PAIGE ATKINS: Good morning and welcome to the NTIA Spectrum Policy Symposium. I'm Paige Atkins, associate administrator for NTIA, and the head of the Office of Spectrum Management. And on behalf of NTIA, I welcome all of you attending here in the room, as well as watching the webcast. And we are very pleased to have such a wonderful cross-section of stakeholders in the audience from industry, academia, as well as government. So thank you very much for attending.

[00:00:37]
The purpose of calling all of you here today is to take stock of our national spectrum strategies and policies, and begin to chart a course to a more comprehensive national spectrum strategy. To do that, we've brought together representatives of many of the key spectrum policymaking bodies, particularly the White House, as well as the Federal Communications Commission. And later in this morning's session, we will hear from them, as well as the federal agencies, as well as industry representatives. And that will be a very wide-ranging panel discussion, so hopefully you'll look forward to that.

However, first, I want to give the floor to my boss, the NTIA administrator and assistant secretary for communications and information, Mr. Redl, to introduce our first speaker. So, please. [applause]

DAVID REDL: Thanks, Paige. And it's great to see such a great turnout for this event. Thanks to all of you for being here.

[00:01:40]
Whether it's global trade, space commerce, or telecommunications, US Secretary of Commerce, Wilbur Ross has been a top voice for US innovation and economic leadership within the Trump administration. Since his confirmation as the 38th Secretary of Commerce more than a year ago, Secretary Ross has shared the President's goals of

freeing up the US high-tech industry, to flourish and expand their leadership around the world. This reflects his decades of experience in investment banking and private equity operations, culminating in his leadership as chairman and chief strategy officer of WL Ross and Company. All together, he has served as chairman or lead director of more than 100 companies operating in more than 20 countries.

[00:02:19]
I'm very pleased and honored that he's agreed to join us here this morning to kick off this policy symposium and to provide remarks on the relationship between spectrum policy and the nation's current and future economic competitiveness. Please welcome my boss, Secretary of Commerce, Wilbur Ross. [applause]

[00:02:40]
SECRETARY WILBUR ROSS: Thank you, David, for that nice introduction. I'm glad to be in front of a very friendly audience. That doesn't happen quite so often [laughter] in Washington these days. So I thank all of you for attending this first Spectrum Policy Symposium. And thanks also to the panelists and speakers for your commitment to advancing our high-tech industries like telecommunications and commercialization of space. The United States leads the world in these industries, and the Commerce Department is committed to fortifying that leadership.

[00:03:25]
The US wireless industry supports more than 4.7 million American jobs and contributes almost a half-a-trillion dollars – $475 billion – annually to the economy. But we cannot be complacent. While the United States leads the world in 4G wireless technology, China and South Korea are both working very hard to position themselves to dominate the next generation of 5G.

China is shaping up to be the biggest 5G market by 2022, and the Chinese government has targeted 5G to develop its indigenous industry and dominate global export markets. But as you know from the recent publicity around ZTE, they do not have themselves all of the technology they need to pull this off.

It's estimated that 5G could create up to three million jobs in America, and generate $500 billion a year in economic growth. That would be a 2.5% increase in our entire gross domestic product.

[00:04:54]
The first 5G phones should be ready in 2019, and all four nationwide mobile operators in the US – AT&T, Sprint, T-Mobile and Verizon – are expected to be generating 5G revenues of at least $1 billion in the US by the end of next year. This will be a major milestone for our wireless industry, and we are working at creating the conditions to prosper for 5G.

[00:05:31]
We understand the importance of a sound spectrum policy to accelerate 5G growth. That is why we want to hear from all of you – as policymakers, leaders, inside and outside of government – about the spectrum needed for 5G, and for American companies to be successful in both domestic and global markets. This includes the satellite industry, as new technologies, including those powering non-geostationary constellations, promise to support widespread connectivity.

[00:06:15]
On the government side, we are dedicated to ensuring that NASA, DoD, FAA, NOAA, the intelligence community and other agencies have access to the spectrum needed to

support their missions to protect the public, foster economic activity, and advance our scientific enterprises.

[00:06:41]
Across all of these areas, our international efforts are critical. The Commerce Department engages actively in the international forums that determine global spectrum allocations, set technical standards, and develop new technologies.

[00:07:03]
NTIA represents the federal government's positions on spectrum issues at the International Telecommunication Union's World Radiocommunication Conferences, which occur every three or four years. These conferences determine global spectrum allocations and the processes to coordinate orbits of satellites through a treaty-level agreement.

[00:07:32]
Our staff at NTIA is currently working with other federal agencies and the FCC to develop negotiating positions for the next WRC, which is scheduled for the fall of 2019. As we engage with the ITU, I ask that you support the election of Doreen Bogdan-Martin, a former NTIA staffer, as the ITU's Development-Sector Director. Our administration has put its full support behind Doreen. She is well versed in US policy objectives, and has championed our pro-growth and pro-competition satellite policies. If elected, she would be the first woman on the ITU's senior executive staff.

On May 24th, President Trump issued a directive aimed at taking additional steps to maintain and extend the nation's global leadership in commercial space activity. Space is already a $340 billion business and may soon be a trillion-dollar business. But to realize

our commercial space potential, our government needs to make it easier for the private sector to achieve success. We are already seeing improvements:

[00:09:16]
Last year, Commerce signed an agreement with the Departments of Defense, State, Interior, and the Director of National Intelligence to reduce wait times on satellite remote sensing applications. The agreement sets more definitive timetables for license decisions, and elevates decision-making to senior government officials if deadlines are not met. Before its implementation, the average time to obtain a NOAA license was 210 days. Now, thanks to these improvements, NOAA estimates the average time to grant licenses has been reduced by more than 50%, to an average of 91 days.

[00:10:14]
This brings me to the Space Council's initiative to create a one-stop shop at the Commerce Department for space commerce. The Department is creating a new Space Administration office within the Office of the Secretary, and is repositioning and consolidating its space commerce functions under my direct supervision. This office will create a streamlined, central interface at the Department for industry needs relating to remote sensing, export controls, spectrum concerns, trade promotion, space traffic management, and space situational awareness, just to name a few.

[00:11:07]
The Office of Space Commerce and the Commercial Remote Sensing Regulatory Affairs Office – both currently housed in NOAA – are being elevated to the new Space Administration. We will also soon name a Director of the Office of Space Commerce, a position that has been vacant for almost ten years.

Our ultimate objective is to provide the space commerce industry with a single place within the federal government to address the majority of its needs. This includes support of NTIA's spectrum management and policy functions.

[00:11:56]
Spectrum policy will play an important role in our efforts to advance space commerce. This symposium comes at an opportune time as we strive for US leadership in 5G and other advanced technologies. We are focusing on spectrum policies to guide our efforts now and into the future. The views you share with us today will help advance the President's goals both domestically and internationally.

[00:12:36]
Thank you again for your participation and your ongoing work to maintain US leadership in these important industries. Enjoy the rest of your day. [applause]

DAVID REDL: Thank you very much, Mr. Secretary, for those remarks and for your continued leadership in the area of spectrum policy.

At this point, we'll move on to a keynote I intend to give. And then we'll have some time at the end for a little Q&A.

[00:13:13]
Good morning, and thank you again for joining us today at NTIA's Spectrum Policy Symposium. We're pleased that Secretary Ross could join us to discuss the status of our nation's spectrum policy. Under the leadership of Secretary Ross and President Trump, the administration is committed to ensuring that US consumers continue to enjoy the benefits of American leadership across the technology sector, and to protecting our

national and economic security. We have a distinguished group of speakers today, and I welcome your participation in what should be a lively discussion on spectrum policy.

[00:13:45]

This is an opportune time to take stock of spectrum policies and management practices. We have accomplished a great deal over the past decade. Mobile and satellite broadband services are empowering job creation, keeping people and information safe, and creating knowledge and fostering commerce around the world. The satellite industry is building and launching a new array of advanced constellations; unlicensed services are empowering consumers to take control of spectrum services in the their homes and businesses; and the Internet of Things, smart cities, driverless cars and drones are fast becoming part of our everyday lives, making profound changes to the way we live. But with 5G on the cusp of reality, there is much work yet to be done.

[00:14:28]

As leaders in spectrum policy across government and industry, we must use this finite resource effectively so we can fully support our 21st century wireless needs. We need to plan for the future so there will be enough spectrum available for 5G, unlicensed, and the next generation of satellite systems that hold so much potential. While commercial and unlicensed needs are extensive, we must also balance that demand against the government's expanding needs for national defense, public safety, aerospace, and other vital missions.

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It is imperative that we make America first in 5G, and we do that by removing obstacles to deploying 5G infrastructure and playing an active role in the international standards-setting processes that will define how 5G unfolds. We must also ensure that we have a collective approach to securing 5G networks.

[00:15:15]
So how do we achieve these goals? We need a strategic approach that will engage both government and the private sector in supporting 5G and other 21st-century spectrum imperatives. With our shared goal of optimizing spectrum in ways that deliver maximum benefits to the American public, we need a comprehensive set of immediate and long-term steps. Immediate actions are necessary to address priorities such as 5G and other emerging terrestrial and space-based based technologies. But we also need to establish the framework for a longer-term approach to spectrum policymaking. This requires true collaboration across government, and significant cooperation with telecommunications, aerospace, and other industries. We must also develop a thorough awareness of current and future spectrum requirements for federal and non-federal access to spectrum.

[00:16:05]
We are taking stock of the valuable progress that's been made to date and assessing how emerging technologies will impact spectrum usage and demand across the United States economy. Our ongoing spectrum-related research and development, testing protocols, and engineering analyses are yielding the tools that will help make more efficient use of spectrum to meet federal and commercial needs.

[00:16:26]
Over the longer term, agreement on foundational principles can drive our collective efforts. The principles must include a commitment to balancing federal and non-federal spectrum requirements, and reflect the need to protect our economic and national security interests. We need to ensure sufficient mechanisms exist to increase spectrum access, including through spectrum sharing, when that is the most effective approach. And we need greater transparency of spectrum use, and should promote increased collaboration

between federal and non-federal stakeholders, including creative public/private partnerships.

