and Exclusive Use and Shared Spectrum Bands." We have Shawn Bone, Director of Public Policy at Verizon. Gus Hurwitz, Senior Fellow and Academic Director of the Center for Technology Innovation and Competition at Penn Law School. David Redl, President of Salt Point Strategies, Jennifer Warren, Vice President of Regulatory Affairs and Public Policy at Lockheed Martin and I'm Sarah Lam, Senior Fellow at TPI.

So this morning to start off the conversation, I thought we could start with an easy topic of spectrum reauthorization. So what is the status currently? I'll just give a brief overview of the timeline. In August 1997, Congress extended FCCU Auction Authority for 10 years in the Balanced Budget Act of 97 until September 2007, the Deficit Reduction Act of 2005, extended FCC Auction Authority for four more years till 2011. The Digital Television Delay Act enacted in 2009 extended auction authority for one more year till 2012, the Middle Class Tax Relief Act, extended auction authority for 10 years till September 2022. So that's where we are, but then there were some temporary extensions to December 16th, 2022, December 23rd, 2022, December 30th, 2022, and then March 9th, 2023. That's where we are now. I just wanted to ask the folks here, even if we had spectrum in the pipeline, how long is this situation going to last? Why doesn't the FCC currently have the authority to run spectrum auctions?

David Redl:

Sarah, I think it's interesting the way it's been framed up, right? But let's be clear, the FCC does actually have auction authority. They don't have the auction authority they want, but they do have auction authority. So auction authority, as you noted in your recitation, was sort of split out into different buckets based upon which authorizing vehicle was looking at Spectrum Policy. And if you look at the Bipartisan Budget Act of 2015, which contained an independent grant of authority that still exists for the FCC. And if you look at the IIJA or the bipartisan infrastructure

law, depending on which party you're asking to talk about the same bill, you will find that there's also authority in there for the auction of the 3.1 to 3.45 spectrum to the extent DoD, Commerce, and FCC find any that can be made available for license. And so, I mean we've talked a lot in the last year in Washington about how lamenting the FCC's inability to conduct an auction, but the reality is they have authority to do auctions. What they don't have is a band that's available to auction. And I think that's perhaps more reflective of what happens after 30 years of spectrum auctions than it is of congressional impasse.

Gus Hurwitz:

So I was going to comment David asking what color glasses are you wearing there? I can't really see the rose tint on them, but that last bit that you had there, it's, sure they've got authority if they have spectrum to auction off and that it isn't just contingent upon the existence of spectrum, but it's contingent upon a large number of stakeholders, especially currently government stakeholders going through the pipeline process and being willing to play ball here. But that last point that you made also, we've been at this for 30 years, Sarah, this might be a little glib of a way to frame this TPI series of discussions. We are celebrating 30 years of Spectrum Auction Authority with a bit of a funeral, maybe. Okay, that's the opposite of rose-tinted glasses. But it's a good point. We have been at this for a while with folks claiming spectrum, getting licenses, and putting those licenses to use.

And the challenge, one of the big challenges with Spectrum has always been how do we repurpose spectrum? How do we change uses? How do we get incumbents to give up or transition to new uses or just how do we change the rules governing the use of spectrum? At some level that's a challenge of any maturing industry. It's a particularly different process to run through a regulatory system as opposed to a more property rights sort of market-based system where we might be able to trade resources between highest and lowest value uses. But spectrum is also a particularly squirrely resource to try and manage through a property rights system. So I hopefully have queued up a bunch of controversial topics there that we can spend the next 40, 50 minutes throwing pies and mud at each other over

Shawn Bone:

And I'm sure we will. The one piece of it I wanted to throw in on that though, going back to what David said is we also have to remember that what was done in the 2015 bill, what was done in the IIJA were grants of specific auction authority that had bounds on them. So in 2015 you were talking sub three sub-three gigahertz spectrum in the IIJA it was focused on the lower three gigahertz. So there is a functional difference between what David said is accurate, but there's a functional difference between having authority to do specific auctions of specific types of spectrum and the type of general auction authority that the FCC has leveraged for decades to explore various bands and use for instance, to do the C-band auction or whatnot. And I think that's important too, to think about as we look at different bands, particularly for the wireless industry and what's most suitable for 5G and beyond, there are certain bands that we may be looking at now that we weren't looking at in 2015 when David wrote the Bipartisan Budget Act.