[00:17:03]
Our strategy must rely on a flexible spectrum management regulatory model, to include standards and enforcement mechanisms that encourage spectrum efficiency and effectiveness. We also need to leverage spectrum research, development, testing and engineering processes to elevate and deploy advanced spectrum sharing tools, dual-use technologies, and innovative ways to access these spectrum resources. We need to make meaningful progress toward establishing secure, enterprise-level spectrum management tools to help us both identify areas for greater spectrum efficiency, and to manage the coordination of shared spectrum access.

[00:17:41]
A foundation is in place today to make progress toward these objectives. NTIA enjoys close cooperation and collaboration with the major stakeholders in the spectrum policy environment – whether they be Congress, the White House, the FCC, the federal agencies that use spectrum, and our commercial and non-federal partners. As the electromagnetic spectrum gets more and more congested, what we have known for a long time is more true than ever – we can only move forward when standing together. Through a cooperative approach, we can build a successful long-term spectrum strategy that balances all of these disparate needs.

[00:18:17]
To get there, we'll leverage and build on existing initiatives. NTIA is continuing to work with all spectrum stakeholders on current and legacy activities that are helping us to align with future spectrum requirements. We have come a long way already from the way we have traditionally allocated and assigned permissions for access to spectrum. Historically,

we have taken somewhat of a zero sum approach: You take spectrum from one use – and federal agency use is always the first target – and give it to another. But that changed when we reached the end of the era of easy and painless spectrum relocations. And let's be clear, that era is over.

[00:18:54]
We discovered that, in many of the most constrained bands, it is too time-consuming and too expensive to simply evict a user, or set of users, from bands they have used and counted on for years or even decades. There is often too much sunken investment in equipment with lengthy life cycles and significant redesign costs. This is particularly true for satellites and radar systems with their long development times and even longer operational lives.

[00:19:21]
Now we are looking for new ways to share spectrum among incumbents and new users. This is rarely problem-free, even when it is technically possible. But with new and dynamic access techniques and technologies, sharing continues to offer a lot of promise. NTIA continues to work with the FCC to develop sharing and repurposing approaches across low, medium, and high spectrum band ranges.

[00:19:44]
One of the most innovative approaches involves the 3.5-gigahertz Citizens Broadband Radio Service, the CBRS spectrum. This is a really exciting time as we get closer to the CBRS spectrum being made available because the 3.5 affords an excellent mix of capacity and coverage capabilities. The FCC's flexible licensing framework may also open the door to a variety of business models for putting this prime spectrum to use and for potentially allowing non-traditional players to take advantage of this opportunity.

[00:20:14]
Progress continues on the technical aspects of this spectrum sharing arrangement that are key to rolling out CBRS while protecting the incumbent operations in the band. NTIA in particular, through our Office of Spectrum Management and our Institute for Telecommunication Sciences, continues to work very closely with the FCC, the Department of Defense, and industry to make it a success. This collaboration includes regular engagement with the Wireless Innovation Forum to complete the standards and the certification framework for the Spectrum Access System and Environmental Sensing Capability that will work together to control the CBRS devices in the field.

[00:20:52]
The WinnForum standard defines the parameters for protection of federal radar systems. And WinnForum recently delivered the certification software that ITS is reviewing and validating. Assuming all goes well over the 60-day review period, we could move to SAS certification testing in the near future, which I know many of you are very much looking forward to. We will also have ESC compliance testing to take care of. The combination of SAS, ESCs, and Dynamic Protection Areas is a complicated sharing framework. DPAs will replace static exclusion zones that principally cover coastal areas in order to protect ship-borne radars, as well as protect other federal equities such as radio-quiet zones, including the ITS-managed Table Mountain in Colorado.

[00:21:36]
Instead of the initial large coastal exclusion zones that were planned and appeared necessary to protect Navy radars, we've moved toward DPAs enabled by these systems and their complex technologies. This will maximize the commercial potential of the band while not losing the assurance that incumbent military radar systems will be protected. This is truly the kind of spectrum win-win that we've all been looking for.

[00:22:00]

The 3.5-gigahertz sharing model also demonstrates a means of introducing more dynamic sharing while still protecting sensitive information regarding federal systems and operations, largely through the use and introduction of the ESCs. NTIA's efforts to make spectrum available for commercial use, however, go beyond 3.5. For example, we are working with the Department of Defense to evaluate whether a neighboring band, 3450-3550 megahertz, could support the introduction of commercial wireless services without harming current federal operations.

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Higher up the spectrum chart, NTIA is supporting efforts to make spectrum available in the millimeter wave range, above 24 gigahertz – or, as FCC calls it, the Spectrum Frontiers. Spectrum Frontiers bands are a key focus for 5G. Due to the technical characteristics of the band, the propagation distances generally are very short. On the other hand, because a lot of spectrum can be made available, large channel blocks will support applications requiring wide channels, such as very high resolution video. To put simply, if you've ever been frustrated by your ability to download a large video file onto your iPad or other tablet, 5G is going to help to speed that up.

[00:23:09]

Fixed deployments are coming first, including home broadband access options, but mobile is certainly on the table. These bands also will be useful for the aggregation of 5G and Internet of Things traffic. NTIA has worked closely with the FCC on the agenda item the Commission adopted last Thursday that moves additional Spectrum Frontiers bands closer to availability and proposes additional study of how we can best accommodate current and future federal operations in a number of these bands. And the US government isn't stopping there. The FCC is also looking at spectrum above 95 gigahertz in its Spectrum Horizons proceeding.

[00:23:45]
For low-band, the Spectrum Pipeline Act requires NTIA to identify for auction 30 megahertz of spectrum below 3 gigahertz by 2022, and to identify an additional 100 megahertz beyond that. As part of this effort, NTIA, OMB and the FCC have been evaluating proposed pipeline plans submitted by federal agencies. Two have been approved and funded – one for 1300-1350 and the other for 1675-1680.

[00:24:12]
These efforts demonstrate that with the FCC and our other federal partners, we continue to respond rapidly to meet market demand for spectrum. Still, with 5G on the way, we share the sense of urgency many of you feel. Congress also demonstrated its sense of purpose and urgency on spectrum policy very recently with the passage of Mobile Now as part of Ray Baum's Act, just signed into law as part of the budget deal. Mobile Now includes a provision directing NTIA to research incentives for federal agencies to relinquish or share spectrum, and it also requires a study of bidirectional sharing, which could allow federal agencies to share existing non-federal bands.

[00:24:49]
Meanwhile, the President's budget for fiscal year '19 includes a proposal to authorize NTIA to administer leases of federal spectrum to non-federal users. This is still very much a proposal at this point, and many details need to be sorted out, but it has great potential. The idea here is to add as many tools to the tool kit as possible to make sure we are making the most of our valuable spectrum resources.

NTIA also has an important role to play in ensuring that US spectrum policy supports the President's goals for commercial space activity, as Secretary Ross noted in his remarks. As outlined in the President's Space Policy Directive issued last month, NTIA will be

supporting the development of a Department of Commerce and White House report on how spectrum policy activities can further US leadership in space commerce.

[00:25:36]
Our agency also plays a pivotal role in international spectrum policymaking, principally through its coordination of the federal agency participation in preparations in ITU meetings, particularly the World Radiocommunication Conferences mentioned by Secretary Ross. These are global, treaty-level inter-governmental conferences that update the rules for international spectrum allocations and satellite orbital slots. To echo Secretary Ross, it is important that all of us with a stake in these matters work together to develop and advance unified, balanced proposals to ensure US success at the WRC in 2019.

[00:26:12]
I'm looking forward to today's panel discussion to help us move forward on these goals and principles that we've laid out, as well as to bring out other areas forward for consideration. NTIA has a rich history in the communications policy landscape, drawing on diverse stakeholder input, relying on expertise to help us arrive at decisions and actions that benefit the American public. Our efforts must empower American companies to continue developing and deploying the innovative technologies Americans have come to take for granted. It is the key to sustaining US leadership, growing the economy and providing good, high-paying jobs for our citizens.

Thank you so much for being here today. I look forward to your questions. [applause]

If anyone has any questions, please raise your hand. We have a couple of people with microphones who can come around and give you the mic. And please state your name and your organization you're affiliated with, even though we all know you. [laughter]

[00:27:17]

Q: Rick Reaser from Raytheon. There's a mention in the Secretary's remarks and yours about 5G standards. A couple of us in the room here participated in a 2015 study of Commerce's telecommunications labs and one of the shortcomings we kind of ran into was, where is the US in terms of leadership for telecommunications standards for 5G. The Secretary mentioned South Korea; that was one of the countries we actually looked out, but has there been any improvement in the government's way they've approached standardization for 5G? A lot of that's been left up to the commercial private sector, but I think one of the shortcomings we noticed was that there wasn't a lot of government participation, whereas in other countries there was. So I was curious if there's been any renewed interest in that.

[00:28:06]

DAVID REDL: I think it's a great question. We have been focused on making sure that, we expect the private sector to lead in standards efforts, but that doesn't mean there shouldn't be a support function from the US government. Our own ITS staff, from our Boulder, Colorado, labs, routinely attend standardization meetings to support private sector-led efforts on these standards, as well as numerous NIST staff who attend as well to help on the standardization efforts.

[00:28:31]

So as you know, standards work is a continually evolving landscape, and certainly we are working every day to make sure that we are trying to adapt to the way the US government looks at standards to respond to the changes in those landscapes. If you have specific comments on ways we can improve that, we certainly welcome them.

Q: Howard Buskirk, Communications Daily. It's a nice-sized crowd here, but I understand they expect bigger numbers for the Caps rally, but we won't draw any comparisons in our story.

DAVID REDL: There's a Caps rally today? [laughter]

[00:29:02]

Q: I wanted to ask you, the Obama administration put a lot of focus on spectrum, and sharing in particular. Now, as deep into the administration as we are now, what would you say are the biggest differentiators between the Trump administration policy and what was the Obama administration policy?

[00:29:26]

DAVID REDL: Well, seeing as Kelsey Guyselman is right in front of me – I believe her name tag is right here – I will let Kelsey have a little more commentary during the panel discussion on sort of where we're headed from the White House's perspective. But at NTIA, we continue to focus on making sure that we are taking – and it's become cliché – an all-of-the-above approach. This is why we're looking at leasing, and the President's budget approaches the idea of leasing. We want to make sure that we have every tool in our tool kit to make sure that we are making sure that we're using effective and efficient spectrum policies to not only bring more commercial spectrum to market, but also to protect the government incumbents.

[00:30:02]

And I think that's what's changed most, is that every iteration we take of bringing more spectrum from federal use to non-federal use makes the federal use challenge more difficult. Every time we make one of these reallocations, we're being asked to do more with less, or, at a minimum, the same with less.

[00:30:21]
And so, it's a continually evolving standard. We certainly are focused on sharing. The Mobile Now Act made clear that we should be looking at bidirectional sharing issues and that we should be looking at incentives for federal spectrum use. But in terms of finding ways to put forth what the Trump administration's policy is, I'll let Kelsey talk a little more about that on the next panel.

Q: Dennis Roberson for Roberson and Associates. One of the challenges that we face in the United States is that we control only a very limited amount of the infrastructure that creates the 5G and other key elements of our communications infrastructure. What's the perspective on that lack of control when only a few of the layers of the stack do we actually have US leadership in. Obviously in deployment we've done well, but in the actual infrastructure, we don't have that leadership. I'd be interested in your comments.

[00:31:33]
DAVID REDL: From our perspective, I think Secretary Ross touched on that a little bit in his remarks, and I certainly don't want to get out in front of my boss. But in some ways, some things have changed; and in some ways, some things haven't changed since 4G. We continue to press to make sure that we're making the most of the equipment that we have, and that that equipment is put to use to meet our 5G needs.

[00:31:56]
But we are trying to strengthen each segment of the US economy when it comes to 5G. And that means strengthening everyone in each piece of the stack. We all recognize that there are challenges, and they're playing out in the media. This is not surprising to anyone. I don't think anyone has all the answers, but that doesn't mean we're not working hard to try and solve them.

If there are no further questions, I'll turn it back over to Paige to move on in the program. Thank you very much, everyone. [applause]

[00:32:39]

PAIGE ATKINS: So we are running very early. I would ask, let's take a five-minute break, and then we'll reconvene. We'll have the panel set up and we'll kick off the panel discussion. Thank you.

[break]

[00:45:45]

PAIGE ATKINS: Folks, we're going to go ahead and get started again, if you could take your seats. We're going to get started. Please take your seats. That was amazingly quick. [laughter] A lot of good discussion.

So we're going to start our panel for this afternoon. We're running a little ahead of schedule, but I know this will be a lively discussion, so we're looking forward to it. I wanted to start off with a few comments, and then I'll introduce our panelists.

[00:46:34]

I've often been asked how I would explain the benefits of our spectrum policy work to the average American consumer. On one level, it's pretty straightforward; it's easy to talk about the increasing spectrum access allows for additional broadband to the consumer. Each of us uses it every day. Every time we pick up our smart phone or our tablet, we use GPS. And good spectrum policy improves our quality of life through enhanced entertainment, improved healthcare, improved education, and increased job opportunities.

So it's pretty evident. And these things clearly help us drive our economic growth, social interactions and overall quality of life.

[00:47:23]
But we have to remember that people are not just consumers; we are also citizens. And great spectrum policy means that I can look you in the eye and say, When you get on that plane today, you'll make it to your destination safely. I can talk to a mother or father that's watching a hurricane come barreling toward their city and tell them that we'll give them enough notice that they can protect their family. We can assure the American public that we continue to watch the skies to help prevent additional terrorist attacks. And as another example, in space research, we not only can see photos of Pluto from three billion miles away, but it also helps us answer fundamental questions, such as how is the earth changing and what are the consequences for life on earth today and, more importantly, for our children and grandchildren for decades to come.

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Those are some of the implications of our spectrum policy work for our nation's citizens. The entire combination of benefits that result from our policy work is really what makes the United States a great place to live and a world leader in technology.

[00:48:42]
So this is why we decided to bring such a great group together for our panel and to represent different facets of industry and government. I think we've known for quite a few years now that spectrum policy only moves forward when all stakeholders work together and respect all of the opportunities and interests that spectrum access can empower; and David Redl talked a little bit about that earlier. It gets trickier when you move from that consensus to specific issues and implementation. That's when it gets tense at times.

[00:49:24]
So for this panel, I'd like to being with the spirit of collaboration and consensus and move into a frank discussion of how we can move this ball forward together and how can we move forward on a strategy that really takes into account all of the interests, national security, economic, balancing federal and non-federal, balancing different types of services – terrestrial, space and others – as well as balancing licensed and unlicensed requires.

[00:49:58]
So we're going to welcome audience participation. This is going to be a Q&A format. So I will start the ball rolling, and I will be soliciting questions from the audience as well. And again, we've got the roving mics, so if you have a question, let us know, and I'll move back and forth for that discussion.

[00:50:16]
So first of all, I'm going to introduce our panelists, and I'm going to go from my immediate left down the table. And you have short bios of everyone, or you should have picked them up at the tables. I'm not going to read the bios, but I will just introduce name and role. Kelsey Guyselman is a policy advisor in the White House Office of Science and Technology Policy responsible for advancing the President's technology and innovation priorities. And as David introduced Kelsey before, she can talk a little bit about perspective from the White House.

Our next participant is Carl Burleson. And Carl is the Acting FAA Deputy Administrator, and he's responsible for ensuring the safe and efficient operation of the US air space, which is a huge, huge job. And we appreciate Carl also taking out time from his extremely busy day to join us.

[00:51:25]
Rachael Bender is next. And Rachael is a wireless and international advisor to the Federal Communications Commission Chairman, Chairman Pai, and plays a critical role as our partner in crime, so to speak, with spectrum policy.

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Tom Power serves as the senior vice president and general counsel for CTIA, and has been there for a few years. Prior role in the White House and NTIA as well. And he will help us understand some of the perspective from industry, and particularly the terrestrial wireless industry.

Next, we have Colonel Fred Williams, and I appreciate you filling in for Fred Moorefield. And Colonel Williams is a senior analyst in the Spectrum Policy and International Engagements Director at Office of the DoD Chief Information Officer. So I thank you for joining us as well to help us understand the DoD perspectives.

And last, but not least, Tom Stroup, who's the president of the Satellite Industry Association, serving as lead advocate for regulatory and policy issues.

[00:52:33]
And again, trying to touch on different facets, different industries to help us see a broad perspective. Obviously, not everyone is represented on the panel, but this will get us started. So I appreciate all of you joining us today. Very important.

And I want to start off, David talked about the progress that we've made to date, and we really have made tremendous progress over the last few years. And this is for increasing access, both from a commercial as well as government perspective. But it is getting

increasingly challenging. All the seeming low-hanging fruit is gone, and even though it may have seemed easy, it has never been easy, but it's getting harder each and every day. And a lot of folks have talked about a national spectrum strategy, and we want to talk a little bit about that. Help us understand, will that help us move forward? Does it help us continue the momentum and propel us forward?

[00:53:40]
So I'd like to ask each of the panelists to talk a little bit about how such a strategy – again, national spectrum strategy – how could that help us address growing public and private sector spectrum requires, and what you think should be included in that strategy. And think top two, three elements that you think are really critical for success. And I'm going to go down the flow of the table for this question. I'm going to start with Kelsey.

[00:54:11]
KELSEY GUYSELMAN: Thanks, Paige. And thanks, NTIA, for having me here today. I think to start, just a little table setting in terms of the White House priorities and how spectrum can influence those, I think there are two critical things that are really informing our thoughts on this:

[00:54:22]
First is the priority of American leadership and economic opportunity. And I think spectrum clearly is a driver of this. As we heard from Secretary Ross, wireless technology is a huge contributor to the economy, as well as a job creator of solid, high-paying jobs. In addition, national security and defense and protecting the American homeland is another critical priority for the administration.

In OSTP, we're focused on enabling emerging technologies and allowing these new, innovative opportunities to really flourish, and for Americans to take advantage of these

new opportunities. Everything from drones and autonomous vehicles, smart cities/IoT, 5G, rural connectivity, space exploration, all of these activities are going to rely on spectrum. And demand is great, but we're only on the cusp of what we're going to see. And I think this is where a comprehensive national strategy, as Paige framed it, is really an important thought to consider. And I think having something long term that is really taking into account all of these different equities, how to balance them, how to account for them, is going to be really important for policymaking and decision-making as we move forward.

[00:55:33]
I think, as was pointed out earlier today, it's not a zero-sum game. And so, I don't want this to be approached as taking from one group to give to another, or vice versa, but, rather, a way that we can all work together to really maximize our use and the efficiencies, the new technologies that are available, different opportunities for taking advantage of new systems, and really taking a look at what's out there to make sure that our spectrum policy is thinking long term, it's sustainable, it's looking at an all-of-the-above approach as was said earlier. So taking into account all of the current demands, but also things that we may see down the road. And this is something that I think has really broad support across the board from both the federal and non-federal side. And I think, as Paige said, the devil's in the details here.

[00:56:21]
And so, I think looking at different strategies and technologies will be a key component, taking advantage of existing research and development that's happening, both in the private sector and within the federal government, as well as having a clear plan and path forward as to how we're going to approach spectrum policy for 5G and beyond. Obviously, much of the focus has been on 5G, but I think this is just the beginning of a conversation of where we're headed next with next-generation wireless networks.

And so, I think that those are really some key components to any successful spectrum conversation.

PAIGE ATKINS: Thank you. Carl, from your perspective?