Jennifer Warren:

I'm going to jump in, but first I'm going to, I took the note on to call Spectrum a squirrelly resource. I am going to reuse that and give you attribution Gus. But one of the things I think that's always challenging when we just talk generally about spectrum auction and whether it's reauthorization of the authority or not, is that it becomes synonymous, particularly in some people's minds with making spectrum available for commercial uses. There are many commercial uses that can have access to spectrum that can be granted access to spectrum without going through an auction. And auction is, to date has been limited to a very narrow pool of the wireless industry. So one of the challenges we often see when looking at mandates and pipelines for auction is that it presupposes an outcome of a study for a particular subset of an economic sector as opposed to it being more broadly available for all segments of an industry or all segments of a sector. So there are some inherent, shall we call them, lack of technology neutrality elements to spectrum auction mandate. So I'll stop there. I wanted to add to Gus, let's be controversial.

Gus Hurwitz:

I just want to ask Jennifer, are there specific technologies that you think might be different and not susceptible to auctioning spectrum? I don't want to go too far out there perhaps, but there might be some low earth hanging or fruit that we could talk about.

Jennifer Warren:

Well, we can talk about things that are governed by the ORBIT Act if we'd like, but unlicensed is part of the wireless ecosystem. It's not apparently a very important part. It's not auctioned. A lot of the manufacturing uses aren't auctioned aviation spectrum is not auctioned all things which I think most of us would agree have value to the economy of the United States. So there are other commercial uses beyond the high power wide area networks that gain access to spectrum through non-auction methods.

Shawn Bone:

I mean I would put a slightly different flavor on that. I agree with you, Jennifer, on a lot of those uses. But let's also remember that auctions, I mean facilitated things like CBRS. So it's not exactly that. A lot of times, yes, we talk about auctions as equating to the wireless industry and the wide area use piece of it, but the auction mechanism itself has sort of been expanded beyond that. And Verizon has figured out ways, for instance, to use the power licensing in our network. The other thing I would say is sometimes people sort of blend this conversation about auction authority and pipeline. And I think it's important to remember a lot of times in the pipeline bills. Yes, a lot of what's directed in the pipeline bill, and I'm thinking the MOBILE NOW Act in 2018, 2017. Yeah, a lot of that talked about how you built a pipeline to auction, but an important piece of that bill was also sort of figuring out where the path forward was on unlicensed.

And one of the very last deals that was cut in the Senate Commerce Committee is we were running to mark up for the very first time on MOBILE NOW was sort of how do you take the ecosystem of spectrum at the time and figure out the balanced approach between licensed unlicensed and everything like that. And that's ultimately how you ended up with sort of a hundred megahertz for license, a hundred megahertz for unlicensed and the sort of switchy middle sort of approach, which is something that I think Congress has worked on over decades

when it deals with auction authority and figuring out how to craft a pipeline that works well with auction authority and the overall uses that we're talking about in the ecosystem.

Jennifer Warren:

And I think that's an important point. And CBRS is always the exception that we like to point to, to the general layman's approach to talking about auctions and pipelines. It's the exception to the rule, and maybe it'll become more the norm. We'll see how it plays out. But I think one of the things to consider is how much does it tilt the scale. And one of the things that I think was very important in the national spectrum strategy, I don't know if Sarah's willing to let me kind of go there, is redefining the spectrum pipeline since we're talking about it, right? The spectrum pipeline was equated pretty much how do you make spectrum available for commercial use and typically exclusive licensed commercial use always with an exception? And now when you look at how the national spectrum strategy has put forward the spectrum pipeline, it's recognizing how much spectrum is at the core of so many industries and national security, other federal government uses and the pipeline needs to feed all of that spectrum demand. I think Alan Davidson did a great job in his opening comments at the National Spectrum Symposium really kind of teeing up that the demand that's being seen on the commercial wireless side is mirrored on the warfighter side, on the federal government side. So I just throw that out there.

David Redl:

Yeah, I think to sort of bring Sarah's opening back into this, right, the auction authority is now 30, and Shawn rightly raises that as we've gone through from 2012 to 2015 to 2018, we've seen a shift. A shift in going from purely looking at exclusive use license for the wireless industry to having a much more balanced approach and understanding the need to bring in other technologies to our broader strategy. And I think look if we're being analogous here, you party a lot in your twenties, you have a good time, the things are good, and you hit 30, and you realize you need to find some balance in your life. And I think all of us being of a certain age, except maybe Sarah, we have gone through this. And so as we look at how we are trying to figure these things out, we're having to look beyond what is the easy, we've always done this before, and I think that's part of what we're seeing play out in Congress right now with the fact that they haven't reauthorized spectrum auction authority is that they recognize we can't just do what

we've always done. We have these other use cases, whether it's unlicensed or CBRS or the host of other services that Jennifer mentioned that don't benefit from spectrum auctions that are critical as we look at a more holistic approach going forward.

Sarah Oh Lam:

On that thesis there are other uses. Does that mean we're dialing back to beauty contests? Is it command and control again, industrial policy? Is that where we are or are there market mechanisms for figuring out what uses are valuable in a time when China and other countries are doing command and control? How do we know our government is picking the right use cases?