[00:57:02]

CARL BURLESON: What she said. [laughter] Again, from an FAA standpoint, again we have a smaller role in this, but I'd say one thing, just to take a lesson from what we've tried to manage in the modernization of the air traffic system, it's critical to bring the diverse parties together to try to figure out exactly what you're going to focus on, what are the priorities, and how you're going to achieve them sequentially. We've made a big effort; we laid out a concept of operations, but, again, part of it was, it took a number of years to get buy-in from a variety of stakeholders who all have very different needs and desires. And so, part of it is, it's a little messy, but I do think you have to take a lot of time up front to try to lay out those policies, and then to get buy-in with regular consultation, whoever that group of stakeholders are. Again, that's going to be really important in the process; at least we found that in aviation.

[00:58:00]

I do think a couple other things. Certainly what we've learned in the SENSR effort, one of the critical things is having the right incentives for federal agencies. And if you're going to explore trying to vacate, you have to actually have some money to do it where it's not a zero-sum game taking on a different agency's hide. So again, I think that's going to be important going forward, to think about that.

[00:58:19]

And then I think public/private partnerships. Again, coming back to what we've done on aviation, there really has to be this thinking through of how do we work with the private sector to best accomplish the particular mission that we're involved in, which, again, in terms of what this administration's trying to achieve in spectrum is going to be important.

[00:58:40]
And then I think, finally, we really think there has to be– and you were just referring to this. It's a broader concept than simply efficiency when we think about how to go forward, because certainly you can be very efficient– I was talking to someone ahead of time, there has to be something broader in terms of the utility of the spectrum use, because while you may have a very efficient entertainment use, it may not quite come to the safety of life use in aviation. And again, I think everyone in this room wants to ensure that, again, when they get on that plane, you're really worried about your bag not showing up or a delay, and not the safety of that flight.

[00:59:18]
So again, I think, thinking through that broader definition of what are we trying to accomplish, rather than just the simple efficiency concept.

PAIGE ATKINS: Thank you. And we'll talk about that in more detail in a few minutes. Rachael?

[00:59:31]
RACHAEL BENDER: Thanks, Paige, and thanks, NTIA, for having me. Thanks all of you for not being in the party on the street and being in here with us.

PAIGE ATKINS: That's where they're headed right after this. [laughter]

[00:59:41]

RACHAEL BENDER: We'll get you there. So I think a national spectrum strategy will keep everyone focused on kind of the dual goals that we've already been talking about. On the one hand, we need to get more spectrum out there for commercial deployment in order to serve all parts of the country, including urban and rural. Chairman Pai, one of his top priorities is closing the digital divide, and a spectrum strategy plays right into that, along with infrastructure deployment.

[01:00:14]

But on the other hand, we also have to project the government uses for the critical missions and services that the federal agencies are working on. And so, having a national spectrum strategy can help us kind of hone in and focus on how we achieve that balance. And I think one of the keys, especially from the FCC's perspective, in crafting any type of strategy is flexibility. So instead of setting out one goal that we have to meet, it should be kind of a living document, something that can move over time as technology evolves, as things change, so that we can keep pushing forward and we can adapt.

[01:00:59]

So I think flexibility is really one of the hallmarks that would make it truly beneficial to all sides. And then working through these public/private partnerships, balancing all of those many interests really allows us a path forward.

PAIGE ATKINS: And I think flexibility, you think five years ago, millimeter wave? We would have never predicted what we're seeing today. Tom?

TOM POWER: Well, let me echo my thanks for having me here today, and for having me on a panel with these spectrum all-stars and all the spectrum all-stars in the crowd. I really appreciate it.

PAIGE ATKINS: For everybody's benefit, I told Tom two jokes max. [laughter]

[01:01:40]

TOM POWER: Now, if they don't laugh, does that count as a joke? [laughter] And there's one already. [laughter] Done! And I do appreciate you keeping things on track here, because we do all have an 11 o'clock appointment, is that right? [laughter] Way over the limit.

[01:02:01]

I think a national spectrum strategy is a really good idea. When you face challenges, you need to have a plan with goals and things to hold yourself accountable to. Obviously, from our perspective, 5G is the big focus, and we're slightly behind, it seems, South Korea and China when it comes to deployment of 5G or the development of 5G. There are spectrum bands, particularly mid-band, that we'd be focused on in a national spectrum strategy. But I just want to echo all the comments here on the need for collaboration, because when you're looking at some of that mid-band spectrum, it's either federal incumbents or in their satellite incumbents or in other bands. We need a collaborative effort.

[01:02:42]

And I totally agree with Kelsey; this does not have to be a zero-sum game. The reality of sharing is here. Technology is improving. The idea that we can do more with a finite amount of spectrum I think is something we all need to be striving for. So it doesn't have to be, as Administrator Redl was saying, you're taking from one and giving to the other. Hopefully we can make this a win/win across the board.

And I would just emphasize that to the extent NTIA is leading that effort, bringing folks in, as Carl said, at the beginning, we need that collaboration, not just in the implementation, but in the design of a strategy. So that would be my main recommendation.

PAIGE ATKINS: Thank you. Fred?

[01:03:25]

FRED WILLIAMS: Yes, ma'am, thank you. And thank you for the opportunity. It's a privilege to be here. It looks like I'm the minority in the room, which is a good thing. And thank you, all, for coming; it's a good turnout.

[01:03:41]

We love, applaud, the idea of getting after a national strategy in the DoD. We do a lot of strategy, and we do a lot of planning. This would be recognizing a Herculean lift. My colleagues have talked about objectives, goals, what are we after. On the military, we call it ends, means and ways. And the ends are, what are we trying to do? And if you look across the landscape of these stakeholders, we have certainly shared interests, but we have very dissimilar missions and that makes our objectives very tough to attain.

[01:04:26]

But just going through the process is worthy. Just hearing the colleagues today, we also have shared things that we can do; I think though we have to be very honest. We've done this before. It's not precedence in this country that we've tried to do this before. And it always turns into– not to slight anyone, but DoD is going to do their thing because we have to. FCC and the nation, as well as everyone, should appreciate their independence.

So it kind of turns into who are you representing, who are your stakeholders. And it gets to be a tough pull. We've got to get past it. And I do think by going through that, diagnosing the ends, then you can learn a lot about each other. And I think if you really look at what's going on, we're going to need to learn a lot about each other, interagency and across that line of federal/non-federal.

[01:05:27]
From our perspective, the very commercial technologies that are being fielded and making society great and changing the way our quality of life, they're also proliferating across the globe, and the very same technologies are being used to wage war. And not just against DoD; it's coming back into our businesses through cyber, and all kinds of other instruments.

[01:05:52]
And so, we see, in the DoD, something that we call flexible access, flexible growth. We look to use those technologies that are being created, and I think that kind of summed up Mr. Redl's speech – flexible access, flexible growth for everyone. So when you go after a strategy, that has got to be one of the targets. And we've got to get past thinking about things in terms of primacy, co-primacy; we've got to stop thinking about things in terms of exclusivity; and we've got to start thinking about, no kidding, getting after sharing, getting into test, prove, trust, these machine to machines still have enforcement.

[01:06:42]
And, man, to be honest, looking at your agenda and the categories of things that you wanted to talk about? Those are all good topics to throw out to the interagency and the non-federal folks as a starting point for developing those ends to a strategy. Your strategy will then become basically the ways that connect your resources to those ends. And that's a big problem; how do you run mandates out of NTIA that tells AT&T or the Air Force

or the Navy what they're supposed to go do? That's going to require leadership, that's going to require advocacy, that's going to require buy-in and it's going to require great collaboration.

PAIGE ATKINS: And I think key to that, as many have said, it's ensuring that we educate one another and understand the missions, the motivators, the end that we're trying to achieve collectively and balancing that in some way. Tom, can I ask you to wrap up this particular discussion?

[01:07:48]

TOM STROUP: Paige, I also appreciate the opportunity to be here. You've heard some of these elements before, but I think that the three key elements need to encompass balance, certainty and flexibility. Certainly there are multiple stakeholders, many of which are represented in the program here today; others are not. But ensuring that not one group, whether it's government or commercial, has undue influence or impact on the decision-making process is important.

[01:08:18]

The next certainty is especially important to our industry. Given the long lead time from identification, to allocation of spectrum, the design testing for those of us that operate in space under conditions that terrestrial providers do not necessarily have to address, and then given the cost of deployment, putting our assets in space, there's an expectation that they'll have at least 15 years of serviceable utility to be able to recover that investment. So certainty is certainly important.

[01:08:48]

And then flexibility. You've heard that from some of the other speakers. Technology evolves so quickly, even discussions about 5G have evolved, at least from my

perspective, considerably over the last few years. The initial discussion seemed to be deployment within the millimeter wave frequency bands. There seems to be an understanding that it's going to take more than that. And certainly, as we've heard today, it has evolved to an understanding and acceptance that the satellite industry is going to play a key role in the deployment of 5G.

So I think that flexibility in terms of any spectrum policy is extremely important.

[01:09:26]

PAIGE ATKINS: I think even if you think about those three elements – balance, certainty and flexibility – there's tension just among those principles. So that's, again, a balancing act for us in how we address all of those in an effective way.

[01:09:45]

I wanted to ask both Carl and Fred, I know FAA's done a lot of planning and looking at what you're doing strategically from a spectrum standpoint. And again, Fred, the DoD has had a spectrum strategy in place for quite some time and is really looking at that. I'd like to ask each of you to talk a little bit about any lessons learned that can inform us as we move forward at a national level. Carl, can I start with you?

[01:10:15]

CARL BURLESON: Sure. Again, I think, first and foremost, what Paige is talking about, the SENSR program, if you don't know about it, it's the Spectrum Efficient National Surveillance Radar initiative that we began several years ago. And I have to confess, the reason we initially did it was based on a study to say, how do we ensure protection of the spectrum we have? Could we actually surrender part of it and still continue to safely accomplish our mission? So again, it was really motivated by our safety concerns because what we saw was a growing demand for usage and we wanted to

make sure we could articulate that, if we needed to. And then, in the process of doing the study, then we found out we actually had some ability to release it.