Gus Hurwitz:

Yeah, that's a great question, and it actually echoes the comment I was about to make in response to David's last comment. David's last comment suggested that I'm going to say something I don't think I've ever said before. Congress is operating on a different plane than the rest of us, which is to say most of the discussion, especially coming out of the Pipeline Act and the National Spectrum strategy is about doing studies on how to use spectrum. And what David suggests, at least implicitly is Congress is having in the background a deeper discussion about what are the mechanisms by which we should be allocating and figuring out not what the uses are of spectrum, not where there is spectrum, not what the pipeline is, but what is the underlying mechanism for allocating this scarce resource and coordinating its use. And you're exactly right, Sarah, to I think frame it the way that you did the traditional dichotomy here is between market-based forces where spectrum is a property, right? That can be traded between commercial actors or non-commercial actors if they somehow get billions of dollars that they can use to buy spectrum or on a regulatory basis, command and control. In which case we've got all of the concerns about lobbying and spectrum going out to politically favorable parties as opposed to the parties that will best benefit society more largely. And one of the fascinating, I'll say two fascinating things to me about this.

We have seen more attention to coming out CBRS ideas of spectrum sharing and something in between these two polls. It's also really interesting to me, just thinking back 15 years ago, I'll give a quick shout-out. Several folks in the audience I see on the call are affiliated with TPRC. I'm on the board, Sarah is the vice chair of the program committee. If you are familiar with

TPRC, you should be and you should be submitting articles. The call for papers is out. I've done my duty as a board member. But 15 years ago at TPRC, so much of the discussion about Spectrum was is this a property, right? Have we gone through the auction process and now spectrum is just a property right? And we should start thinking about that way and that conversation is dead. We are in a very different place in how we're thinking about the allocation mechanism for a spectrum. And I'll just sprinkle in a little bit more cynicism to explode this to the international level. We also need to be thinking when we're talking about spectrum allocation, is the European Union going to follow along? Sure, probably is Russia, is China going to follow along with whatever approach to harmonized spectrum rules If we go that route, that's a lot more dubious a proposition, and boy oh boy China, they're definitely moving into LEO satellite, and doing different things with spectrum that we need to be thinking about.

David Redl:

I do want to say in response to that real quick because, Jennifer, I know you want to talk, I'm not suggesting Congress is having that conversation. I'm outright saying it. Congress is having that conversation. Congress went from 2012, we're going to extend Auction 30 for 12 years and we're going to give you a couple of bans to 2018 where it had a more balanced approach. We had CBRS happening where you saw NTIA much more involved in spectrum policy on the nine commercial side than you've ever seen before. And in IIJA we saw PATHSS which presented a new paradigm for bringing federal and non-federal actors together to have an extensive conversation about how to put spectrum to the best uses. So I'm not suggesting that it's changing, I'm straight up saying it. There are a lot more tools in the toolkit now than there were in 2012.

Sarah Oh Lam:

I had a question, is there a difference between satellite and terrestrial uses? What is the difference here? What are the use cases that are competing for spectrum?

Shawn Bone:

Go ahead, Jennifer. I know you've been wanting to jump in and then I'll come after you.

Jennifer Warren:

But not on this question.

David Redl:

Oh, come on.

Jennifer Warren:

That's okay. I'll get back to my point.

Sarah Oh Lam:

When we're talking, I mean we're talking kind of in generalities, but in specifics, is it military use versus terrestrial? Is it, are we talking satellite versus?

Jennifer Warren:

So I think we need to get away from versus because from where I sit in the aerospace and defense industry, we want to leverage commercial technology, not always commercial services, but commercial technology into solutions that we're offering our customer sets domestically and internationally, right? So we're very interested in commercial standardized technologies that can be deployed for different solution sets that we provide. That said, what you're asking I think is more coexistence necessary? It's coexistence. That's the necessary next step in 30 years, I'm just going to pick on David's point, I think the 30 years was yes, you were auctioning exclusive licensed spectrum because there was some that could be made available on an exclusive licensed basis with little harm, some that were disenfranchised might say differently, but with little harm to a community of interests, whether it be national security, whether it be weather observation systems, all things that today under climate intelligence we think are important under deterrence, the great power competition we think are important.

But at the time there was plenty of spectrum in retrospect that could be auctioned. We're in a very different environment now where coexistence is what has to be looked at. And it may not be for everyone, for every flavor of wireless and fill in the blank, but I think we're also when we're talking about because you started the question at one point with global competition. Global

competition is not limited to mobile wireless global competition as I mentioned earlier, is really global power competition and that is national security and a very important part of that. So I want to make sure that we are looking at it in its entirety because there are no empty bands except way high up and they need to be encouraged and incentivized to be exploited. But certain bands like those referenced earlier, 3.1-3.45 GHz, there are unique characteristics that allow for discrimination of targets honestly, that can't be replicated anywhere else.

Sarah Oh Lam:

So just to tease it out a little bit more for the efforts of I guess reallocating or repacking, do you think it's not worth it then to repack spectrum or clear old use cases? Is that the line of reasoning?

Jennifer Warren:

I'm not sure I understand what you mean by an old use case because most use cases that I deal with are more enhanced now than they might have been if you like.

David Redl:

Sarah, if I can chime in quickly, I don't think we can lay down a blanket rule like that in spectrum policy. We've never been able to lay down a blanket rule like that. It's never been auction is the right answer all the time. It's never been non auction is the right answer all the time. And that's what's fun about spectrum policy. I think that's why we all work in this space is that the challenges keep changing. As Jennifer rightly points out, the challenge we have now is coexistence, right? It's the old adage, that there's only so much land in Manhattan, so at some point you stop building out, and you start building up. And that's what we've been trying to do in the last couple of years, finding ways and CBRS is a perfect example of that, of stacking services together.

Shawn Bone:

But we haven't been just doing that for a couple of years. David, and this is where I get a little bit confused because the conversation, I mean you can go back to 2012 in the AWS-3 situation sharing has been part of the ecosystem on auction authority bills, spectrum pipeline bills, and the

discussion about how to figure out coexistence models and things like that for over a decade. And I think as we look at the path that the pipeline bills have taken, we are thinking about new mechanisms for coexistence that facilitate the continued existence of exclusive license spectrum or the functional equivalent of exclusive license spectrum that may have some types of sharing with it that aren't a dynamic shared model like CBRS, but create spectrum that we can integrate into a network that works for us. I think the other thing I want to go back to your point, Sarah, on the beauty contest because I think you raise an interesting question about the functional role of Congress in the conversation on a pipeline let's say, and the way the agencies play into that.

And I think to something Gus talked about too, I think where the conversation in Congress is evolving somewhat is stepping back, say from specific band allocations and saying go after this piece of spectrum to saying, look, we need goals set for the country. The executive branch may not always be in the best position to set a goal for the country, and we should have a goal of some amount of spectrum that powers wide area networks that's exclusive license or the functional equivalent. We should set a goal of finding enough to power wifi and things like that. And then we move to that and we give the agencies the tools to do that. And I think where we do a disservice sometimes to Congress, and maybe just in the conversation we have about spectrum when we're thinking about uses and things like that, is forgetting that the allocation model matters. The usage pattern of it matters, what we want to do with that matters. And when we're setting a goal like that, again, I reflect on MOBILE NOW from 2018, I think we move a lot further along the path towards meeting that balance and moving away from just a strict beauty contest where we're all just sort of making the best case we can for it and we get to some sort of rigor in the conversation.

Jennifer Warren:

I'm just going to jump in because that same demand curve that Shawn's talking about that should guide policymaking is on the government side as well, right? There's that same demand curve. Nothing they're doing that is less data intensive, and it's not things that ride typically over a commercial wireless network with the, well I'll just leave it at that. So you've got different allocations that need to be accommodated, different growths that need to be accommodated. And that's what leads to this need for coexistence in the bands where the commercial wireless industry wants to expand. The good news is you don't really see too often a lot of what defense

applications at least are proposing that go beyond defense allocations and encroach into other spectrum. Now satellite and other commercial services, there's a different type of competition among terrestrial, satellite, aeronautical, et cetera. But I think we've moved from a decade ago to where today some of the bands that are of interest to the MNOs, in particular, are already heavily encumbered and being heavily encumbered even more because of the nature of the technology and the nature of the threat. Wideband is not unique to national carriers.

Gus Hurwitz:

I always wonder when I hear a point like that, how unique is that? And I think that it's important with spectrum to always be thinking how is spectrum different? Why is spectrum different? Is spectrum actually different from other resources? The government uses all sorts of resources out there. Government has telephone service, it has internet service, it has catering services, it buys stationary. We don't have dedicated stationary production facilities for government purchasers. They buy this stuff on the free market just like everyone else. And the challenge then becomes, well, there are some national security critical contexts or other contexts where perhaps their interaction with the free market needs to be different, but we don't say anymore. We're going to replicate an entire private government version of the market in order to facilitate those needs. So that's I think an important challenge in tension that we continue to face. This is the CBRS tension. This is the 3 GHz spend tension. How does the government actually share spectrum with commercial and non-government uses. Shawn's point, I think really there's a lot interesting there and the move away from the traditional band plan, I expect we all somewhere have the old band plan map poster on a wall somewhere.

Gus Hurwitz:

And that's the way of the past. It's not the way of the future, at least not to the extent that it used to control. Spectrum is spectrum nowadays and there's much more flexibility in how we use different bands. And that is one of the biggest changes, changes just with technological shifts. I think it is pushing us, and we're not at this point yet, but it's pushing us to think more clearly about how we delineate these property rights. Academics have been talking for years about whether should we be focused on interference thresholds instead of band allocations when we're thinking about a property right approach to spectrum. That brings me to the last thing that I'll say.