[01:11:00]
Now, a couple things we've learned through this whole process, I mentioned this earlier, having the right incentives for federal agencies and having that upfront money to actually explore some options has been absolutely essential. Because, as we've worked with our other partners here, it hasn't been, "Well, you've got to spend this and you've got to spend this and we're not taking it out of budget." So it has really been an ability to explore the engineering and the R&D of this at a much more quick pace and a much more effective pace.

[01:11:28]
I think another thing we've learned, which has been terrific, is, we don't have a challenge in this particular solution set of the technology itself. We have the challenge – I know you will all be shocked by this – of agencies all having different requires, engineers sitting around and saying, "I would really like that bell and whistle." So that has been, again, a really interesting discussion. But the good news is, it wasn't the technology. We have technology solutions out there.

[01:11:57]
I think another thing that we have learned is, we have a different discussion about sharing. Everyone here is talking about different users sharing spectrum. In our case, we've actually seen, there's an ability to share platforms. So again, you may be able to free spectrum because – at least in our case of FAA, DoD, DHS and NOAA – we have the ability to develop a common platform to accomplish multiple missions within a set of spectrum that then allows us to free up other spectrum. So, as you talk about sharing,

don't just think about how do we share spectrum, but, how do we share common platforms. And certainly it's a bit easier among common agencies.

[01:12:36]
I will say people often forget the back end, but the acquisition side is a real challenge. Now, the good news is FAA had some acquisition reform, which hopefully will help us a bit. But we're really having to push the envelope even there. And I will also say that having a time constraint is a wonderful thing because, again, if we don't have the time constraint, again you can imagine all the different engineering studies that would go on. So having that constraint, that we have to make a decision and we have to be confident in that decision by a particular time in order to allow the auction, really is a godsend.

[01:13:13]
And then finally, the one thing that is really helping us is, we are able to look at this with a clean sheet of paper. We have 600-plus radars in the United States today. Now, again, these are created over multiple decades. And again, in some places, in one city we have three radars. Do we need three radars there? Probably not. So it's giving us a chance to completely rethink how would we place these radars, or how would we place this new technology in a different way to meet the needs of today.

[01:13:44]
And so again, having this kind of ability has actually been tremendously helpful, I think, to all the agencies as we're trying to cope not with the mission that was developed back in the '50s, but the mission we're facing now in the 21st century. So all these things, I think, have been real helpful to us as we've gone through the SENSR program.

PAIGE ATKINS: Thanks, Carl. Fred, from a DoD standpoint?

[01:14:04]

FRED WILLIAMS: Yes, ma'am, thank you. So let me put a little context. The reason we decided to get our head around a DoD spectrum strategy back in the 2010/2011/2012 timeframe was a confluence of a few things – certainly, the President Obama 2010 500-megahertz memo, but our enemy matters, they get a vote. So we're always assessing threats; we're a threat-based organization. And we don't like to be threatened, we don't like people to even be close to us. And we'd already started talking about what our present day Secretary is speaking to today about strategic atrophy. And that is, we had near-peer competitors in the past, and we've been working counterinsurgency and jihad terrorism for quite a while now, two to three decades. And so, that's allowed us to shift resources and priorities to the existing mission. And well, our near-peer competitors – ie, Russia and China – have caught up. So that was informing us.

[01:15:24]

I was fortunate enough to be in the right place at the right time; I was in the room. The director of CAPE, a few under secretaries of Defense, they huddled up and they talked about this and they went after a DoD spectrum strategy that's unprecedented. And some of the challenges are, strategy's inherently hard; defining what it is that you want to do. A lot of times we take a big chunk and then we can't ever agree on what it is. And so, our problem is, you're trying to enable this from a policy shop of spectrum where you don't really have any authorities to tell them what to build. And so, it really takes a lot of advocacy and creativity and leadership. And you've got to have stamina and endurance to see it through.

[01:16:17]

In the DoD, they'll look at you, but they really want you to show them. And so, we started showing. We showed them the broadband plans that were coming, and 3G, 4G, the push on the 500 megahertz. We were seeing things, again in the threat arenas, that

were causing us to think about electronic protection, electronic support, electronic attack a little harder. We were thinking about joint electromagnetic spectrum operations, which is our militaries executing those missions down range.

[01:16:55]
And so, that confluence, in combination, allowed us to get after it. And whittling down everything that you want to do into nice, tight ends is a tough thing to do. And it's going to be tough with the interagency. Add the industry to that and it's almost counterproductive. [laughter] But it doesn't have to be. Like I said, we will use commercial technology where it makes sense to. We have to; the enemy's there. We have to.

[01:17:36]
But other challenges are resourcing. So first of all, trying to get buy-in from the Secretary level. The Secretary of Defense signed out our strategy document. That's a big deal. That means you have got the Joint Staff and the services lined up and you've got a big part of what we now call OUSD engineering and research, formerly AT&L. That's where we develop capabilities. That is a big deal.

[01:18:14]
The resources are the tougher piece because your strategy becomes stepping stones to those ends and you have to resource it. And that has to be sustained, and you have to be committed to it. Which inevitably you're going to develop a road map, an action plan, and someone's going to have to go do those things to achieve those objectives.

Very quickly, we're going to have to expedite SDS systems that are flexible to access a variety of spectrum. Because we have to. The other things we looked at were huge gaps in the tools that we have given their airmen, soldiers, Marines to do the job at the tactical

and operational levels. We wanted to put more emphasis into this machine-to-machine and cognitive and get the humans out of the loop. And then, of course, all those things will have implications on your regulatory and policy reforms.

[01:19:18]

PAIGE ATKINS: Thank you, Fred. Several of you mentioned we need to understand the end state – what are we really trying to achieve if we go down the path of a national spectrum strategy? And I'd like to peel that back a little bit. We've talked, and I apologize for those that are not in the 5G arena, but we've talked a lot about 5G; obviously a US priority. And most of the time it might be "give us as much as you can as quickly as you can." But that doesn't necessarily help us shape an effective strategy moving forward. We continue to look at, I'll say pipelines for both government and commercial uses.

[01:20:03]

So I'd like to ask Kelsey, Tom Power and Rachael to talk a little bit about what is that end state, particularly related to 5G or other emerging terrestrial wireless services? And how does that look in terms of developing a strategy? Kelsey?

[01:20:24]

KELSEY GUYSELMAN: Thanks, Paige. In terms of 5G, I think there are really sort of four different buckets that I'm thinking about to retain American leadership in the wireless space. So first if obviously strong, sustainable spectrum policy, like we've been discussing. I think the second piece of that is having smart infrastructure policy. Given the network architecture of 5G networks, it's going to be even more important that we have policies in place that are going to do things like streamline the permitting process, leverage existing assets, make sure that pricing is rational, that processes are predictable, that the whole deployment sort of end state is going to be something that can be achieved

quickly, and that the costs and timeframes associated with deployment don't become prohibitive to deploying 5G quickly.

[01:21:16]
I think the third piece of that is related, but that's the investment side of the equation. Private sector investment has obviously already been tremendous in terms of 5G. But I think through efforts like the tax reform, deregulation, encouraging investment through a whole host of different both legislative and policy priorities, I think all of these are going to be critical to make sure that we have American companies investing and have the kind of deployment that we need to see.

[01:21:46]
And then I think the final element that's really important to think about with 5G is the security component. The President's national security strategy in December specifically highlighted the importance of a secure 5G network. This is obviously a major concern as we have more ubiquitous connectivity, particularly looking at people's homes, and the opportunities for vulnerabilities and for access and manipulation of those devices. I think it's really important that we be thinking about security from the very beginning and baking that into the devices, into the networks, into the applications so that we can ensure that while consumers are able to benefit from these new and exciting developments, that we're still protecting consumers and our network, our businesses, our federal agencies, et cetera. So I think that's a really important concern that we're all thinking about.

PAIGE ATKINS: I think that highlights key spectrum policy or spectrum strategy – we can't do it in isolation. So it's going to touch a lot of other components that we need to take into account, understand how it might affect the strategy, but we need to look at it holistically. Rachael?

[01:23:00]

RACHAEL BENDER: Paige, I think what you said, that it doesn't have to be everything all at once, is important. We just had our third report and order, and third FNPRM on Spectrum Frontiers working with industry and our federal partners over the past several years. But that's because it doesn't have to be everything we teed up is now ready to go. It's, how can we move forward on these bands that are now becoming more important to the commercial side, or setting up coordination mechanisms for sharing with our federal partners. And so, we have tried to take an incremental approach at the FCC to make sure we're getting each of those bands right as we go along, instead of trying to push everything through all at once.

[01:23:50]

I think what Tom said earlier about 5G evolving so much and how we think about it is really true as well. It's not just the high bands anymore. And so, we're working on getting the 600-megahertz band cleared for 5G. And mid-band; you all have come to see me about some mid-band proceeding in the past few weeks, at least one or two of them. So 3.5, 3.7; 2.5, which you can count as low or mid-, depending on where you sit. And so, we're trying to look at that more comprehensively.

[01:24:27]

And I think another part of the 5G strategy has to be satellite and how satellite is going to be part of that going forward as well. And so, at the FCC we're trying to make sure we are streamlining processes for getting satellite services out there and approving new NGSO market access and licensing grants. And even from changing, tweaking some of our rules so that more satellite operators could participate in our CAF-II reverse auction that's coming up this summer.

So I think all of those things put together are part of the package, as was pointed out, on making sure we continue to lead in 5G. I think the other big priority for the FCC is infrastructure – infrastructure deployment, streamlining those barriers, like Kelsey was talking about. We have our wireline and wireless proceedings going on now that we've taken, again, some incremental steps on pieces of that, and there's definitely more to come.

[01:25:30]
So I think we have a lot of work to do, but we've also gotten a lot done. And if we continue to all work together, we'll all evolve together.

PAIGE ATKINS: Thank you. Tom?

[01:25:42]
TOM POWER: I think Kelsey's four buckets make a lot of sense. And on infrastructure, as Rachael just said, infrastructure is obviously a key piece of this. Solving the spectrum challenges doesn't do you much good if we're still operating under siting rules that were designed for 200-foot towers when we're in the world of small cell. So that's certainly a key aspect of this.

[01:26:05]
On spectrum in particular, it is all of the above – low band, mid-band, high band. As Rachael just said, her door is darkened every day by multiple meetings on mid-band in particular. And it's really where the whole world is going; it really is the foundational block of spectrum when you talk about 5G. And it's important that we be a part of that just because of the economies of scale, whether you're talking about antennas or roaming or chip sets, or whatever it is. All those areas are made more efficient and more cheap if

we can glom on to the harmonization and the standardization that's going on in all those areas.

[01:26:45]
We've led the world in 5G[sic]; it meant a huge boost to our economy. We need to do it again in 5G. It's billions of dollars, hundreds of billions of dollars in GDP potential and millions of jobs. So we need to replicate that.

[01:27:00]
I think when you look at that mid-band in particular, and that's, as I said, kind of where a lot of the focus is now, from 3.4 up to 4.2, one of the huge potential opportunities there is the ability to have very large contiguous bands of spectrum, 100-megahertz bands, that, as Administrator Redl was talking about earlier, are needed if you're going to support the really high bandwidth applications, like streaming of 4k video content. But it does require, back to the opening, collaboration, because if you're talking about the 3.4 band, as Administrator Redl discussed, they've launched a study of that. But we need to figure out how to work with the federal incumbents there. On 3.7 to 4.2, of course, the satellite incumbents are there, and we're starting to have that discussion, about the different opportunities as to how we might move forward. The 3.5 gigahertz were further ahead; the Commission putting what we hope are the final touches on the details around license sizes.

[01:28:00]
But that mid-band has really been the focus, but we don't want to lose sight of the high band. And as Rachael just said, the Commission's obviously moving ahead in a smart way, the last week's notice seeking comment, particularly on 26 and 42 gigahertz. And then back to the low band, of course, we've been talking about the 1780 band for quite a while, and Carl's comments on the SENSR project and looking at the 1.3 band. I like to

say that the 1.3 band is on our radars, but the problem is, his radars are on the band. [laughter]

PAIGE ATKINS: That's one. I'm not counting the joke that nobody laughed at. [laughter]

[01:28:39]

TOM POWER: But it does speak to the need for two things – this collaboration, and secondly the Spectrum Relocation Fund, again, to the extent that that funding can be used to help support NTIA in the study of the 3.4 band and the SENSR project and other projects like that, and maybe at some point funding NTIA itself. If you need that money to do the planning and NTIA is in the middle of the planning, maybe at some point NTIA can be a beneficiary of the Spectrum Relocation Fund.

[01:29:11]

PAIGE ATKINS: Thank you, Tom. So I'm going to go to Tom Stroup for one more question, and then I'm going to ask the audience. So think about questions that you might have. Tom, we've talked a lot about the role satellites play in 5G, or at least to some extent. And as we think through NTIA, as well as other spectrum policymakers, the role of satellites, whether it be in 5G or delivering other types of emerging services, what should we be thinking about when we think through these, not competing requirements, but these different requirements, particularly from a satellite standpoint for spectrum planning and the strategy?

[01:29:57]

TOM STROUP: Well, certainly, the multiplicity of services that are provided by the satellite industry today is something that I request that you consider; but, also, the role of the industry going forward. And so, a question that we get a lot is, what is the role of

satellite in 5G? And there was a report that came out of Europe recently that put it very succinctly. There were four categories that were identified and the first is, communications on the move – planes, trains, automobiles, ships. A very good example for all of you who have flown recently and seen the upgrade in quality of Internet access is airlines have transitioned from terrestrial-based systems to taking advantage of the spot beam high-throughput capability of satellites.

[01:30:45]
The same thing is true with respect to automobiles. Toyota announced that they are particularly interested in the ability of the satellite industry to download software to their cars because 60% of their automobiles are sold into markets that don't have 3G service. So I think that that's a perfect example of the application of satellite technology for some of the use cases that have been identified for 5G services.

[01:31:09]
The next is a hybrid multiplay or service to homes and small offices. The distribution would be via satellite and then distributed via wifi or small cells within those buildings.

[01:31:21]
The other two are more traditional applications – trunking and head-end feeds, backhaul in towers. Given the sheer number of sites that are going to have to be deployed for terrestrial 5G services, I don't think that there's going to be any kind of opportunity for fiber to serve all of those. I think satellite will provide a significant role in deployment of those systems.

So there are other use cases that have been identified for 5G – IoT, direct to consumer applications – but I think the four categories that I identified encompass those. And so, I think those are particularly striking examples of how the satellite industry will play a role

in 5G services. So I would urge you to consider that going forward and, as noted, the multiplicity of services that the satellite industry is already providing.

PAIGE ATKINS: Can you expand just a little bit in terms of the implications, particularly on the spectrum requirements and the policy elements or strategy elements?

[01:32:23]

TOM STROUP: Yeah, absolutely. So all of these applications require spectrum. And I noted in terms of spectrum policy there needs to be a balanced approach. And I think that the Commission has been seeking to do that; the Spectrum Frontiers order acknowledged that there is a need for dedicated spectrum for the satellite industry. There are instances where the industry can share. It's been sharing for a long time with fixed terrestrial users, amongst itselves, the deployment of LEO systems as was mentioned earlier. They need to share with existing GL systems.

[01:32:58]

So there are instances where the industry can share. It has shared. But ultimately, there is going to be a need for dedicated spectrum. And I'd ask that that be taken into consideration.

PAIGE ATKINS: Thank you, Tom. So I'd like to see if anybody from the audience has a question.

Q: Thank you. My name is Toby. I'm from PolicyTracker, which is a newsletter about spectrum. David Redl mentioned leasing. I was wondering if the panel had any views of how we can make that work, if there are some incentives that can be put into place to make that work. And I have another question as well, which comes from my own naiveté

about how spectrum policy works here. Who would be holding the pen on a spectrum strategy, and if that's the right person.

[01:33:55]

PAIGE ATKINS: So leasing. I'll ask if anybody, Rachael or others– if we look at the opportunity – and I'll repeat what Mr. Redl was talking about – in the '19 budget, there is a proposal for NTIA to gain authority to potentially lease federal spectrum to non-federal users as a tool in our tool box. And to perhaps be able to take better leverage of spectrum that may be underutilized but still needed in some capacity. And the thought process is a very high level concept, and we need to figure out how to make it work and how it would make sense for both – and I'll use the word – for the certainty that the commercial folks would want, as well as the certainty on the government side that they will, one, get the spectrum back once the lease is up, et cetera. So Rachael, can we start with you?

[01:34:53]

RACHAEL BENDER: Sure. I think, as has already been pointed out, leasing could be another tool in the tool box, which we can never have too many of. I think as far as how to set that up, I don't think it would be the FCC with the pen, to answer your question on a national spectrum strategy or on how leasing would work. But we would, of course, coordinate with our federal partners on the process.

[01:35:24]

And I think the process is probably the more important thing to start out with trying to frame because each band that federal users may want to share are going to have a unique set of challenges. And so, having a road map of "here's procedurally how we would set up a leasing process" is kind of step one. And then from there, once everybody has that road map, you can identify, "well, then that might make sense in this band over this band

or for these type of users or other types of users." And from there, you kind of then solve for the technical challenges.

So it would be a process. But I think the procedural posture would be important to lay out first, and then you could solve for the math of how we share.

PAIGE ATKINS: Fred, did you want to chime in?

[01:36:15]

FRED WILLIAMS: Sure. For someone to advocate bidirectional sharing, we need flexible sharing, flexible growth. We would be talking out of both sides of our mouth if we didn't accept something like this and entertain it. And we think it's healthy. However, I can start you with a list of things to go down through that process. No, it's fun! [laughter] I've had help.

[01:36:46]

First, how do you qualify for a lease? Does industry come and say, "Hey, I want this," and we all look and see that, hey, we've got technical characteristics in there with six federal entities. Do we proportion that out by assignments, how do we do that? And then it's, who gets the money? Does NTIA get a cut of that money?

PAIGE ATKINS: Does Paige get a cut? [laughter]

[01:37:15]

FRED WILLIAMS: A check, that's how it works for us. What color is the money? What can I spend it on? What time constraints? Am I going to get sequestered? There's just a litany of questions. However – I'll shorten this up – we look forward to those discussions although it's new. But it's fresh. I mean, we on the federal side, if Justice says,

"Hey, DoD, can I borrow some of your assignments tonight?" We kind of go, yeah, and we don't charge them. Right?

PAIGE ATKINS: Thank you, Fred. Tom, do you want to talk a little bit from an industry standpoint?

[01:37:51]

TOM POWER: Yeah, and I echo – it's great to have the creative thinking and all the tools in the tool box, and it's certainly worth exploring. I would say from the wireless carriers' perspective, first, on the one hand, what's the difference between a lease from an agency and a license from the FCC? The form may be different, but the substance could be very similar. But if you look back at the substance of FCC licenses, I think a couple of the characteristics that make 4G so successful and that generated $300 billion in investment over the last ten years from the wireless carriers – and that's not auction revenue, that's just capex – two things: one is ten-year licenses, and the second is expectancy of renewal. Those are key drivers to have the certainty, to do the investment, and to do the build-out.

[01:38:38]

So if you carried that over into the leasing world, that would be great, but I could imagine Fred or Carl thinking, "Well, gee, it's still kind of my spectrum and maybe I don't want ten-year licenses or renewal expectancies." And that is certainly reasonable from their perspective, but it starts to undermine some of the characteristics that made the 4G rollout so successful.

But these are things to wrestle with. And as Fred pointed out, federal allocations are often shared between agencies, and so how do you coordinate between them? Where does the money go? Obviously, some goes to Paige, but other than that– [laughter]

[01:39:12]
And then the question I think was, who would have the pen on the national spectrum strategy, I have a pen. [laughter] I would be thrilled.

PAIGE ATKINS: That's not an option.

TOM POWER: That's not? Okay.

PAIGE ATKINS: I think in general, the national spectrum strategy as we move forward, it's a collective effort. And so, we would be working in partnership, NTIA and FCC, to formulate what that looks like in cooperation with the agencies, the White House, industry, et cetera. So we will have to think through that as we move forward.