I'm the academic on the call, so I get to be nerdy and pointy headed and all that stuff. When Jennifer starts talking about coexistence, I immediately think, yeah, we've got a coexistence problem also known as a commons problem. The regulatory approach to let's have central planners allocate these rights does not have a great history compared to market-based and property-based allocation mechanisms. The challenge with property-based systems is getting the delineation of property rights correct. And that's hard with spectrum. I think it is uniquely hard with spectrum historically and with changing technologies, how we think about those delineations also continues to change.

David Redl:

So Gus, I like that you're making this market-based because I've said this many times, if you are a market guy, you got to take the market's answer even when you don't like it. And I think we are in a position where the market is telling us why policy is changing. The growth in spectrum use is not what the MNOs are doing on the macro-cell level. The growth in spectrum use is at the metropolitan level, it's at the local level, it's private 5G. It's not a growth in what is happening on macro networks. Macro networks have been saturated with users as many as they're going to get excluding IOT devices. And in fact, when you look at what the MNOs are doing now, they're branching out into the other services. As Shawn rightly points out that their users of CBRS, they found ways to incorporate that into their network.

We're seeing other companies take big leaps into fixed wireless, which is a completely different market segment than traditionally has been the MNO market. And I think what we're seeing there is the market telling us you don't need more spectrum for national macro cell networks. What you need more spectrum for or what you need more investment in is local and regional coverage, either network densification or alternative technologies, that's played out and it's continuing to play out right now. So I like that we're looking at this from a market perspective because I think the market supports the idea that what we need is more unlicensed or CBRS or sharing and less of trying to spend hundreds of billions of dollars on moving systems.

Shawn Bone:

I mean I got to jump in on that one. I think they would take issue with the question about utilization. I mean what we're seeing is a demand curve going up on our network both on the

mobile and look, we're a huge fix wireless company. That's the advantage of the flexible use licensing model that we can use our spectrum to engineer it, make it reliable, resilient, give the quality of service to power things like new broadband competition to cable and other companies in the ecosystem. But I want, this is a conversation I have with folks all the time and it sort of goes back to the core of the panel, which is or the core of what TPI is doing. Remember the world that existed 30 years ago when we started auctions and what the cellular ecosystem of that day was. I remember I was a generation after that and still had the Nokia brick phone that was like this and had to worry about roaming and everything like that.

And the consumer expectation model for connectivity has evolved so much largely in link with the fact that we've had the auctions and the demand curves. And there was an interesting chart I saw the other day by I think deficient or another analyst that's looking at, look, people are utilizing hotspots and things like that more because the mobile connectivity is more reliable in many respects when you're out in the public than say the public wifi networks even are. And that's not to say that wifi isn't important, but our connectivity models have evolved and I think everybody's expectations of connectivity have evolved and I don't think you can say it's saturated just because the device ecosystem, you have to look at how they're using it and how the companies are doing that. That's first point. Second point, I also worry to Gus's point that we think technology is always going to be a panacea here and I don't think we want to suggest that there are, as we all know working in this area, there are physical limitations to what spectrum can do.

Rain fade is real, things like that. So as we think about how we model allocations, as we think about utilizations and whatnot, there are physical parameters to the spectrum that matter. And yes, we have been able to move from low band to mid-band and Verizon has worked on millimeter wave and how all that fits into an MNO ecosystem and a wide area network ecosystem, but we are stuck with the physics of spectrum and it's why we have a lot of tension around the mid-band. It's why we're having this conversation and yeah, utilization is going up, but I think if we default to the idea that coexistence has to equal dynamic sharing or whatnot, we miss opportunities to have a larger conversation about technology upgrades and other things that work and think about the spectrum relocation fund and how that has been in the ecosystem to do things like figure out how to move our systems and whatnot. So we can't always say technology

is going to solve everything, whether that's a sharing model or new spectrum utilization because we have to deal with the physics of spectrum and interference and everything like that.

David Redl:

Shawn, I think we hit on that topic. We can all agree on that physics matter.

Jennifer Warren:

I was going to say we found our point of agreement, physics do matter. It's taken a long time to get there, but yay.

Sarah Oh Lam:

So going down that line a little more, I think when we look back, David, you were there for a spectrum relocation fund, inventory, government inventory is your assessment now that it's not, it's like less important to do or NTIA is how is that whole mechanism working because that's an innovation that a lot of people worked hard on in that middle time to figure out a way for federal users to assess their usage of spectrum and the institutional process within NTIA of evaluating federal agency uses. What is your assessment of that then?