[01:39:48]
FRED WILLIAMS: Let me make one last comment. Certainly what my distinguished colleague said about how long do you give this up, what's the value of it, but I just want to point out, if we're thinking that it's the money that would come into DoD is the incentive, it's not really. It's access. And so, hey, I'm willing to work with you and give you some white space in there on a short period of time, but I need something back, somewhere where I may have a need. And I think that's where we're going. We're going to get there; it's just, we need to take some steps and start thinking about this. But that's kind of where we're going.

PAIGE ATKINS: That's a good point, Fred, thank you. And there was another question over here?

Q: Thank you, Paige. Beau Backus from NOAA. A question that I had originally came to mind – and it's all Tom Powers's fault, and it's not because of the Caps – collaboration was mentioned. And one of the challenges between working in federal and non-federal entities and trying to develop good spectrum usage is the means by which you do collaboration between the parties. It's been a challenge for a long, long time. And I just wondered what the thoughts would be on ways forward for good policy on means of collaboration.

PAIGE ATKINS: Who would like to grab that? Fred?

[01:41:20]

FRED WILLIAMS: I'm just going to give you two quick examples, what AWS-3 did to us. And with help from OMB, Congress, NTIA, we've done some partnering. We've got a $1.5 billion other transaction authority or authorization that we have gone after, the National Spectrum Consortium, which has opened up a broader base of technological innovation to help get after what we're having to do with AW-3 assets. So some of these things rolled up to 2025 and we're just doing primitive collaboration. I mean, it's time, space, frequency, and calls, and where's the hot buzzer, the POC if something breaks?

[01:42:12]

But we're getting after things through this consortium that will help those radios deconflict with those broadcasters. In the place where we compressed, this consortium is going to– we have 27 projects. We were able to get $500 million, thanks to, as I said, Congress, OMB, NTIA. We send these projects through the tech panel just like a transition plan. They get approval. Money comes. And these folks go to work. We have 27 on contract right now getting after automation at the tactical and operational level, new waveforms, new modulation, test ranges, training ranges. These are collaborative efforts, these are companies that weren't in the industrial base. We have universities now

working on this. And we just think that that is going to be– it's a great start. It's unprecedented.

[01:43:12]
We've also partnered with the National Advanced Spectrum and Communications Test Network through NTIA and NIST. And we're getting after LTE aggregation. And also looking specifically at LTE impacts on AMT, and vice versa, because that, AMT and air combat training systems are huge problems in the training and test ranges for interference.

[01:43:36]
So those are just a couple of things that we're doing that are brand new in the collaboration world with SRF money that we're very proud of. And we think that, as we go through these– right now, there's a couple that have gone through operational test and evaluation, and are showing promise. Some are non-spectrum solutions, even. And we're getting ready to tie the AWS-3 side with the research side and do some deep diving on making the research to ops transitions and seeing if we can't bring some of these things out. But those conduits are set up now that we can use for the future to get after any of these type of events for either relocations or sharing.

Also, the NIST and DoD, they're doing some things in that 3.5 to 3.6 bandwidth with SAS and ESC out there, too. So there's a couple with collaboration

[01:44:41]
PAIGE ATKINS: I think from a strategy standpoint, we need to frame a more robust and consistent process. Collaboration's going to be key to everything. Fred mentioned some specific examples of new ways of collaborating that have been established. And so,

those are examples and lessons learned we can draw from. And then we have to create, again, a more robust, consistent process. Carl?

[01:45:10]

CARL BURLESON: I think because of the time scale that SENSR's one and the– again, what we're trying to do is replace the entire radar infrastructure of the United States. This has required a huge amount of collaboration at the federal level, but also it has required us to have an ongoing, very detailed dialogue with industry about what the capabilities are. And not just a one-off, "here it is, we now have a plan, we're going to put it out." No, it's an ongoing dialogue to see how we're going to get this done.

[01:45:41]

So again, one of the critical lessons we've learned from SENSR is this need; if we're really going to get this kind of technology inserted, nationally, on the kind of timescales we're talking about, you have to have a robust and ongoing dialogue with industry about how they're going to deliver it. And we in the federal government have to think a little bit differently in the acquisition and deployment process, versus our sort of standard "here's the five- and seven-year acquisition, and here is the 20-year deployment." We have to think about it differently. And none of that's going to get done because we're not the ones deploying it. It's the industry that's going to produce the technology we need, and it's the industry that's going to deploy it.

So again, we're really having to have a level of partnership and a depth of dialogue we haven't necessarily always had in the past.

PAIGE ATKINS: Thank you, Carl. Tom?

[01:46:33]

TOM POWER: To take it to a slightly higher level, I sort of think of it as you have these– you need alignment and you have sort of these concentric circles. So NTIA leads the interagency process, the policy and planning steering group. They need to be aligned. And then, the hook to them is maybe to OSTP, right. And then OSTP brings in OMB and DoD and FAA. And then they bring in the broader group at the FCC and the commercial side and the public interest community. But it takes alignment and everyone staying focused on some particular goals. And as Carl said, there's nothing like a deadline to make things happen.

[01:47:09]

PAIGE ATKINS: And I would add, in AWS-3, we also leveraged CSMAC, the Commerce Spectrum Management Advisory Committee, in a way that probably is untraditional, which allowed us to use that federal advisory committee to NTIA to bring together diverse players and work through some of the hard issues that led to the success or the ongoing successes of AWS-3. So again, there are many different vehicles that can be used, but we need to see what that framework looks like and lay it out in a way that we can execute against.

Any other comments? A question up here, and then we'll go to the back.

[01:48:00]

Q: Jennifer Warren, Lockheed Martin. Kind of to build on Carl's point about the level of collaboration, which really goes deep into manufacturing as well, not just the service providers or the users, to what degree do you see expanding – this is for anybody up there – expanding from kind of retrofitting sharing to really looking at sharing by design at the front end of technology development as opposed to kind of mid or tail end? Thank you.

PAIGE ATKINS: Anybody? Because I'll answer.

[01:48:38]

FRED WILLIAMS: I have a short answer. I mean, that's exactly what this consortium does. This is a technical innovation initiative that's run by the Office of Under Secretary of Defense for Research and Engineering. And we're watching that. And I think right now, speed and time are causing us to think kind of, Hey, we're going to have to bolt these things on because these things are already rolling out and doing their thing. But I think in the future, getting on the front end and getting this stuff baked in is going to be the way forward. And we are going to see success in the next five to six years with the machine-to-machine, the rule-making that allows that to happen, the policymaking that's going to be necessary. But I think we have to look and go, Why don't we just take a strategic pause and let some of this technology mature. Because sometimes it informs what policy you need. In other words, do we need to insert a spec manager there? Do we need enforcement there? Or can we back off? Some of this stuff, machine-to-machine, is very trusted. It doesn't mess up. Some of it, we're going to need to have enforcement.

[01:50:01]

PAIGE ATKINS: And I think as we look at new technologies, and think 5G or beyond, and especially for bands that we might be considering that are, quote/unquote, greenfield, very little use today, it gives us this huge opportunity to work together and look at dual-use technologies and other avenues that can promote better sharing of spectrum, as well as sharing of technology, sharing of systems, et cetera. Carl, did you want–

[01:50:32]

CARL BURLESON: I was going to say, we regrettably have a lot of experience in this area because, as we've tried to modernize the air traffic system, part of it is, how do we put new capability in aircraft. So clearly, when an aircraft comes off the line, it's designed, it's with the aircraft, that's a wonderful thing. The challenge is, you have long-

lived assets that operate 30-plus years on the commercial side and you have general aviation aircraft that date back to World War II operating in the system. And when you say, We want to equip you with new avionics, it becomes quite a challenge.

[01:51:08]
So I do think one of the things that we've tried to work through is, in different users, how they're going to use the system, about what is the requirements they may need and have in that retrofit question. Because again, if you're a general aviation aircraft and you're going to be flying in what we call visual conditions out in the middle of Montana, it probably is not as important if you're a general aviation aircraft flying around New York City in terms of the kind of avionics you have.

[01:51:35]
And so, in thinking about the retrofit question, part of it may be just defining what are the requirements for this system to work, and can you do it in a way of sort of spiral, incremental adoption depending on what the needs are in different parts of the system.

[01:51:51]
TOM STROUP: Paige, if I could add, having run the company that developed sensing-based sharing technology, it is far easier to be able to identify the characters of a known entity. So it's far easier for new entrants to be able to develop their system, to be able to share with the incumbents, than for incumbents to go back and try and retrofit their system. So I think building to share is definitely a policy that should be examined closely as we move into a greater sharing environment.

PAIGE ATKINS: Thanks, Tom. Rachael, did you have something?

[01:52:24]

RACHAEL BENDER: I just wanted to add from the FCC perspective. For a long time, we've been looking for clearing for exclusive use. And that's still a goal of ours. But there's not a lot left. So we're going to have to go with these types of sharing-from-the-beginning ideas and regimes, and that's the way we're going to be able to get more spectrum as we balance with our federal and non-federal partners. And so, I think that we don't have a choice. We're going to be doing that going forward. Again, it's part of that all-of-the-above approach. We can clear where we can clear, and we can try to share where we can share. Those are all tools that we need to look at. For instance, in the Frontiers proceeding last week, we have some bands that were teeing up for potential clearing; we have some bands that were teeing up for potential sharing. And how do we get those coordination mechanisms right in each of those bands based on their unique characteristics.

PAIGE ATKINS: Thank you.

[01:53:28]

DAVID POWER: I would add we're moving in that direction, right? I think software-defined radio is a move in that direction. Even spectrum access systems are a move in that direction where you're contemplating sharing as you design these things. But then they also do come with challenges. If every car has to stay in its lane, you're going to have fewer accidents than if cars have permission to be moving back and forth. But that's what makes it fun. [laughter]

PAIGE ATKINS: That's it, Tom. Questions in the back?