David Redl:

I think the irony should be lost on no one. Shawn and I are both on this panel since we spent a lot of time working at Capitol Hill in spectrum auction authorities fund. I think there are a couple of things that we have learned since 2012 from the processes we've had in place. One is, the spectrum relocation fund was a great tool for a very specific purpose and it's been doing a good job of achieving that purpose, but we are rapidly approaching the point where we have to say, okay, we picked off the fruit we can, what do we do to get the higher hanging stuff? And I think the most important thing we've seen change is the change we saw first in AWS-3 and Shawn will remember when we were on the Hill yelling at federal agencies to play nice with industry and now again with the DoD led PATHSS process of seeing actual trust building between the federal users and the commercial stakeholders who want to have a seat at the table.

And I think if we take nothing else away from the IIJA, we should take away that collaboration between the public and private sectors on increasing spectrum efficiency, making spectrum available, whichever one of our adages you'd like to throw out there for finding ways to be better at using spectrum as a country is going to have to be done collaboratively considering the different technologies, considering the real physical challenges we've talked about and considering the real economic challenges that are faced on the commercial side and the mission challenges that are faced on the federal side. And I think that's the thing we lose track of sometimes when we have these market-based conversations and board knows, I tried in many pieces of legislation to force the federal government to put numbers on its spectrum. It's not as easy as I wanted it to be or wished it would be when I was writing those pieces of legislation and what I had to try to enforce them as the administrator of NTIA.

I can tell you it's not easy to get people to put numbers on anything and sometimes you literally can't. Jennifer mentioned that some of these systems are critical to national security. There's no putting a number on stopping incoming enemies, there's no putting a number on that, and unfortunately that sounds trite, but it actually happens to be reality also that some of these systems are actually that important to our national security. Is everyone that important? No, and that's why having the PATHSS process where you could have people have real candid conversations about what's really happening in the security space and what's really possible from an engineering perspective, I think is perhaps the most important spectrum innovation in the last five years.

Jennifer Warren:

Yeah, I want to actually jump in on that because I'm not sure I can say it any better, but I can at least say ditto, which is the IIJA really did inject innovation into the spectrum governance arena by creating embers and then the Department of Defense creating the PATHSS process, which wasn't even required, right? It was their tools to bring the collective stakeholder community together and a stakeholder community that doesn't always congregate elsewhere naturally. From academia to OEMs on both the wireless and defense side as well as MNOs, as well as cable providers. I mean it was a consortium of collaborative folks. Everybody learned a lot. As someone who sat in the classified sessions with my chief radar engineer, a lot was learned between Max for example at Verizon and my radar engineer Mike. And those are important

conversations that happened and exchanges that quite frankly in an A process in a proceeding wouldn't happen.

And so the innovation of embers, regardless of where people were at the beginning of liking that it was in the IIJA or not, but the innovation of embers shouldn't be lost. That just like there's really very little, I'm sorry to say this for the MNOs, but there are going to be fewer pockets of exclusive license spectrum. So for those entities that realize that we have to do sharing in many bands where that might be attractive, it's the new form of collaboration. It should not be a one-off. It is an innovation that we haven't experienced in how to increase collective use of already heavily utilized spectrum, which I think everybody in that process now understands, but I just want to put it in that context. Thanks.


Gus Hurwitz:

I would add, this conversation that we're having right now isn't only limited to spectrum. We see it across several domains of public-private partnership and collaboration, especially between the federal government and industry that is providing all sorts of technological infrastructure from the cloud environment to cybersecurity. The conversations that the government has been having with private industry has completely changed over the last 10, 15 years, let's just say 10 years or so. As we've recognized government relies on these technologies. It's both a user of these technologies as commercial services but also to provide government services frequently national security or other classified services. And the historic approach was antagonistic or if not antagonistic, at least not collaborative. And today it's a much more sophisticated understanding with much more engagement and willingness to work together and that is undoubtedly good. It also understandably for some raises lots of questions and concerns.

Going back to Sarah's framing of the beauty contest model. When we start getting into government collaboration with industry, we understandably have concerns about transparency and lobbying and public choice interests and how that all plays out. And at some level we need to recognize in the 21st century we are in a more complex geopolitical, economic environment, which isn't to say that we don't worry about all of those issues, but we need to think about them, we need to think about the oversight, we need to think about how to ensure against these concerns in a different sort of way because they are legitimate concerns, but also the realities on the ground require this sort of integration.

Shawn Bone:

Well, and I'll throw another point on the board. I guess for all four of us we've got physics and now we have collaboration, so we can't all agree on that. Look, Verizon probably knows better than just about anyone here, what collaboration can mean with a government agency because it was what it took to unlock the C-band for us when we were having issues with the FAA and others. A couple of points I would raise though, and I don't want to repeat the conversation you and Umair had at the Sectrum Symposium, Jennifer, but I will say the important pieces to think about when you're thinking about going forward, collaboration one I think is figuring out how to filter more information out of the classified setting to other people because rightfully so, there are things that the government doesn't want everyone to know and that there are only certain people that should know that information.

But when you're really talking about getting engineers to understand how systems work, when you're really talking about functionally understanding coexistence models and the opportunities for retuning relocation, band splitting, channelization, all of these questions, you can't always get every engineer in the room who may know pieces of that. And being able to filter more information out of that classified setting is important. Second thing with PATHSS too was I think there's an open question about whether PATHSS was representative of all of the government agency's interest in lower 3 GHz. There were other agencies that use lower 3 GHz. And at that level I think there's a lot of conversation in the spectrum strategy and others about NTIA taking over what PATHSS was and sort of reworking it and maybe in the CSMAC or others. I think that may be a welcome thing because we can get more stakeholders at the table and have an open conversation.

Last point, and this really goes to the rub of these questions about how does collaboration work is from our perspective, the wireless industry Verizon's perspective, you want to go into those conversations without a preconceived notion of the outcome. And I think in PATHSS there was a struggle with that, not because of DoD, but because of the way the IIJA language was structured. And I think that's one of the reasons why NTIA is now talking about a wider study of lower 3, not that PATHSS was wrong or embers was wrong, even though we still don't know what the outcome really was of that. But that if you don't have all the information and you're not having an open conversation at the table, we may miss opportunities that or otherwise.

David Redl:

There. Shawn, you might have found another place that we actually all agree, which is to have a preconceived outcome. I mean that's essentially what we've been saying all along is as we look, and I'll bring it full circle to the extension of spectrum auction authority, if we're going to extend spectrum auction authority prescribing which technologies, which power levels should be used in particular bands is deciding the outcome. And I think I would agree with you, I don't think we should predetermine the outcome of these studies. They should look holistically at what needs to stay put, what can be moved, what can operate around, and what go in. I would agree completely that we should not be predetermining these outcomes.

Jennifer Warren:

Fair to spectrum auction mandates, which is clearly a predetermination of an outcome. So if we all agree on that, we have made great progress in Washington policy circles. But I did want to go back to a point on collaboration and as someone who participated in, I guess it was AWS-3 through the CSMAC process, it was necessarily not as robust as the PATHSS process. I'm not sure if anybody else here was in both, but I've got that ability to look from both processes, many considerations, and I'm very respectful of the CSMAC process, but there are inherent limitations in FACA that are not in the other process. It's designed to deal with challenges that are in the national interest designed to deal in conversations that are not reported out, both for the benefit of the commercial wireless industry for frank conversations about usage deployment and the like as well as the federal users and the OEMs that are developing solutions for all of the customers in the room, both the commercial wireless OEMs and the aerospace and defense OEMs.

So if you look at collaboration, really having to start almost beyond the end users or the service providers, but really with the ones that are manufacturing the capabilities and understanding what the systems can do can be built to do. You need to have the OEMs of all the flavors in the room together. And that was an innovation as well that DoD brought where it focused on having those players together. That is something we should not lose because just, I don't mean to be trite, but the concept of privacy by design, that same thing should be applied to spectrum coexistence by design because trying to just jerry-rig how a radar operates after the fact or how a wireless network operates after the fact isn't as good as coexistence by design. And if the US can

actually pioneer that, that is an opportunity for leadership globally on both national security and wireless communications and that would be a win-win.

Gus Hurwitz:

A really great point and tying a couple of threads together, Shawn made the point that it's important that the insights from these processes can be shared. And again, as the academic in the room, this is such an important area for study. Jennifer, you mentioned the APA process. We also can look to the intergovernmental coordination process, and the role of FACAs. Then we have more government, internal national security, top secret closed-room processes. These are all very different, but they're doing some similar things. I mean, golly, do I need to mention the FCC/FAA 5G kerfluffle, the FAA didn't know how to work in the FCC rulemaking process. They made some really basic mistakes of administrative law, but putting that to the side.

Jennifer Warren:

Yeah, let's not go there. We don't have an agreement Gus, we were doing so well keep going.

Gus Hurwitz:

I know. Understanding this is an important topic of study and we think, oh, we need to study property rights and the technological aspect and what are the use cases, what are the economics, what are the boring government coordination processes? What are the administrative procedure processes that will make for effective information sharing, not between use cases, but between the users, the regulators, the various stakeholders so that we don't have unpleasant surprises so that we don't undermine coexistence or cooperation. That's a serious topic of study, and it's not an exciting sort of thing that people think about until 30 years after the case when maybe we do a retrospective and that's no way to run a country.

Jennifer Warren:

Sarah I just have to tell Gus one thing. Go to the CSMAC report from 2018, 2019 maybe, that looked at spectrum governance for the 21st century. It challenges this exactly. And tees-up stuff makes no recommendations, but you're spot on in many ways.