Q: Dale Hatfield from University of Colorado. I'm very interested in this notion of the national spectrum strategy. But it seems to me that the rules that are developed to provide increased sharing, high dynamic and even bilateral sharing are not worth much unless

you have a very effective enforcement strategy. And what I was curious about, especially one of the things that worries me, as many of you know, is deliberate jamming and deliberate spoofing. I was sort of curious as to how you feel that in the national spectrum strategy, what the strategy might look like in terms of making enforcement. Because without enforceable rules, you kind of might not even need– I mean, the rules depend upon enforcement. And I was just curious about your thinking in that area.

[01:54:59]

KELSEY GUYSELMAN: Yeah, I think that's an excellent point, and I think that's something of significant concern. Because as we have a more and more crowded spectrum environment, I think enforcement becomes more and more important. And so, obviously, I think the FCC and their enforcement bureau and their role in that will become more and more critical as we start thinking about these things. And I think, as Tom pointed out, when you have sharing, you start getting more complicated, too. And so, it's certainly a consideration that I think we will have to account for as we move forward, and it's something that I think the FCC in particular will have a leadership role in.

[01:55:36]

RACHAEL BENDER: Yes, our enforcement bureau will be the cop on the beat, but I think it's also important that, as we set up any sharing regime, we kind of set out the clear guidelines up front and work with, if we're sharing with our federal partners, what are their specific risks? What can we be looking for? What can we try to guard against right off the bat? And that goes to Jennifer's question, how can we set this up from the beginning to make it work as best as possible? So then our enforcement bureau can come in on the back end and make sure everything is running smoothly. But if we lay out those rules of the road in the beginning, everybody kind of knows what lane they're supposed to be in. See? We can bring it all back together. [laughter]

[01:56:23]

PAIGE ATKINS: And I think in our vernacular, we've moved to a new acronym. That shouldn't surprise anybody. And it's "interference, prevention, detection and resolution," I believe is the right– so, IPDR. When you talk about enforcement, a lot of folks have a particular idea of what enforcement is, particularly traditionally what it is. But the whole idea is, as we move to these greater sharing environments, particularly more dynamic environments, how do you make sure you build in resilience to prevent interference from occurring in the first place. But if something happens, you have to detect and resolve it very quickly. And this goes back to the idea of certainty. You have to understand that it will be a certainty that you can remedy situations that arise.

[01:57:13]

So a critical component to any strategy, in my personal opinion. In terms of your jamming questions, Dale, I think we're all concerned with potential intentional activity or disruption. But you can get similar effects with unintentional disruption as well. And again, the more we can build resilience into our technologies, our systems, our infrastructures, we'll be better off all the way around.

Did anybody want to add? Carl?

[01:57:47]

CARL BURLESON: So just back on the enforcement question, because again, speaking as an agency that has a lot of experience that has a lot of experience in this, about 20 years ago, or a little bit longer, we actually changed how we were going about it. Because again, what we saw was the traditional enforcement pattern was not going to work given the pace of accidents and the growth of aviation. And so, we went about changing the paradigm where we actually invited industry in and had conversations

where they were sharing what the risks were that we would have never seen if we had kept the traditional enforcement paradigm. And our focus was, how do we ensure compliance? How do we ensure that risks are dealt with and addressed as quick as possible? Sometimes rule-making, sometimes just from voluntary action of the industry. But the whole point was to get the safety achieved.

[01:58:42]
And again, what we've been able to do is, in the last nine years, we've only had one fatality, one tragedy recently in the Southwest Airlines. But again, think about that. Nine-and-a-half years without a commercial fatality because of this approach where, again, we went away from just simply the enforcement. And again, not that enforcement is stopped; I mean, in the last three years we've issued 75 million in civil penalties. So if you can't comply or if you're unwilling to comply, then we come after you hard.

[01:59:10]
But the point is, it's not simply enforcement, but how do you create a dialogue in this area where industry is coming with the government to identify risk on an ongoing basis on the different technologies and the different– and the issue is, as you have this common dialogue, you'll see that different companies, again, will have the same issues.

[01:59:29]
So again, I'm not sure exactly how the paradigm would work here, but I do think it's at least worth exploring just because we've been able to– and again, I think this model is now trying to be adopted in the medical world and other worlds, trying to not focus so much on enforcement after the fact, but how do I get compliance to take care of the risk.

PAIGE ATKINS: Thank you. We have time for one more question. And actually, let's do two because Carl's been very patient, waiting for the mic.

[02:00:00]

Q: Howard Buskirk again. I thought I should ask the question of Kelsey, since David Redl specifically said "you should ask Kelsey this question." But are there differentiators between where the Obama administration was on spectrum and this administration? I will point out that Tom Wheeler, the former FCC chairman, talked a lot about an all-of-the-above approach on spectrum. But I'm just wondering, in sharing, for example, are there nuances? Thanks.

[02:00:30]

KELSEY GUYSELMAN: I think generally speaking, I don't view spectrum as a partisan issue. This is something that we've all embraced, and I think that there are a lot of technical considerations and conversations around this. I think one of the things that has shifted since the last administration, and much of this is due to new developments in technology, is a shift away from specific, targeted number goals and things of that nature. And a lot of that is, again, because of the way that we're talking about spectrum when you're looking at things like Spectrum Frontiers and Spectrum Horizons. The amount of spectrum that's being freed up in those proceedings along is just so massive compared to what we were talking about eight years ago.

[02:01:11]

And so, I think that's one of the biggest shifts. And I think as we've discussed today, there's fewer and fewer opportunities for just outright clearing and reallocation for exclusive use. And I think that's something that we're going to have to pivot and really focus on, how to make use of what we have and to move quickly to get to those goals. And I think that while there are still bands that can be cleared, those are going to be both expensive and probably take a significant amount of time. And given just the pace at which we're moving with wireless, it's really important that we act quickly. And in many

instances, sharing is going to be the way to get to those goals and use spectrum as quickly as possible.

[02:01:54]
So I think that's probably the biggest difference that I would see. I defer to Tom, if he has any additional thoughts. But I think that we're viewing our actions in many ways as building on the work that's been done in previous years, both under the last administration, but in years prior to that as well. So this is an evolutionary process; it's not about upending or undoing what was done, but, rather, continuing to evolve and address new and emerging technologies.

[02:02:28]
TOM POWER: As Kelsey said, I think this is a lot more about physics than partisanship. Eight years ago, millimeter wave spectrum was not something we were thinking about. Technology evolved, standards evolved, and suddenly we have these much greater opportunities. So I think it's all moving in the right direction.

PAIGE ATKINS: Thank you. Carl? He's been raising his hand for the last 30 minutes.

[02:02:55]
Q: Carl Nevy with Align Science. [?] And I do remember just a few years ago when CTIA and others laughed at 3.5 gigahertz when NTI suggested it. So things are changing very rapidly, and that's a good thing. But my question was, in past reallocations, the approach, even for those reallocations that have been willing to leave behind some systems to stay there long term – whether it's satellite systems in 1750/1780, or the two DoD locations, 1710 to 1755 – those reallocations have always been based on the idea that those staying behind were fixed in place, and the wireless industry was essentially granted maximum flexibility to use the rest of the space in terms of technology, various

choices, aggregating areas, and so on. As we look to the future, is there a regulatory construct that the wireless industry can accept, that accepts changing needs of the satellite industry and the government in remaining in these bands? Is there a process or a structure that we can actually foresee where those groups can continue to grow and change and evolve even staying in the bands that the wireless industry seeks to enter?

[02:04:31]

TOM POWER: I'm sure the answer is yes. [laughter] But it's almost 11. That's a huge question. I think the one thing we keep saying up here is that there's a lot we still don't know. The one thing we do now is that constructs are changing. So something like that? Yes. We haven't defined it; we're nowhere close to defining it yet.

PAIGE ATKINS: Fred, did you want to say something?

[02:05:04]

FRED WILLIAMS: I do. I'm not going to answer it, but I think it's important to give a couple examples. Look at what we're learning in 1695 to 1710 right now. We started that with exclusion zones, that turned into coordination zones because the service providers brought a technology in. So we accepted that. But to his point, we're locked in there because of lifecycles of satellites. But the system doesn't allow for me to flex my mission.

[02:05:43]

For example, if I had to go under BRAC or whatever, maybe I do have a location change where I need to move those assets, that is like a non-starter in the negotiations with the satellite providers, or with the mobile broadband.

The other thing is, what if the Europeans launch a satellite? We may not get an assignment in this country, but they're launching L-band satellites in Europe and we

would like to catch that data. This is where DoD and NOAA are going to be in lockstep, to say, "Hey, don't lock us down; we need to flex mission." At least allow for the negotiation to happen. And this is kind of greenfields and frontiers, right? We shouldn't do an all-rush to Oklahoma and do a land grab. If you do and you got there first and you got some important, great, but just don't lock everybody else out. That is not leading the world in 5G. I would argue, if we could show the world a model where industry and federal government share in a bidirectional manner and sell that abroad, that works.

[02:07:02]

PAIGE ATKINS: And I would say that I think this is one of the most significant challenges we have, is how do we address, I'll say, flexible access for new entrants and incumbents so they can evolve and grow over time. And do it effectively with the certainty that both sides need to make it happen. So I do think that's one of the most significant challenges that we need to come together and address.

[02:07:29]

So I'm going to have to wrap up for today. I want to thank everybody for coming. We're going to close the panel and symposium for this morning. Really appreciate your questions and perspectives throughout, particularly the panel members. Thank you again for coming. It just shows the wealth of experience and breadth that we have addressing this problem. Because it is a hard one, but an important one, it will take all of us coming together in a collaborative way to address effectively.

[02:08:03]

I also wanted to in particular thank Secretary Ross for joining us today and underlining the importance of spectrum for our entire economy and for the future of US technology leadership. And of course, thanks to my boss, Assistant Secretary Redl, for his leadership and vision in convening this august group to start having an important conversation and

to carry us forward. This is just the beginning of an ongoing dialogue, but a new start for us to come together and figure this out collectively.

So thank you very much. Really appreciate your time. [applause]

END