Sarah Oh Lam:

I did have a question kind of like Gus'. So your argument is the PATHSS process is innovative, it brings engineers together, it's candid, and it gets to the point faster than the rulemaking. And so are there mechanisms in a PATHSS-type process to have transparency or what's happening inside? How do competing interests win out their positions? What kind of market is there in there is what happens in a PATHSS process?

David Redl:

I don't think it's any different than we've always decided allocations in terms of how the decision gets made. At the end of the day, allocation decisions are made by the United States government. There's never been a fully market mechanism for allocation. There has been for assignment, but there has not been for allocation. At bottom, that's a governmental function of weighing the uses on the federal side and the uses on the non-federal side and finding the right balance. That's an inherently federal function.

Jennifer Warren:

David, and finding the uses among the commercial functions.

David Redl:

Correct, and finding where they overlap and where you can have both federal and non-federal use together. Everyone likes to describe it as akin to zoning. I think that's a fine analogy, but to describe either zoning or the spectrum allocation process as a fully market-based mechanism, I think belies the fact that you can't bring a market where you're comparing federal and non-federal issues. Those decisions have to be made by policymakers who have things other than pure market decisions, and pure market factors that contribute to their decision-making. And so I don't think that what we're seeing with PATHSS  is necessarily a change in how we make allocation decisions. What it is is a change in how we surface information about making those allocation decisions. At the end of the day, the deciders are still the deciders. We want to make

sure they have access to everything they can and PATHSS as an innovation in bringing that information to the decision-makers.

Shawn Bone:

And I think that's fair, David. I like that description of what the outcome is that almost coming out of PATHSS as a solution set. You have A, B, C, and D options if you're doing it in a sort of neutral way that I think we would prefer that it would be done and sort of gives the policymakers the tools and the information to be able to come through it. I want to go back to something earlier though. The important role in all of this though is still to have a goal set in mind. What do you want to see? What do you want to see in the larger wireless ecosystem? We can all disagree on what that goal set may be, but I think study and optionality on a table without some sort of policy goal set in mind just continues to sort of leave us a bit in the lurch, which is why I sort of was making the point earlier about the role of Congress and setting targets and things like that and the neutrality comes from the study process. I think the point of the policymaker function and the role that Congress has played often in this ecosystem alongside auctions is to figure out what the goal set you have in mind and not forget that you need to see different technologies like MNO networks and whatnot at the end of the allocation process. And then you use the studies as the tools. I mean that was sort of the model of MOBILE NOW.

David Redl:

I real quick, I just want to chime this. I agree with you, Shawn, that we should be bringing innovations in both directions in this space. We make the federal users say, show us how this is a market mechanism. Show us how you can be more efficient or how you can move and what it would cost. And I think that's good. We should be having conversations about the value proposition on the federal side. Conversely, we have always asked federal users, show your work, show why you need this. I think we need to be bringing that to the non-federal side as well. Let's ask questions. If we're going to be talking about what are the outcomes, why are we choosing those outcomes? Are we choosing them because it's what a market mechanism says we need? Are we choosing them because we need more federal revenue or are we choosing them because it's best for a layered connectivity model in the United States? I think we have to have those conversations on the non-federal side as well.

Shawn Bone:

No, and I think that's fair. I think we're open to having that as an industry sector. We've tried to show our work. I mean we did commission a paper from Coleman Bazelon who works for all of us at various times, but the Brattle Group did sort of go through the analysis of everything being equal. Look at the demand curve on the MNO networks. Look at what you can solve through non-spectrum means and say, here are the spectrum inputs that you're really going to need to meet the demand curve. You can quibble with the evidence, but I think we're perfectly happy to have that fight on an evidentiary level. The other thing that I thought was interesting in this too is, and I think it's an important point that Jennifer made, and it's something I think that will come at that done right, could actually really help all of these conversations from the national spectrum strategy, which is trying to inculcate in the federal agencies an expectation that the spectrum ecosystem around them is not going to stay static going forward. I think sometimes we get into conversations with agencies and things and we get into conflicts with agencies when they imagine the spectrum ecosystem system being relatively static. And I think we have to move away from that model. And I think the national spectrum strategy talking about receiver standards and performances and things like that. Gus, you may have brought this up. Two, I think that actually could help this conversation going forward. And I'm curious to see how the spectrum strategy operationalizes that for [inaudible].

David Redl:

You. Sean, did TPI pay you for that segue to Dale?

Sarah Oh Lam:

Thank you guys so much because we have 30 seconds until we hand it off to our next conversation. And so I just want to say thank you so much for bringing all your expertise to the table and having a really good conversation about spectrum legislation, reauthorization, and all the new developments that are coming. So thank you all so much!